THE NURTURANCE OF CREATIVE BEHAVIOR IN EDUCATIONAL ENVIRONMENTS: A COMPREHENSIVE CURRICULUM APPROACH

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ABSTRACT

THE NURTURANCE OF CREATIVE BEHAVIOR IN EDUCATIONAL ENVIRONMENTS: A COMPREHENSIVE CURRICULUM APPROACH

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The purpose of this dissertation was to provide guidelines for educators that would expedite the infusion of creative thinking processes into the total curriculum. The guidelines were developed in response to seven questions that were posed.

Question 1: What are the elements of agreement and disagreement across definitions of creativity, that provide a definition of creativity that is applicable to a variety of creative activities?

Using the definitions of twenty-two investigators, a matrix was designed with those definitions on one dimensions. The other dimension listed the attributes that were found in the definitions. Using the matrix, a definition was generated that included the attributes that were consistently identified. A rationale was built for omitting other attributes that received less support.

Question 2: How do the distinctive components from three major information-processing models, and one intellectual development model, relate to one another to produce a comprehensive Cognitive Skills Model (CSM)?

The definition generated was found to have limitations as a tool for defining curricular objectives. A more definitive analysis was needed. Thus, the models of three cognitive psychologists, Guilford, Gagné, and Bloom, were synthesized into a Cognitive Skills Model (CSM). This three-dimensional model described the scope of known cognitive processes. The final arrangement of the concepts on each dimension was based on a developmental approach, including the theory of Piaget. The development of this model permitted a more specific description of cognitive processes.

Question 3: How are the primary and contributory elements of creative thinking analyzed through the Cognitive Skills Model (CSM)?

Using the definition arrived at in response to the first question and the CSM, a description of creative thinking was proposed. This description demonstrated that the creative thinking skills are the higher level skills with the lower level cognitive skills contributing to their effectivness.

Question 4: How are the processes of human behavior analyzed, using the Human Ecological System Model (HES), a process map of human behavior?

Because creative thinking occurs in the total context of human functioning, including the affect and the environment, and results in creative behavior, a model was developed to describe the key elements of the human ecological system involved in creative behavior. A number of theories of behavior and behavior change were used to support the applicability of the model.

Question 5: In what ways might creative behavior be described using the Human Ecological System Model?

The literature on creativity and the definition were used to determine a description of creative behavior. The description included the environmental stimuli and consequences, the cognitive processes, and the affective influences.

Question 6: In what ways might a curriculum be designed to nurture creativity?

Several definitions of curriculum were examined to identify the basic components addressed by a number of curriculum theorists. Strategies recommended for each of these components to nurture creativity were presented. Examples of objectives for a traditional and an innovative social studies unit were given. In addition, basic skills objectives for each of the 128 cells in the CSM were presented in the Appendix.

Question 7: What can be done to facilitate the transformations of a curriculum to one which nurtures creativity?

Recommendations were made for in-service workshops for teachers that would assist them in the infusion process. The pre-service teacher education programs were also addressed. In addition, principles of the diffusion process, as they relate to creativity in the curriculum, were stressed.

The major purpose of this dissertation was to assist educators in thinking about creativity in curricular ways. The responses to the seven questions were designed to accomplish that purpose.

ACKNOWLEDGMENTS

One of the insights that surfaced in the preparation of this dissertation is that I was experiencing the same creative process about which I was writing--the agony of the encounter, the need for incubation time, the ecstasy of inspiration, and the struggle to organize the many insights into a meaningful product. Throughout the experience, it also became evident that the members of my doctoral committee were providing the very nurturance I was describing and without which this project might never have reached fruition. I am deeply indebted to the caring guidance of Drs. J. Bruce Burke, Charles Blackman, Castelle Gentry, and Stephen Yelon. Additionally, I also am grateful to the thoughtful comments of Dr. Henry Cole, University of Kentucky. My editor, Mary Groty, and typist, Grace Rutherford, also were indispensable.

I also wish to thank the Creative Education Foundation and the Journal of Creative Behavior for permission to reprint J. P. Guilford's Structure-of-Intellect Model and H. P. Cole's poem, "Tell Me, Teacher."

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CHAPTER I

INTRODUCTION

Creativity has long been considered a phenomenon that has had mystical or magical qualities. It was looked on as a "gift" or talent reserved for a few exceptional persons, while the label "genius" was often reserved for inventors. Only recently has creativity been considered a concept worthy of systematic study. The pioneering effort was initiated by J. P. Guilford in his landmark 1950 address to the American Psychological Association.[1] That event has been considered a critical incident in the development of scientific and practitioner interest in creativity. Since that pivotal event, a growing number of researchers in diverse fields, such as education, psychiatry and engineering, have begun to view creativity not only as a legitimate area of study, but a highly valuable one. There is increasing acceptance of the notion that creativity is not a gift of an elite few, but a basic human potential of which almost all people are capable in varying degrees.

While scholars have been investigating what constitutes creativity, and as a group tend to view creativity as a basic human potential, there are problems in transferring this view to public school

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[1]Joy P. Guilford, "Creativity," American Psychologist 5 (1950): 444-454.

educators. One of the problems seems to be that the word creativity is popularly reserved for the distinctive products of exceptional individuals. Or, if the word is not used to describe the invention of the light bulb or production of the "Mona Lisa," it is devalued by applying it indiscriminately to commonplace activities. It is understandable that if the word "creativity" is reserved only for the truly exceptional or if it describes any behavior someone happens to value, the word itself is not a useful term for educators.

In the absence of a standard definition of creativity which educators could consistently and confidently apply to the school environment, they are unable to discern what is creative and what is not. If educators cannot identify creativity in the behavior of students, they cannot consciously and intelligently nurture its development. An understanding of the phenomenon of creativity on the part of educators would enhance the possibility that they could plan a curriculum designed to develop this quality in their students.

A world which is experiencing increasingly scarce resources cannot afford to treat the human resource of creativity as a scarce commodity. The wasted human potential for confronting and solving problems, when creativity is neglected in schools, is analogous to the wasteful predilections of our "throw-away" society.

This dissertation is based on the assumption that creativity can be captured vividly in order to make it a useful educational concept. The necessary elements of the process of making creativity an efficacious concept include a careful definition, backed by a comprehensive

construct or model which is concrete enough to promote recognition of creativity when it occurs. It is further necessary to describe the creative process as it usually unfolds with both the internal (e.g., attitudes and feelings) and external (e.g., stimulus cues and support) conditions that are characteristically related to its manifestation. Given these necessary elements, the nurturing of creativity can be infused throughout public school curricula.

Problem

The first step in an analytic approach to the concept of creativity is to construct a definition which is congruent with the essential descriptors of creativity found in the literature. At present, the literature contains such a variance of definitional statements that the task of defining the concept of creativity is a challenging one. Much of the variance can be accounted for by the frame of reference of the investigators. Psychologists have tended to emphasize the personality traits of the creative person, artists and inventors have focused on the creative products, educational psychologists and educators have looked at the relationship of creativity to intellect and education, while other social scientists have examined the sociological impact. A comprehensive view is rare.

Guilford has perhaps come the closest to addressing the comprehensive nature of creativity.[1] His models (Structure-of-Intellect

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[1]Joy P. Guilford, "Executive Functions and a Model of Behavior," Journal of General Psychology 86 (1972): 279-287; and Joy P. Guilford, "Three Faces of Intellect," The American Psychologist 14 (1959): 469-479.

and Executive Functions) provide a significant framework for analyzing creativity. He has not, however, placed much emphasis on the affective elements of creativity nor has he related his models to other theories of intellect and behavior. The reason this is a problem is that there are definitions of creativity which are tied to models of intellectual activity different from Guilford's. In order to expedite a comprehensive and utilitarian understanding of creativity, it would be beneficial to be able to demonstrate that the models of intellectual process that incorporate a definition of creativity are related.

Because of this present confusion as to the nature of creativity, educational systems are unable to provide a milieu for its nurturance, even if they want to. It is not uncommon for educators to declare the desirability of programs in school that will encourage creative behavior. There are certainly schools and districts that have curricula and programs intended to encourage creativity. The major difficulty, however, is that educational experiences in creativity are almost without exception a segment of the school's curriculum rather than an integral part infused throughout the total curriculum. This segmentation may well occur because creativity is often viewed as a talent or ability related only to certain human activities and academic disciplines, particularly the "frill" subjects like art and music. The process of creativity is rarely conceived as a critical component of all intellectual activity. Creativity should be incorporated into all components of the curriculum as one kind of thinking skill that can be applied to any subject matter area. In fact, it lends its complex function effectively to an interdisciplinary approach to learning.

The accomplishment of the application of creativity to the broad spectrum of curricular content requires that educators recognize and understand the process of creativity and also use a comprehensive approach to develop the educational environment for its nurturance. In order for this to occur, educators first need a usable definition of creativity; and, secondly, they need a comprehensive model of creativity from which to judge the adequacy of school curricula designed to foster creative behavior in learners. They also need to be able to translate the elements of creativity into a utilitarian curricular format. Finally, if this is to be accomplished, a diffusion process is required to assure that educators acquire the needed knowledge and skills, as well as the level of motivation necessary to achieve a significant impact on those who are potential adopters of this alternative approach to curriculum development.

Purpose

The successful transformation of curricula to one that nurtures creativity requires a set of broad guidelines based on an analytic system for assessing and planning curriculum. A list of "do's and don'ts" can provide only minimal direction for curriculum developers. There are a number of problems to be addressed in relation to those broad guidelines. The purpose of this dissertation is to confront these problems and provide possible solutions for educators to consider.

The problems to be addressed are hierarchical in nature; that is, each is contingent upon the generation of an acceptable solution to the previous problem. In the body of the paper, the problems will be

addressed, beginning with the basic and progressing to the ultimate concern. For the purposes of the introduction, however, the ultimate problem will be discussed first, working then in reverse order.

Staff Development

Since it has been stated that schools have been, on the whole, less than successful in nurturing creativity, the primary outcome or purpose that is achieved is a description of the means by which educators can be encouraged to nurture creativity. The focus is on strategies for instructing and motivating educational staff toward a curriculum that stresses the nurturance of creativity. The final problem of this dissertation is:

> *What can be done to facilitate the transformation of a curriculum to one which nurtures creativity?*

Curricular Application

In order to provide for professional development in this area, there needs to be an understanding of the more effective ways in which a curriculum might succeed in emphasizing creativity. The curriculum will need to spell out clearly the manner in which it addresses the creative abilities and attitudes of learner. The next crucial problem then is:

> *In what ways might a curriculum be designed to nurture creativity?*

Creative Behavior

The development of a curriculum that nurtures creativity will be dependent upon an understanding of the essential elements of creative

behavior. That behavior will be an observable human activity that occurs as a result of the interplay of cognitive, affective, and psychomotor aspects of human functioning, as persons act on and react to the environment to synthesize creative products. The product may be an idea, an invention, an artistic work, a system of thought or a number of other forms. A description of the elements of creativity and their interaction, derived from a model of human behavior, can provide clarity and facilitate attention to the many individual aspects of creativity. The clarity will enhance the process of selecting nurturing strategies. The problem that addresses this issue then is:

> *In what way might creative behavior be described using the Human Ecological System Model (HES)?*

Human Behavior

Since creative behavior is one facet of the totality of human behavior, it seems plausible to conclude that a model of the various elements of human behavior, the cognitive, affective, and psychomotor, could be used to account for the process of creative behavior. Consequently, the problem that evolved is

> *How are the processes of human behavior analyzed using the Human Ecological System Model, a process map of human behavior?*

Creative Thinking

There are a variety of motivational factors involved in creativity and they vary greatly from person to person. There is, however, evidence that in the cognitive elements of creativity there is consistency in the process skills used across disciplines. That is, the

creative artist and inventor both engage in comparable intellectual activity. Creative thinking requires many aspects of the total intellectual spectrum, some primary to creative thinking, and others contributing to it. Several theorists have described creative thinking as components of cognitive activity. There is a lack of consensus, however, on the elements and the terminology. A model which synthesizes the various descriptions of thinking may be used to address the problem:

> *How are the primary and contributory elements of creative thinking analyzed through the Cognitive Skills Model?*

Cognitive Skills

As creative behavior is one kind of human behavior, creative thinking is a component of human thinking processes or skills. The term "creative thinking" is used to label the cognitive process skills specifically involved in creative production. These creative thinking skills should be able to be elucidated from a description of the cognitive skills engaged in by human beings.

There have been a number of researchers who have proposed theoretical descriptions of cognitive functioning. The major difficulty with these descriptions is the lack of comparison and integration among the separate theories. A description of cognitive functioning which addresses the major extant theories that were created to guide educators in the development of curriculum objectives should provide a broader base for understanding by educators who acknowledge one or more of the existing theoretical approaches. The problem that is addressed is:

How do the distinctive components from three major information processing models and one intellectual development model relate to one another to produce a comprehensive Cognitive Skills Model (CSM)?

Definition of Creativity

In order to design analytical models of creative thinking and behavior, it is necessary to develop a definition of creativity characterized by a modicum of agreement among theorists and practitioners. There exist a reasonably large number of variations, some major and others minor, in the definitions rendered by the authors of literature on creativity. Some of the variations exist because only limited facets of creativity are examined, such as the physiological basis of imagination or creative personalities. Others are discrepant because the researchers look at only certain types of creative products that, on the surface, vary widely. For example, a creative dance routine seems quite different from a space capsule. There do, however, appear to be fundamental similarities in the process by which these products are created. The key to a useful definition of creativity is to capture the essence of those fundamental similarities. The initial problem that is posed is:

What are the elements of agreement and disagreement across definitions of creativity that provide a definition of creativity that is applicable to a variety of creative activities?

The seven key problems serve as the major issues addressed in this dissertation. They have been presented in inverted order from that with which they are dealt in Chapters III, IV, and V and in which the solutions were developed. The ultimate concern herein is with the plan

for the transformation of curricula to ones which are infused with a creative process. The accomplishment of such a transformation is certainly contingent upon an understanding of the nature of a curriculum infusion. The infusion of creativity cannot occur, however, unless it can be identified, evaluated, and nurtured. Thus, creativity must be understood as a process of human functioning characterized by the interplay of the cognitive, affective, and psychomotor domains. The basis for an analysis of the elements of creativity is a functional definition of creativity. The functional definition of creativity is the initial objective that must be achieved before any subsequent solutions can have any substance. The plan for this dissertation is to consider these questions in their logical sequence from initial to ultimate concern.

Plan

The first step in developing the elements of curriculum that provide for the nurturance of creativity in learners is to acquire an extensive survey of the literature on the topic of creativity. Chapter II is a summary of the relevant literature. It looks at the writings of scientists, philosophers, educators, psychologists, and others, as they describe their investigations and theories of creative persons, creative processes, creative products, or creative environments.

Subsequent to a review of literature there is an overview of the major issues and a description of the procedures by which the resolutions are developed in Chapter III. The spectrum of definitions is also examined in this chapter and a synthesis proposed that can

serve as a functional definition both for the dissertation, and for subsequent use by educators in curriculum planning and development for creativity.

Chapter IV presents the models developed for this study. These models are the Cognitive Skills Model (CSM) and the Human Ecological System Model (HES). The Cognitive Skills Model describes the elements of cognitive processing, i.e., the content, processes and products of thinking, and their relationship to one another. Using this model, a description of the cognitive skills involved in creative thinking then may be identified. A second model that describes the elements and processes characterizing human behavior in the environment, the Human Ecological System Model, is proposed. This second model is designed to facilitate an explanation of the elements and flow of activity, internal and external, in creative behavior.

The curricular applications of the models and descriptions of creative thinking and behavior are expressed in Chapter V. There is a proposal for the design of a curriculum which exemplifies a recognition of the value of creativity as a human resource. Since an effective model is not adequate to assure implementation of the innovation, attention is also given to a diffusion process that includes staff development and public relations.

The propositional nature of this work suggests that there are many opportunities for research to verify both the basic knowledge and its applicability. There are also recommendations for the further promotion of creativity in educational environments. These are included in Chapter VI with a summary of the solutions presented.

Summary

There has been presented a rationale for the need for creativity to become a valued integral element of school curricula. To address the need, seven problem statements have been developed. Possible solutions to the problems were highlighted. The format or plan of the dissertation was explicated. The next chapter examines the literature on creativity as it relates to the focus of this study.

CHAPTER II

REVIEW OF LITERATURE

Creativity has been defined in so many different ways, and used as a synonym for such a variety of terms, that there is considerable confusion concerning an acceptable definition. This phenomenon is illustrated, for example, by the current use of the word "creative" by the general public to describe anything from "creative" budgeting to "creative" dieting. The word appears to be used to modify a skilled craft, a new activity, or an enjoyable hobby. The consequent confusion makes it difficult to use the word "creative" with any sense of confidence in its meaning.

Although there is not yet a standardized meaning in either popular usage or formal literature, it appears that researchers and educators do agree on several basic attributes of the concept. The areas of disagreement have less significance for educators, because they tend to refer to criteria for creative products. Educators need to be concerned with nurturing the processes used by creative persons, with only secondary attention to products in the developmental stages of creative growth.

Even while there is some agreement on the definition of creativity, there remains a tendency among scholars to emphasize different facets of the very complex concept. The major approaches to the study

of creativity generally include investigations of creative persons, processes, products, and environments.[1] Researchers who focus on creative persons seek to identify the personality characteristics of those who exhibit significant levels of creative behavior. Cognitive psychologists particularly focus on the internal processes involved in creative behavior, while other researchers are concerned with the creative works of persons, e.g., sculpture, poetry, inventions, theories, and humor. Those persons concerned with the environment look at the external factors that shape and nurture creativity.

There is a need to bring together the various definitions and descriptions of creativity into a cohesive system of attributes. Without this organization, it is difficult to understand the concept of the level of complexity of creativity. The review of the literature gives some indication of the diversity of topics that contribute to an understanding of the concept. The first section examines the spectrum of definitions found in the literature. The second section surveys what is known about creativity as a process. The third section summarizes the literature on creative persons, their abilities, attitudes and aptitudes. The fourth section looks at the outcomes of creative behavior: the products of creative thinking. The fifth section describes the environment known to support and encourage creative behavior--those variables which are manipulable to some degree, particularly in academic settings.

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[1]Guilford, "Creativity."

Definition of Creativity

The pioneer of creative research, J. P. Guilford, used his own Structure-of-Intellect Model to define the concept of creativity.[1] He focused on creative thinking, which he characterized as a process requiring transformation of knowledge using divergent production. He defined the process of divergent production as a broad search of the memory for alternative responses, where there are several possible acceptable responses, rather than a "right" answer.[2] According to him, all other cognitive processes contribute to the ability to be creative, but transformation and divergent production are essential to its expression. Concerns about the nature of the resulting product, its social novelty, and value, did not enter into Guilford's definition. He emphasized primarily the importance of the cognitive processing that occurs, with novelty only a criterion as it relates to the person creating. If the idea or product generated is novel for that person, creative thinking was experienced. For further understanding of Guilford's definition, the Structure-of-Intellect Model will be reviewed in greater detail in the section on process in this chapter.

Torrance defined creativity in a similar manner while presenting more distinct criteria.[3] He suggested that "creative thinking occurs when a person responds constructively to a situation

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[1]Joy P. Guilford, Way Beyond the IQ (Buffalo, N.Y.: Creative Education Foundation, 1977), pp. 160-161.

[2]Ibid., p. 92.

[3]Paul E. Torrance, "Uniqueness and Creativeness: The School's Role," Educational Leadership 24 (1967): 493-496.

that calls for non-habitual behavior, solutions for which the person has no learned response."

In order to develop these non-habitual responses, the creative person must use a process that includes problem awareness, search for clues in the situation and his existing repertoire of knowledge, formulation of possible hypotheses, testing, modification, and retest, then communication of the results.

More specifically focusing on criteria of creative behavior, Anastasi and Schaefer proposed that creative achievement must include novelty, originality, a reality-oriented goal and sustained activity leading to development, evaluation, and elaboration of an original idea.[1] They defined originality as the degree of frequency of occurrence of an event. The less frequent, the greater the degree of originality. The concept of a purpose was explicitly stated here, also. In other definitions, it appeared either implicitly or not at all. In addition, they emphasized the importance of a creative thought being carried to its implementation in order for it to qualify as creativity.

May, who centered much of his work in creativity on art rather than science, described creativity as "bringing into birth some new reality . . . [that enlarges] human consciousness."[2] He proposed

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[1]Anne Anastasi and Charles E. Schaefer, "Biographical Correlates of Artistic and Literary Creativity in Adolescent Girls," Journal of Applied Psychology 53 (1969): 267-273.

[2]Rollo May, The Courage to Create (New York: Norton, 1975), p. 39; and Rollo May, "The Nature of Creativity," in Creativity and Its Cultivation, ed. Harold H. Anderson (New York: Harper & Row, 1959), pp. 55-68.

creative process as the primary means of growth or self-actualization, suggesting that the product of creative thinking may be not only aesthetic art, but also more mature human beings.

Alden Dow, an architect who shared the podium with May at the conference on creativity in 1959 at Michigan State University, was very definitive in describing creativity as the production of something pleasing to human beings.[1] He did not address the issue of novelty or uniqueness, stressing instead positive value.

Goldman took a similar approach, suggesting that creativity is originality with value.[2] That value may be intellectual, social, or aesthetic, but must exist to warrant the term "creative." He characterized creativity as oppositional to destructiveness.

Two psychologists who have studied creativity extensively, Stein and Heinze, defined creativity as the production of "a novel work that is considered useful or tenable by some group at some point in time."[3] This definition places the major emphasis on social value based on evaluation by an external source. Although the definition of "novel" is not qualified as to to whom it must be novel, the implication seems to be that it also must be novel to society.

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[1]Alden Dow, "An Architect's Views on Creativity," in Creativity and Its Cultivation, ed. Harold H. Anderson (New York: Harper & Row, 1959), pp. 30-43.

[2]James A. Goldman, "The Restoration of Quality to Originality," Humanitas 12 (1976): 5-21.

[3]Morris I. Stein and Shirley J. Heinze, Creativity and the Individual (Glencoe, Ill.: The Free Press, 1960).

The likelihood of an evaluative social group perceiving a product as valuable, when it is a replication, is low. The question remains, if a product is creative, that is, novel and valuable in the experience of the evaluators, but in actuality is a replication, is that product truly creative?

Munk, taking a philosopher's view, declared that true creativity involves both continuity with the "best achievements of the past" and significant novelty.[1] He alluded to the synthesizing ability of Guilford by specifying the importance of being able to see relationships existing between isolated bits of knowledge. His continuity criterion appears to relate to the building of new ideas on the basis of extensive knowledge acquired over time.

In response to the frustration many felt about the ambiguity of the concept of creativity, a committee was convened to delineate the concept with greater precision.[2] The Criterion Committee of the 1959 University of Utah Research Conference on the Identification of Creative Scientific Talent studied the issue and reported their conclusions. Their criteria stated that a product was necessary to the expression of creativity. They evaluated the products on their novelty and the extent of their usefulness and applicability. The evaluations of creativity were to be made by the professional judgments of

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[1]Arthur A. Munk, "The Role of Creative Ideas in Human Affairs," Intellect 105 (1976): 195-196.

[2]Research Conference on the Identification of Creative Scientific Talent, University of Utah, Scientific Creativity: Its Recognition and Development (New York: John Wiley, 1973).

contemporaries, and the criterion group doing the evaluating was to be selected on the basis of their own creative contributions, rather than on personality traits.

As a psychologist, Rogers also developed an ongoing treatment of clients using creativity, as it related to the mental health of persons:

> My definition, then, of the creative process is that it is the emergence in action of a novel relational product, growing out of the uniqueness of the individual on the one hand, and the materials, events, people, or circumstances of his life on the other.[1]

He made the distinction between creating constructive or destructive products. Assigning value, he believed, is practically impossible because a product may serve a variety of purposes with the value thus determined by the user; or its value may not be recognized in a given time period. He also did not attempt to measure degree of creativity, and believed that it can relate to any content, not just the traditionally accepted ones, such as art.

MacKinnon, who has spent a number of years in creativity research, was reluctant to define creativity because of his belief that it is a multifaceted phenomenon with a broad scope of application.[2] He described rather than defined creativity as a range of behaviors from simple problem-solving to the full realization of a person's potential,

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[1]Carl R. Rogers, "Toward a Theory of Creativity," ETC: A Review of General Semantics 9 (1954): 249-260.

[2]Donald A. MacKinnon, In Search of Human Effectiveness: Identifying and Developing Creativity (Buffalo, N.Y.: Creative Education Foundation, 1978), p. 46.

based on bringing something new into existence, i.e., new ways of functioning intellectually, emotionally and/or physically. MacKinnon also reiterated Guilford's categorization of creative product, creative process, creative person and creative situation.

Barron supported May's definition that creativity is simply the ability to bring something new into existence.[1] Since humans, however, cannot make something out of nothing, the "new" is really a reorganization or revision of existing materials, ideas or perceptions.

Roe also believed any activity may be judged as creative, whether or not the product is judged as creative or is seen as absolutely unique and socially useful.[2] That means that she was concerned with the nature of the process, rather than discriminating products by external criteria.

Maslow attempted to deal with the polarities in definitions by describing two kinds of creativeness.[3] Self-actualizing (SA) creativeness described the personality, as opposed to its achievement, and assured the tendency to be creative in all things. Special talent creativeness focused on one specific talent with which a person is gifted.

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[1]Frank Barron, "The Psychology of Creativity," in The Creativity Question, eds. Albert Rothenberg and Carl R. Hausman (Durham, N.C.: Duke University Press, 1976), pp. 189-200.

[2]Anna Roe, "Psychological Approaches to Creativity in Science," in The Creativity Question, eds. Albert Rothenberg and Carl R. Hausman (Durham, N.C.: Duke University Press, 1976, pp. 165-175.

[3]Abraham Maslow, Toward a Psychology of Being, 2nd ed. (Princeton, N.J.: Van Nostrand, 1968), p. 137.

Mednick defined the creative thinking process as the "forming of associative elements into new combinations which either meet specified requirements or are in some way useful."[1] He claimed that the more remote the elements are, the greater the creativity, and, consequently, developed the Remote Associates Test (RAT) to measure that aspect of creativity. He stated that the difference between creative thinking and original thinking is the usefulness of the response. Originality is based only on the inverse relationship of the probability of its occurrence in a given population, while creativity requires purpose.

A psychiatrist who believed creativity was a preconscious activity, Kubie described the creative process as the "capacity to find new and unexpected connections . . . new relationships, in time and space, thus new meanings. . . ."[2] These preconscious processes are under the influence of the unconscious and the conscious mind, which may distort or obstruct the creative process. The greater the freedom from distortion and obstruction, that is, the greater the degree of mental health, the more creative a person may be.

Skinner, a classic behaviorist, took an eccentric approach to creative behavior, believing that the 'creator' merely expresses

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[1]Sarnoff A. Mednick, "The Associative Basis of the Creative Process," in The Creativity Question, eds. Albert Rothenberg and Carl R. Hausman (Durham, N.C.: Duke University Press, 1976), pp. 227-237.

[2]Lawrence S. Kubie, "Creation and Neurosis," in The Creativity Question, eds. Albert Rothenberg and Carl R. Hausman (Durham, N.C.: Duke University Press, 1976), pp. 143-148.

elements of his past history, rather than truly creating something.[1] He likened the process to a mother giving birth, who essentially only provides a locus for fetal growth rather than "contributing anything positive" to the growth and development.

Getzels and Dillon, in their work on creativity, preferred to look at creativity as a special kind of problem-solving process.[2] Creativity is the development of solutions to problems, in which there are several criteria, including no previously formulated problem statement and no correct solution known to anyone. They characterized artistic creation as a special form of problem-solving.

Rothenberg and Hausman, psychiatrists who did empirical studies on creative thinking as it related to their clients in therapy, stressed the importance of products which are both new and valuable as manifestations of creativity.[3] They opposed equating creativity with originality, productivity, spontaneity, good problem-solving or craftsmanship. These may be a part of creative behavior, but not the substance of it. Rothenberg proposed two specialized processes he called

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[1]B. F. Skinner, "A Behavioral Model of Creation," in The Creativity Question, eds. Albert Rothenberg and Carl R. Hausman (Durham, N.C.: Duke University Press, 1976), pp. 267-273.

[2]Jacob W. Getzels and J. T. Dillon, "Giftedness and the Education of the Gifted," in Second Handbook of Research on Teaching, ed. Robert Travers (Chicago: Rand-McNally, 1973), pp. 689-731.

[3]Albert Rothenberg and Carl R. Hausman, eds., The Creativity Question (Durham, N.C.: Duke University Press, 1976), pp. 27-31.

Janusian thinking[1] and homospatial thinking.[2] The Janusian thinking is the synthesis of opposites. Homospatial thinking is the synthesis of two elements in the same space.

Koestler, a philosopher, chose to describe the act of creation as the "bisociation" or intersection of two planes of experience.[3] He was using the term "planes" as a geometric analogy. The novelty occurs, according to Koestler, at the points of intersection. The more oblique the angle of intersection, the more dramatic the product of creation. He described creativity as occurring in three major areas: art, science, and humor.

Gordon was an early pioneer in the area of creativity research, as was Guilford.[4] He was instrumental in the development of Synectics theory, a strategy for enhancing creative production. "Synectics" is another word for creative process, a Greek word meaning the "joining together of different and apparently irrelevant elements." The Synectics approach is one of metaphor using four types of analogy to achieve

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[1]Albert Rothenberg, "The Process of Janusian Thinking in Creativity," in The Creativity Question, eds. Albert Rothenberg and Carl R. Hausman (Durham, N.C.: Duke University Press, 1976), pp. 311-27.

[2]Abraham Maslow, "Creativity in Self-Actualizing People," in The Creativity Question, eds. Albert Rothenberg and Carl R. Hausman (Durham, N.C.: Duke University Press, 1972), pp. 86-92.

[3]Arthur Koestler, The Act of Creation (New York: MacMillan, 1969), p. 35.

[4]William J. J. Gordon, "Metaphor and Invention," in The Creativity Question, eds. Albert Rothenberg and Carl R. Hausman (Durham, N.C.: Duke University Press, 1976), pp. 250-255.

its purpose.[1] Gordon stressed that creativity is the thinking process, while innovation is the public expression of that creativity.

Tasman shared the view that creative behavior is related to the cognitive and perceptual style of the individual, and involves perceiving stimuli and breaking down (analysis) and rearranging (synthesis) the internalized patterns into novel patterns.[2] The child does this throughout his development, and thus, creativity is present to some degree in all persons from early childhood.

These definitions represent the thinking of many of the major scholars who have been interested in the construct of creativity, particularly in the past thirty years, at least since Guilford's springboard speech to the American Psychological Association. The diversity in definitions of creativity appears, at first glance, to give an impression of serious discrepancies in the interpretation of creativity. A more likely explanation is that each definition is related to a component of a complex concept. There is a degree of agreement among these definitions, and yet a variety of opinions on some aspects of creativity remain. Creativity was once considered to be a single personality trait. Psychologists, however, believe a simplistic view of creativity is no longer credible. The challenge for this study is to synthesize a useful conceptualization that would facilitate educational decision-making.

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[1]William J. J. Gordon, "On Being Explicit About Creative Process," Journal of Creative Behavior 6 (1972): 295-300.

[2]Allan Tasman, "Creativity, the Creative Process, and Cognitive Style and State," Comprehensive Psychiatry 17 (1976): 259-269.

Process

In an examination of creativity, there are several ways of delineating process. The internal intellectual activity that is engaged in is the cognitive processing of creativity. A description of the involvement of the brain in this processing provides a physiological basis for creative process. When these processes are implicit in an observable sequence of behavior that begins with the awareness of a problem and concludes with the implementation of a solution, the total process of creativity is captured. Each of these levels of process are reviewed.

Intellectual Process

There are a variety of cognitive abilities which appear to contribute to creativity. One of the models which addresses these abilities is Guilford's Structure-of-Intellect (SI).[1] This three-dimensional model defines intellectual abilities in terms of the contents, processes, and products of cognitive functioning (Figure 2.1).

Contents refer to the nature of the perceived stimuli or information upon which the intellect functions: visual, auditory, symbolic, semantic, or behavioral. Visual and auditory are both "figural," according to Guilford, and there is some evidence to suggest other sensory input may also constitute figural stimuli.[2]

The product dimension is related to the way in which the information is structured in the mind. These structures are:

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[1]Guilford, Way Beyond the IQ, p. 151.

[2]Ibid., pp. 14, 16.

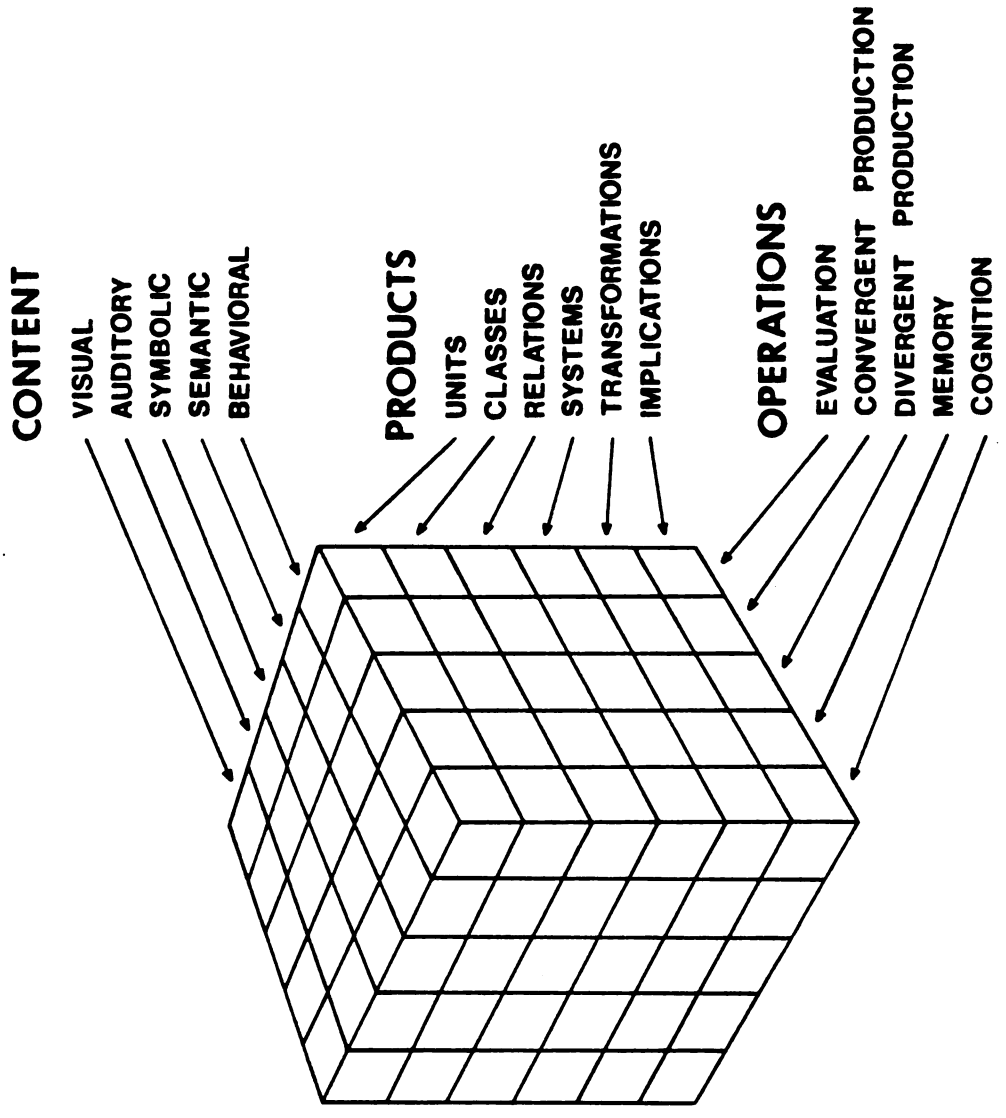

Figure 2.1 Guilford's Structure-of-Intellect Model.

units, classes, relations, systems, transformations and implications. Units are isolated examples. Classes are conceptual categories, i.e., several units that have common attributes. Relations describe the way in which two units are connected or related. Systems require three or more related units and usually at least two relations. Transformations are descriptions of change.[1] These transformations may occur with the other kinds of products, e.g., the transformation of a system. Implications are descriptions of expected events or change. For example, if a siren sounds, an emergency vehicle probably will appear. Implications would include what commonly are called predictions, conclusions, deductions, and elaborations.

The third dimension is the intellectual processing of the contents/products. These processes are: cognition, memory, convergent production, divergent production, and evaluation. Cognition is basically the perception of information. Memory is the organization and storage of the perceived information. Convergent and divergent production are two kinds of retrieval of stored information. Divergence is called "broad search" by Guilford. It is a search for alternative ideas. Convergence is the search for a single correct response or piece of information, i.e., deductive thinking. Evaluation is the comparison of retrieved data with the desired result to determine whether or not the information is what is sought. This may be called identity, agreement, and/or logical consistency.[2]

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[1]Ibid., p. 25.

[2]Ibid., p. 48.

Guilford suggested that the SI abilities most relevant to creative thinking come in the operation category of divergent production and the product category of transformation. Without these, he felt that creative thinking had not occurred. Other categories contribute, but only secondarily. The SI model is perhaps the most comprehensive model presently available that permits an understanding of the elements of creative behavior. One of the difficulties, however, is the tendency for researchers and practitioners to label their concepts differently. Perhaps much of the misunderstanding of creativity today relates to the plethora of terms and the shades of meaning those terms represent.

Haynes performed an hierarchical analysis of Guilford's model, using the Wherry hierarchical factor solution. His conclusion was that the model is first order only, rather than hierarchical.[1] Although he felt that there may be an implicit hierarchy, it is ambiguous. Consequently, the model does not allow for higher level abilities or abstractions, even though what is described is useful.

One taxonomy of the cognitive domain describes cognitive skills somewhat differently. Bloom and his colleagues developed an hierarchical taxonomy of educational objectives that has been widely referred to in educational milieu.[2] The taxonomy provides one alternative means of describing creative thinking as it relates to educational outcomes.

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[1]Jack R. Haynes, "Hierarchical Analysis of Factors in Cognition," American Educational Research Journal 7 (1970): 55-68.

[2]Benjamin S. Bloom, ed., Taxonomy of Educational Objectives: The Classification of Educational Goals: Handbook I--Cognitive Domain (New York: David McKay, 1956), p. 10.

The levels described are (1) knowledge, (2) comprehension, (3) application, (4) analysis, (5) synthesis and (6) evaluation.

The knowledge level is that in which recognition and recall, that is, basic memory processes, occur. Comprehension is the level at which a learner can explain the meaning of the knowledge, that is, translate it into his/her own words. When the comprehended knowledge is put to use in the appropriate circumstances, the application level is achieved. At the next level, analysis, knowledge is broken down into its component parts, while synthesis is defined as "the putting together of elements and parts so as to form a whole."

The authors proposed that creativity occurs in the synthesis level. They qualified this proposal by excluding free creative expression, since they implied limits set on the results, in terms of materials, methods or theory. The process of synthesis, and consequently the creative process, involves the use of the lower level processes as well. That is, before synthesis, there is a memory search and analysis of a problem or situation, perhaps using rules of application. Using the recalled and/or analyzed elements, new instructions are produced: new ideas, plans, or abstract relations. These are considered creative results.

Another way of looking at creativity could be through Gagné's description of learning types.[1] According to Gagné, there are eight types of learning: signal learning, stimulus-response learning,

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[1]Robert M. Gagné, The Conditions of Learning, 2nd ed. (New York: Holt, Rinehart & Winston, 1970), p. 62.

chaining, verbal association, discrimination learning, concept learning, rule learning, and problem solving. Gagné defined problem solving as: "a process by which the learner discovers a combination of previously learned rules that he can apply to achieve a solution for a novel problem situation."[1] He further clarified it by suggesting that it be called productive problem solving, to distinguish it from the mathematical skill of substituting different numerical values into one particular formula. It is unclear as to why he then referred to novel problems rather than novel solutions. One could find a different, but as appropriate, solution to a once-solved problem. He did not appear to distinguish between those problems that have one correct answer, and those that are open to more than one possible solution, but his emphasis on novel problems suggests that he was generally referring to one correct answer.

The process of problem-solving, as defined by Gagné, is one of using the subordinate levels of thinking, including learned rules, to develop a higher-order rule. He identified as prerequisites to effective problem-solving, an adequate store of rules, ease of recall, concept distinctiveness, and fluency of hypotheses.[2] These prerequisites appear to support the hypothesis of the value of an extensive knowledge base for effective creative production. Gagné also proposed that problem-solving is similar in function to rule-learning, in which the major difference is that more guidance is given in the latter. He

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[1]Ibid., p. 214.

[2]Ibid., p. 223.

termed the former discovery learning, in which the learner must formulate the higher-order rule without specific help.

In describing creativity as a special form of problem-solving, Gagné believed that the really dramatic creative events require "inductive leaps." He elaborated on this concept, describing it as a combining of ideas that come from widely separated knowledge systems, a bold use of analogy that transcends what is usually meant by generalizing within a class of problem situations. He gave the example of the development of the kinetic theory of gases. The inspiration evolved from a synthesis of subordinate rules from two very different fields: the study of the behavior of gases and the study of the laws of motion. The awe-inspiring aspect came from the remoteness of the association, as well as from its value and accuracy.

According to Gagné, creative discovery is dependent on skills and knowledge at the levels below problem-solving, with the most creative contributions having been made by persons with the greater wealth of stored knowledge and understanding of not only their own discipline, but often of other disciplines as well. Gagné, however, cautioned that while teaching problem-solving skills may provide for greater retention, transfer of learning, possibly even an increased motivation toward learning, he did not propose that it would predispose a person to become a creative thinker.

Many researchers have investigated specific cognitive processes or skills that appear to contribute to or be a component of creative thinking in many instances. Others, such as philosophers, have

attempted to describe these processes on the basis of their observations and examination of creative persons and their production. Many of these observations and findings provide a greater understanding of creative thinking.

Arthur Koestler, as a philosopher, has discussed creativity at great length.[1] He proposed that creative thinking is primarily a process he labeled "bisociation" for which he used a geometric model. He described this process as a synthesis of knowledge or images. Bisociation is the intersection of two different planes of thought or ideas that produces a novel result at their intersection. The planes and intersection may be related to the arts, sciences, or humor.

Mednick looked at creative thinking as that which brings remote ideas into association.[2] In order to measure the potential for creative thinking, he developed the Remote Associates Test (RAT). According to him, the more remote the associations, the more creative a person tends to be.

Roth presented a rationale for free association being a distinctive factor in creativity, particularly as it relates to psychoanalytic therapy.[3] He described free association and interpretation in the course of therapy as a creative act. Free association involves

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[1]Koestler, p. 35.

[2]Mednick, pp. 227-237.

[3]Nathan Roth, "Free Association and Creativity," Journal of the American Academy of Psychoanalysis 3 (1975): 373-381.

saying whatever comes to mind. "It is not merely the evoking of memories or the ecphorization of engrams, but also the formation of reconstructions and the adducing of enlightening new insights through a rearrangement of connections between data."[1] In this approach to therapy, the psychoanalyst appears to facilitate creative synthesis and bring it to the conscious level of thought. That synthesis necessary to mental health is apparently blocked in the client by repression or the inability to see connections.

Another study was designed by Welch to determine the relationship between creativity and the recombination of ideas.[2] Using tests designed to recombine words, lines and shapes into various configurations that met certain criteria, he found that artists had a significantly greater ability to recombine verbal and non-verbal knowledge into new forms much more quickly. The individual scores of a subgroup of the artists who worked in the same facility were also compared to evaluations of their creative talents and imaginativeness by their colleagues to validate their identification as creative persons.

One psychoanalytic approach to creativity was taken by Domino.[3] He designed a study to examine the proposal that creative people exhibit greater use of primary process thinking. Primary process thinking is

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[1]Ibid.

[2]Livingston Welch, "Recombination of Ideas in Creative Thinking," Journal of Applied Psychology 30 (1946): 638-643.

[3]George Domino, "Primary Process Thinking in Dream Reports as Related to Creative Achievements," Journal of Consulting and Clinical Psychology 44 (1976): 929-932.

defined as that thinking which does not involve the process of logical thinking and evaluation. The nine primary process mechanisms investigated by Domino were:

1. condensation--two or more objects or persons are fused to make one object or person;
2. unlikely combinations--description of events not impossible but unlikely;
3. fluid transformations--sudden appearances and disappearances;
4. visual representation--the concrete representation of an abstract relationship;
5. symbolism--a dream element that is emphasized to an unusual degree;
6. contradiction--a logical inconsistency;
7. magic occurrences--dream elements having a magical effect;
8. inhibited movement--inability to act; and
9. taboo acts--acts of a sexual and aggressive nature whose occurrence does not logically fit in the dream narrative.[1]

The results of the study demonstrated that creative students exhibited significantly more primary process thinking in three categories: condensation, unlikely combination and symbolism; and significantly less of contradiction. Contradiction is defined as inappropriate reasoning, feelings or action, a logical inconsistency.

One skill which appears to be associated with creativity is the ability to utilize fantasy or imagination. Ungersma pointed out that research has shown that creative people in all creative areas have active imaginations, and incorporate their fantasies into their works.[2] He discussed the general belief for many years that fantasy was unhealthy behavior. Psychologists now believe that a fantasy life

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[1]Ibid.

[2]Aaron J. Ungersma, "Fantasy, Creativity, Conformity," Humanitas 12 (1976): 73-88.

is necessary both to goal setting and to sustaining hope. Fantasy is only counterproductive if it results in destructive, or avoidance of constructive, behavior. Man's ability to convert fantasy into reality is responsible for creating new forms in his life and his environment.

Khatena has done extensive research on imagery and its production.[1] He found significant evidence that imagery is a crucial part of creative thinking. The factor which turns imagery into creative imagination is the fantasizing of new images that recombine known images. Khatena described these newly synthesized images as analogical or metaphorical thinking.

Rothenberg, as a psychiatrist, described a process that he felt was relevant to creativity.[2] He labeled this process "Janusian thinking." Janusian thinking is the ability to accommodate two or more opposing or contradictory ideas or images. Examples he gave are Yin and Yang, Mazda and Ahriman, Nirvana and Samsaea from Eastern culture. In Western thought he cited Nietzsche's Dionysius and Apollo, Freud's Eros and Thanatos, Being and Becoming, and God and Satan. The products of creative thought are typical Janusian thinking. The term is derived from the two-faced god Janus. Rothenberg saw this type of thinking as related to creative process in both the arts and sciences. He defined it as secondary process thinking, in contrast to the earlier reference to primary process thinking by Domino. Secondary process involves

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[1]Joe Khatena, "Imagination and Production of Original Verbal Images," Art Psychotherapy 1 (1973): 113-120.

[2]Rothenberg, "The Process of Janusian Thinking in Creativity," pp. 311-327.

the use of the verbal, logical elements of intellectual process. Rothenberg pointed out that all metaphor is based on verbal opposition, and that there is widespread support in the literary world for the theory that paradox or opposition plays a key role in literary creativity. If this is so, he suggested that the concept of Janusian thinking is essentially the same and is a major component of creativity. He also described Janusian thinking in other creative endeavors, citing Frank Lloyd Wright's concept of "affirmative negation" as an example.

Rothenberg supported his theory of Janusian thinking with extensive clinical evidence, interviews he had with creative and non-creative writers. He found that "creatives" used Janusian thinking frequently, but he never identified one example of it in his "non-creative" interviewees. The creative writers were both veterans and novices who were identified as such by awards and peer designation.

In discussing Janusian thinking, Rothenberg pointed out that one of the primary outcomes of its use in art is that it produces conflict, both cognitive and affective, in the consumer. This conflict stimulates thought as well as interest in the content. He felt that this Janusian thinking is probably an expression of emotional conflicts in the creator. The conflicts serve to stimulate the resolution of problems bringing harmony and integration. As a prerequisite to Janusian thinking, Rothenberg identified ambivalence as the wavering between opposite poles of feelings. He thought that ambivalence does not assure Janusian thinking, but that the latter probably is contingent upon the former.

In conclusion, Rothenberg stated his belief that Janusian thinking is one variable in creative production which is also dependent on other cognitive and affective processes. He made it clear that he did not see it as the equivalent of creative thinking.

In more recent studies, Rothenberg proposed the concept of homospatial thinking in creativity.[1] Homospatial thinking is the process of integrating two distinct concepts into a single spatial configuration, producing a novel concept. The process results in highly effective poetic metaphors. He proposed that homospatial thinking serves to synthesize Janusian thoughts, which is one element in creative process. Rothenberg supported his proposal with extensive clinical observations of creative people.

In describing both Janusian and homospatial thinking, Rothenberg suggested that these are not primary process thinking, but a progressive and highly adaptive ego function of secondary process thinking. He illustrated this contention by noting the differences between primary process thinking and the actual process in creation of a poem described in detail by one of his research subjects. Rothenberg also believed that both processes function as means to uncover unconscious material and its meaning for the creator. He stated that "psychodynamic fusion is a function of the homospatial process but it is not a primitive or regressive fusion, it is an adaptive one."[2] Homospatial thinking

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[1]Albert Rothenberg, "Homospatial Thinking in Creativity," Archives of General Psychiatry 33 (1976): 17-26.

[2]Ibid.

involves fusion of cognitive and perceptual elements and, as cognition and perception always have affective and motivational components, it also involves some fusion of drives as well. Arieti supported this thesis that both primary and secondary processes are involved in creative production.[1]

Other researchers have also examined the relationship of metaphor to creativity. Gordon developed the concept of analogical or metaphorical thinking into a program called "synectics," a specialized approach to creative problem-solving.[2] The essence of the technique is transformation, making "the strange, familiar and the familiar, strange." He has further described four types of analogy: personal, direct, symbolic, and fantasy, that refer to the content of the image.

One concept that continually resurfaces in creativity literature is that of divergent thinking. Bennett equated creativity with divergent thinking.[3] Guilford described divergent thinking as a component of creative thinking.[4] Guilford also defined divergent thinking as a broad search of the memory store for alternative responses.[5]

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[1]Silvano Arieti, "From Primary Process to Creativity," Journal of Creative Behavior 12 (1978): 225-246.

[2]Gordon.

[3]S. N. Bennett, "Divergent Thinking Ability: A Validation Study," British Journal of Educational Psychology 43 (1973): 1-7.

[4]Joy P. Guilford, "Aptitude for Creative Thinking: One or Many?" Journal of Creative Behavior 10 (1976): 165-169.

[5]Guilford, Way Beyond the IQ, p. 92.

Torrance has developed a variety of evaluation instruments that measure divergent thinking abilities.[1] He has analyzed divergent thinking into several skills. These skills include ideational fluency, flexibility, and originality. Ideational fluency is the ability to produce high numbers of responses in a given time period. Originality is the ability to produce original ideas. Flexibility is the ability to make transformations that are distantly related. The capacity for each of the skills enhances creative behavior. A similar ability is that of elaboration. This is the ability to take an initial idea and transform it into a more complex entity.

One area of research that has shed some light on the process of creativity is that of consciousness. Psychoanalysts have emphasized that the cognitive processes that occur in creative thinking can function both consciously and subconsciously.[2] The existence of an incubation period in creative activity appears to support the functioning of creative mental processes below the conscious level. The preconscious may be the locus of processing knowledge stored in the unconsious with varying degrees of retrievability.

An understanding of the role of consciousness can be enhanced by studies of altered states of consciousness. These states involve reduction of perception of external stimuli and sense of time, which is exemplary of descriptions of creative people during the encounter

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[1]E. Paul Torrance, Torrance Tests of Creative Thinking: Directions Manual and Sorting Guide (Princeton, N.J.: Personnel Press, 1966).

[2]Edith Wallace, "For C. G. Jung's One Hundredth Birthday: Creativity and Jungian Thought," Art Psychotherapy 2 (1975): 181-187.

phase of creativity when they forget to eat or sleep. Simon referred to the hypnogogic state of consciousness, that plays a role in creativity.[1] She indicated that this state occurs in the transition between sleeping and wakefulness and involves dream-like imagery. One significant example of inspiration that occurred in that state is that of the chemist, Kekule. He aroused from a partial sleep to see an image of entwined snakes that led him to see the configuration of the benzene ring, a problem he had been working on for some time. Simon suggested that the artist creates in a similar fashion. She described this state as "self-transcendence."

The theories of intellectual functioning that play a role in creative thinking are interesting in the light of newer research into the physiological aspects of intelligence. Krippner, whose interest in creativity is extensive, emphasized the importance of research to understand human consciousness.[2] The study of altered states of consciousness, parapsychology, brain/mind relations and biofeedback may provide avenues to further understanding of the process of creativity.

Physiological Process

The recent developments in biofeedback, and its use in the investigations of the mental processes of creative persons, have

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[1]Jane Simon, "Creativity and Altered States of Consciousness," American Journal of Psychoanalysis 37 (1977): 3-12.

[2]Stanley Krippner, "Consciousness and the Creative Process," Gifted Child Quarterly 12 (1968): 141-157.

provided tentative evidence for these altered states of consciousness.[1] The brain waves, designated alpha, beta and theta, vary according to the level of consciousness. Increased alpha waves are recorded during conscious mental activity in creative persons, according to Martindale, while fewer are produced during relaxation.[2] In most people this response is reversed. He explained this by stating that "creativity and intellectual ability require two different thought processes, the former calls for low cortical arousal and defusing one's powers of concentration; the latter calls for higher cortical arousal and focused attention."[3] Martindale, in concert with May's theory, suggested that teaching people to control alpha waves may decrease rather than increase creativity.

Another area of neurophysiological research that relates to and provides evidence for the nature of creative process is the recent split-brain research. Geschwind summarized the work that began with Broca's observations in 1865 that the left brain controls language.[4] Man appears to be the only animal with a unilateral brain. Ninety-seven percent of the people with language distortion due to brain

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[1]Robert E. Ornstein, The Psychology of Consciousness (New York: W. H. Freeman, 1972; Penguin Books, 1975), p. 218.

[2]Colin Martindale, "Creativity, Consciousness and Cortical Arousal," Journal of Altered States of Consciousness 3 (1977-1978): 69-87.

[3]Ibid.

[4]Norman Geschwind, "Language and the Brain," Scientific American 226 (1972): 76-83.

damage have the damage on the left side of the brain, which supports the theory that in most people the left brain controls speech.

Additional understanding of hemispheric function resulted when surgical severance of the corpus callosum, the connecting tissue of the two hemispheres, was used to control epileptic seizures.[1] It was discovered that each half could operate independently and the hemispheres controlled different functions.[2] The left brain was shown to control not only language, but logical, sequential thinking and mathematical calculation. The right brain was found to control primarily holistic, visuo-spatial imagery. These findings have been enriched by discovering the connection of the sensory organs on one side of the body to the brain hemisphere on the opposite side. That is, sound heard with the left ear is processed primarily in the right hemisphere, while the left hemisphere processes the sounds received by the right ear. Each ear tends to "hear" stimuli differently. This differentiation is not absolute, nor identical in all persons, but the correlation is extremely high.

Ornstein preferred to describe the functions of the left and right brain as being concerned with processing information (in sequential and holistic ways, respectively) as opposed to the type

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[1]Michael S. Gazzaniga, "The Split-Brain in Man," Scientific American 217 (1967): 24-29.

[2]Timothy J. Teyler, "An Introduction to the Neurosciences," in The Human Brain, ed. M. C. Wittrock (Englewood Cliffs, N.J.: Prentice-Hall, 1977); and Stanley A. West, "Creativity, Altered States of Awareness, and Artificial Intelligence," Journal of Altered States of Consciousness 2 (1975-1976): 219-230.

of data they process, i.e., verbal or spatial.[1] He and his colleagues did extensive work on hemispheric functioning which clarified and expanded earlier studies.

Alajouanine described some interesting examples of the effects of brain damage on several of his creative clients that, although done before the split-brain theory was set forth, supports that theory.[2] He shared the experiences of three aphasic patients: a writer, a musician and a painter. Each had an aphasia located in a specified area of the left hemisphere.

The writer, although he could continue to read in three languages, could only write very simple sentences. He was incapable of the synthetic construction that contributes to literary creativity. His creations were primarily verbal and analytical, which the left brain tends to control.

The musician, Maurice Ravel, after a serious brain trauma could recognize his works, whether they were played correctly or not, and actually sang his pieces by heart if the first notes were given. He could not, however, use musical expression, such as naming notes. In other words, analytic deciphering was nearly impossible for him. He could play his own pieces "by heart" but could not learn a new piece. Those activities which required a certain type of left brain processing were not possible for him.

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[1]Robert E. Ornstein, "The Split and the Whole Brain," Human Nature, May 1978, pp. 76-89.

[2]T. Alajouanine, "Aphasia and Artistic Realization," Brain 71 (1978): 229-241.

The painter, on the other hand, who also had a left-brain aphasia, experienced no reduction in his artistic ability. He had considerable difficulty in verbal speech and writing. If anything, the emotional impact of his illness may have given more intensity and acuity to his artistic expression. Evidently the location of his aphasia controlled only the verbal and symbolic interpretative skills which did not figure in his art.

The results of these observations appear to support the need for capable use of both hemispheres in creativity. Even though the artist was artistically unaffected by his aphasia, the question remains, could he have learned his technical skill without left-brained participation? The musician was unable to acquire new technical knowledge; he depended, instead, entirely on his already acquired knowledge. The other significant factor is that the aphasia was located in a small portion of the left hemisphere (Wernicke area), which does not control all verbal skills. It is unknown what other executions might have occurred in the unaffected portions of the left brain to produce the paintings. Sculpture, dancing, and just a few other art forms have a non-verbal nature. Thus, effective left brain activity is probably necessary in most creative production, and it is an open question as to whether or not some left brain activity may be necessary to all creative production.

The primary and almost exclusive emphasis in our culture, and thus, in our educational system has been on the left brain.[1]

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[1]Madeline Hunter, "Right-Brained Kids in Left-Brained Schools," Today's Education, November-December 1976, pp. 45-48.

The creative process, however, is dependent on the rich use of holistic visual/imagery as well as left-brain activity.[1] The multiple skills of creative production require coordination of left and right brain processing. To quote Ornstein, "All knowledge cannot be expressed in words, yet our education is based almost exclusively on its written and spoken forms. We seem unable to expand our ideas of education and intelligence."[2]

Goodrum attempted to relate hemispheric function, creativity and Piagetian theory.[3] He found that the various creativity measures were not related to right or left hemispheric thinking, suggesting the necessity for the involvement of both in creative process. He also found no relationship between Piagetian cognitive development and creative thinking. The cognitive development was more closely related to left-brain activity. He also found that development of left hemispheric thinking is related to grade advancement while creativity is not. Development of right hemispheric thinking appeared to be found in some schools and not in others.

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[1]Susan V. Garrett, "Putting Our Whole Brain to Use: A Fresh Look at the Creative Process," Journal of Creative Behavior 10 (1976): 239-249.

[2]Ornstein, The Split and the Whole Brain.

[3]Denis Goodrum, "A Study to Investigate the Correlations Between an Adolescent's Creativity, Right and Left Hemisphere Thinking and Piagetian Cognitive Development" (Ph.D. dissertation, Dissertation Abstracts, 1978: 38[11-A]6634).

Behavioral Process

As a means of understanding the processes that comprise creative behavior, it is helpful to describe the stages that people reportedly go through in being creative. Wallas first elucidated these stages as preparation, incubation, illumination and verification,[1] and subsequent biographical accounts tend to support these stages.[2] These stages have been given several labels, but they appear to follow the same pattern.

The first stage is preparation or encounter. During this phase, the person is intensively involved in an encounter with stimuli in the environment that arouse intense interest.[3] This may be in the form of a perceived problem, avid concern with, or lack of understanding of, an existing situation. During this phase, the person seeks data, puzzles over the perceptions, examines the situation from many angles, and perhaps tries to define what the problem, discrepancy or dissonance is. An effective problem statement or sensed need (as in the arts) is the key to achieving desired results.[4] The creative person is so intensely involved in this observing, perceiving, analyzing and formulating hypotheses that he/she often forgets to eat or loses track of

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[1]Graham Wallas, "Stages in the Creative Process," in The Creative Question, eds. Albert Rothenberg and Carl R. Hausman (Durham, N.C.: Duke University Press, 1976), pp. 69-73.

[2]Anastasi and Schaefer.

[3]Sidney J. Parnes, "Effects of Extended Effort on Creative Problem Solving," Journal of Educational Psychology 52 (1961): 117-122.

[4]J. Vernon Jensen, "A Heuristic for the Analysis of the Nature and Extent of a Problem," Journal of Creative Behavior 12 (1978): 168-180.

time and surroundings. Much of the cognitive activity during encounter is conscious mental activity.

When a person reaches a point of having struggled with his/her thoughts until no new revelations appear to be forthcoming, and withdraws to engage in another activity, the second stage begins. This is the incubation phase.[1] During this phase, conscious attention to the situation is replaced with conscious attention to another activity. There is, however, apparent continuing preconscious activity. Kubie described the preconscious as a level of mental activity beneath the conscious or awareness level that is able to manipulate previously stored data in the brain, pulling it from the unconscious and reorganizing it into meaningful patterns.[2]

At a given point, which is not well understood, the synthesis that occurred in the preconscious, reappears in the conscious mind as an insight.[3] This third stage is usually called inspiration. This may occur in dreams, under hypnosis or in conscious experience in unlikely places and at unexpected times. It can occur after an incubation period of seconds, hours, days, months or years. This is sometimes called the "AHA!" or "Eureka!" experience and sets the stage for creative production.

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[1]Ante Fulgosi and Joy P. Guilford, "Short-Term Incubation in Divergent Production," Journal of Creative Behavior 4 (1970): 131-132.

[2]Jensen.

[3]Otis M. Walter, "Creativity and the Rules of Rhetoric," Journal of Creative Behavior 1 (1967): 383-390.

Once the idea, solution, or insight has occurred, the fourth and last stage of implementation should follow. This stage involves a high level of perseverance to bring the creative idea to fruition.[1] Successfully creative persons are able to proceed through all four stages effectively.

A more comprehensive model of creative behavior is one which addresses the many skills required to generate a creative product. This is known as the creative problem-solving process as described by Parnes, Noller and Biondi.[2] The process is a structured five-step plan designed to facilitate the production of creative ideas and solutions to problems. These steps include (1) fact-finding: discovering as much as is feasible about the situation that poses a challenge; (2) problem-finding: identifying the real problem and refining the problem statement; (3) idea-finding: using divergent thinking and other creative cognitive skills to generate many possible ideas; (4) solution-finding: evaluating the ideas for their appropriateness; and (5) acceptance-finding: planning the implementation of the idea, including both technical and motivational aspects.

The process as described actually uses divergent and convergent thinking as well as evaluation in each of the five steps. In the first step, a broad or divergent search, to use Guilford's term, is made for

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[1]Leon E. Trachtman, "Creative People, Creative Times," Journal of Creative Behavior 9 (1975): 35-50.

[2]Sidney J. Parnes, Ruth B. Noller and Angelo M. Biondi, Guide to Creative Action, revised ed. of Creative Behavior Guidebook, 1967 (New York: Charles Scribner's Sons, 1977), p. 30.

as many facts as seem even vaguely related. These are then evaluated convergently to select those that are truly relevant. In the second step, using one or more suggested techniques, a variety of ways of stating the problem are generated without judgment of acceptability. The statements then are evaluated to select the most accurate description of the problem. In step three, the brainstorming technique is employed which calls for generating a large quantity of "wild" ideas, building on the ideas, and deferring any judgment. These ideas are then culled to select those that have potential, discarding the unrealistic or useless ones. In step four, divergent thinking is used to produce a list of criteria important in selecting a solution from the idea list, which is then narrowed to the important ones and used to evaluate and select the best idea. In step five, a quantity of possibilities for implementing the ideas are generated and then the preferred plan selected.

Each step in the creative problem-solving model described above is flexible and lends itself to the use of a variety of proven strategies to accomplish the purpose of each step. The application of this model appears to be most effective as a means to facilitate creative thinking where it does not "come naturally."

The two descriptions of the stages of creative production first reviewed are the observable elements of creative behavior. They do not explain the interplay of the cognitive and affective elements with the environment that occurs prior to the expression of creative behavior.

In addition to his Structure-of-Intellect Model, Guilford proposed a behavior model (Figure 2.2) to explain the internal elements of human problem-solving.[1] This model incorporates the cognitive processing into a stimulus-response format. The attention filter in the reticular formation selects out, from both environmental and somatic stimuli, the information which is sent on to the cortical area of the brain. This step appears to relate to problem sensitivity. Information that is sent on is brought to awareness, while stored data is retrieved from the memory store, evaluated for relevance, and related to the new data. Also, some retrieved data are unevaluated, yet consciously recognized. It may prove later to be relevant. Once this information is examined, the search begins for a solution or idea. If the right answer or only one answer is sought, then that answer is found in memory store, evaluated, and approved by convergent production. If there are several alternative possibilities or no right answer, then the memory is searched for alternatives which are evaluated for best choice.

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[1]Guilford, "Executive Functions and a Model of Behavior."

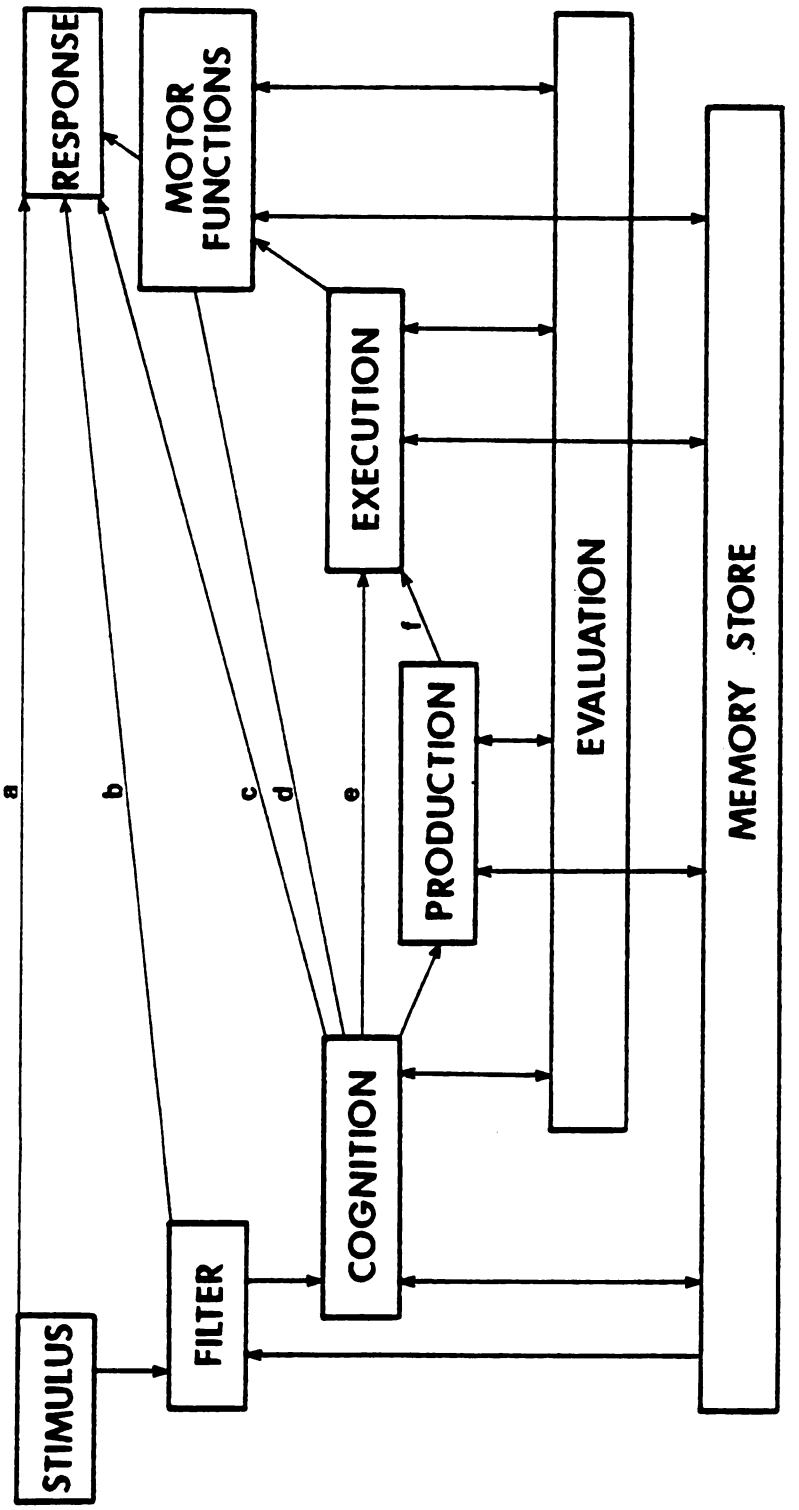

Figure 2.2 Outline of an Operational Model of Behavior that Incorporates Intellectual and Psychomotor Functions.

In summary, creativity has been characterized as a synthesis of appositional or oppositional elements.[1] At its most productive level, and perhaps in almost all instances, creativity utilizes the interrelated functions of both brain hemispheres.[2] Other ways of describing creative thought are the "bisociation" of two different planes of thought,[3] or the bringing together of two or more remote ideas or images.[4] Also, it has been proposed that creativity is the process of generating imagined goals toward which human beings strive to produce the uniqueness of human personality.[5]

One philosopher, in a review of creativity, concluded that the one word which best characterizes creativity is "paradox."[6] As Doyle described it in her own words:

> The creative process involves freedom and spontaneity. The creative process demands discipline and concentration. It involves the primitive and the emotional, intelligence and thought; it calls upon fantasy and inventiveness--a willingness to deviate from what is; it demands honesty and a commitment to truth. It is an expression of self and it cannot take place without forgetting the self. It is a joy and a terror; it is its own reward; it requires encouragement and understanding from others. From the perspective of time, they no longer seem so paradoxical.[7]

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[1]Rothenberg, "The Process of Janusian Thinking in Creativity."

[2]Albert N. Katz, "Creativity and the Right Cerebral Hemisphere: Towards a Physiologically Based Theory of Creativity," Journal of Creative Behavior 12 (1978): 253-264.

[3]Koestler.

[4]Mednick.

[5]Rogers.

[6]Charlotte L. Doyle, "The Creative Process: A Study of Paradox," Urban Review 7 (1974): 292-302.

[7]Ibid., p. 302.

The concept of paradox is not unlike Rothenberg's Janusian thinking[1] and homospatial thinking.[2] This description is also reminiscent of a philosophy proposed by an early creative educator, John Dewey, who believed that there were few "Either-Or" situations.[3] He believed that the appropriate direction to pursue in schools would be a synthesis of two polarities, experience and education. The result would be more creative products, whether social, educational, scientific, artistic or personal. A comparable field of personality theory is founded on the same principle. Assagioli developed a psychotherapeutic process known as psychosynthesis.[4] The primary focus is on the integration of opposite drives and tendencies within individuals which resolves intrapersonal conflicts, producing increased mental health.

Product

One principle which many experts agree on is that creativity involves the development of a product, tangible or intangible. Ambiguity surfaces in relation to the nature of the products, and to the criteria by which they are adjudged "creative." In the past several decades, the restrictive view of creative production has been expanded

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[1]Rothenberg, "The Process of Janusian Thinking in Creativity."

[2]Rothenberg, "Homospatial Thinking in Creativity."

[3]John Dewey, Experience and Education (New York: MacMillan, 1938; Collier Books, 1963), p. 17.

[4]James Vargiu, ed., "What Is Psychosynthesis?" Synthesis 1 (1977): 112-115.

to include products not previously considered eligible to qualify as "creative." Many of the creative products of today were, in the past, overlooked, with the emphasis on the artistic works and inventions of an elite and "anointed" few. In contrast, the majority of scholars in the field now believe that almost everyone has creative potential to some degree, in one area or another, often unrealized or unrecognized.

There is a high level of difficulty in determining which products are truly the result of creative process. If the criterion is uniqueness, the qualifier must be asked, "unique to whom?" If it must be unique to world culture, who has the extensive knowledge needed to assure that it has never been produced before? The product may have been developed in another time or place and not have achieved acceptance or wide dissemination. If it must be unique only to the creator, there is always the possibility that it is the result of an earlier memory stored in the subconscious rather than a new transformation.

While it may be difficult, if not impossible, to look at a product and determine the level of creativity present in its production, it is not necessary to do so in determining which products are potentially creative. With the broader definition of creativity, any tangible or intangible result of man's endeavor was, at its premier appearance, a creative product. Whether that product was paper money, an aria, the safety pin, a quilt, or a mud hut, it required creative process to bring it into being. Improvements on those products also represented creative thought. To set apart only certain kinds of man's creative genius is to do injustice to many others.

Instead of emphasizing specific examples of creative products, it seems more appropriate to develop a system of general categories with representative examples as a means of expressing the scope of creativity. To accomplish this intent, creative products will be identified as either art, science, a synthesis of both, or personality. In addition, there will be a comparison of the work of the creative person as compared to that of the skilled technicians.

Art

The arts have been defined as those activities that have provided mankind with aesthetically pleasing products.[1] This is probably not an adequate definition, as instances can be cited in all of the artistic fields of works of art that are in some ways offensive rather than pleasing. Writings of social evils, paintings of tragic events and ominous colors, tragic plays, and cacophonous music have elements of unpleasantness, even gruesomeness, and yet qualify as creative art. More likely, they are expressions of the artist's perception of the inner and outer worlds of reality. The aesthetics perhaps exist in the manner in which the elements of a work of art are integrated. There is some disagreement as to whether the artist creates for himself or to communicate to others. Perhaps this also is not an either-or situation, but a matter of a blend of both, within varying degrees, depending on which is most important at a given time.

Art takes many forms. The category that is usually thought of first is the visual arts. These include painting, sculpture,

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[1]Will Durant, The Story of Civilization, vol. 1: Our Oriental Heritage (New York: Simon & Schuster, 1954), p. 82.

photography, wood carving, and other forms of visual images, using Guilford's SI terminology. Also, they may represent behavioral content if they include living forms, such as statues and portraits. Any one of these products may, however, not warrant the label "creative."[1] It may be the work of a technician who copies existing art, or a photographer who lifts the camera and snaps a picture of anything in sight. Creative art implies production that synthesizes elements purposefully to produce something meaningful and aesthetic.

Music is another area of artistic endeavor. Creativity in music may be expressed in compositions that synthesize aural elements with expressive themes, e.g., in synthesizing words with music, or in the personal interpretation of a technical score. The way a piece is sung or played, transformed by the design of the performer, gives it a unique quality. The musician, however, who executes a musical composition on an instrument just as it is written, no matter how skillful the performance, is not creative, but is a technician. In other words, the child who fumbles at the piano keys to come up with an original tune, albeit crude and unskilled, is being more creative than the most skilled technician who plays flawlessly the work of another.

Dance is a synthesis of behavioral expression with music. As with music, the dancer who choreographs his or her own dance or interprets the choregraphing of another is being creative, while those who follow the choregraphed dances with great technical skill are fine technicians but are not creative. One of the problems with the definition of "creative" is that this distinction is frequently overlooked.

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[1]Clark Moustakas, Creativity and Conformity (Princeton, N.J.: Van Nostrand, 1967), p. 37.

Another form of pure art is drama. Creative drama uses unique ways to convey thoughts, emotions, and ideas. It combines the use of creatively written dialogue, plot ideas, and symbolism. In addition, the actor can add interpretation with his/her own emotions and body language. The actor who just reads the lines and the writer who repeats real-life experiences verbatim are technicians and not creative artists.

Humor is a specialized form of creative writing and drama. It is incorporated into drama referred to as comedy, or may stand alone as a joke. Koestler refers to humor as a third form of creativity in addition to the artistic and scientific forms, partly because of the different response it generates in the recipient.[1] Plays on words, such as puns and malapropisms, evoke laughter because they represent unusual uses of the word, or substitute for a word with a similar pronunciation, producing ludicrous images. Not all that is laughed at is creative humor, however. Man has a penchant for laughing at persons who are made to look ridiculous, or to cover his own embarrassment. Also, the comedian who tells the joke may not have participated in the creativity involved, although he may create the behavioral mode.

Another major area of art is creative writing. In this category we find novels, poetry, essays, short stories, drama, and non-fiction. The creativity may come in the plot, the metaphorical language, and the character development. The level of creativity may range from the construction of a simple rhyme by a child, to the production of a highly sophisticated piece of literature. The child's work may be

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[1]Koestler, pp. 91-93.

one of recalling simple phrases until two are found that rhyme and make sense, or may be a novel construction from the imagery in his mind. Although both are creative efforts, they differ in degree of difficulty.

These basic forms of art that exemplify art for art's sake have been the classic areas that have qualified as creative for centuries. There are variations of them that will be discussed in the section on "translation."

Science

The word science comes from the Greek word meaning "to know." Science is knowledge and the way that knowledge is organized.[1] The purpose of basic science is to acquire an understanding of the nature of the universe in a manner which is comprehensible and predictable. The sciences are generally divided into the physical, biological, and behavioral sciences because of the distinctive differences in the objects of study among those divisions.

In the physical sciences, scientists deal with observable events involving non-living matter. They observe and record, if they are technicians, working with primarily sensory data. Much of this is converted to symbolic and semantic representations. The creative scientist either observes data, and then hypothesizes statements of laws (principles) that explain the data and predict subsequent related events--for example, the Laws of Thermodynamics, or may classify the data or organize them into systems--for example, the Periodic Chart of the elements.

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[1]Paul Davidson Reynolds, A Primer in Theory Construction (Indianapolis, Ind.: Bobbs-Merrill, 1971), p. 4.

Similar processes hold true for the biological sciences, except that the subject matter is living organisms. Classification systems, such as Linnaeus' taxonomy of the plant and animal kingdoms, and Mendel's principles of heredity, are examples of creative products in the biological sciences.

The behavioral sciences focus on the behavior of animals, human and nonhuman, rather than on the structure and function of biological organisms. The behavioral sciences have their creative scientists as well. An example of a classification system is Guilford's SI model,[1] while Pavlov's classical conditioning is an example of a behavioral principle.[2] Berne is known for his development of a system that describes human personality and interaction, known as transactional analysis.[3]

The creation of these descriptions of classifications (conceptualizations), principles (relationships), and systems, require synthesis and evaluation which are the major processes involved in creativity.[4] Thus, they represent the creative products of scientific endeavor, unique and useful ways of knowing and describing the universe.

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[1]Guilford, "Three Faces of Intellect."

[2]Wendell I. Smith and William J. Moore, Conditioning and Instrumental Learning: A Program for Self-Instruction (New York: McGraw-Hill, 1966), p. 19.

[3]Eric Berne, Transactional Analysis in Psychotherapy: A Systematic Individual and Social Psychiatry (New York: Grove Press, 1961), p. 1.

[4]Bloom, pp. 165, 185.

Translation of Science and Art

If science is knowledge and art is expression of meaning, then the translation of knowledge into forms that have meaning for persons is another kind of creative endeavor. The process might be described as bringing together or "bisociating" the plane of knowledge with the plane of meaning for self and others.

Certainly, the profession of teaching would qualify here. The basic role of teachers can be defined as translating the science of learning into the art of teaching.

Many of the service professions of today describe their purpose as the translation of science into art. One example is the profession of dietetics which declares its purpose to be the "translation of the science of nutrition into the art of health care."[1] Health care is an art in that it must be tied to events of meaning for the recipients if that care is to be effective. The health care provider needs to identify meaningful dimensions and communicate them to the client. That requires creative synthesis and/or problem-solving.

The art of selling can be a creative translation of science also. The process involves the understanding of the tangible or intangible product, and connecting that product to the unique needs of the client. The creative person may well be among the most successful salespersons.

Other forms of translation involve examples such as architecture, the translation of engineering principles into works of art

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[1]The Profession of Dietetics: The Report of the Study Commission on Dietetics (Chicago: American Dietetic Association, 1972), p. 3.

to be used and enjoyed by people. Perhaps interior design falls in this category, also. The designer uses principles of traffic flow, lighting, use, and other related principles, and creates an aesthetically pleasing, and yet functional, living space. Producers of tableware and other useful, yet aesthetically pleasing, products would appear to belong to this translation class.

Human Personality

A fourth kind of creative product that has recently joined the others is that of the human personality. Landau and Maoz, in working with aging persons, correlated creativity with the self-actualizing person.[1] They believed that the nurturing of the creative attitude in persons prepares them for a meaningful life and a satisfying aging experience.

Wenkart proposed that creativity and freedom are interrelated and uniquely human.[2] She felt that both are necessary to mental health. As a psychoanalyst, she emphasized the importance of creativity for both analyst and client.

Rogers described creativity as the curative force which nurtures man's tendency to actualize his potential.[3] It is the human being

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[1]Erika Landau and Benjamin Maoz, "Creativity and Self-Actualization in the Aging Personality," American Journal of Psychotherapy 32 (1978): 117-127.

[2]Antonia Wenkart, "Creativity and Freedom," in Psychoanalysis as Creative Process: A Symposium, American Journal of Psychoanalysis 23 (1963): 195-204.

[3]Carl R. Rogers, "Toward a Theory of Creativity."

utilizing the resources of his environment and his own being to create a unique relational product, himself.

Weiss, in introducing a symposium on psychoanalysis as creative process, cautioned his colleagues against overlooking the creative dimension of persons in therapy.[1] He recalled Horney's contention that man's ability to create is the substance of his desire to be self-actualizing.

The concept of therapy as creative process is further expanded by Siirala.[2] Specific forms of therapy using the arts, such as dance therapy and music therapy, thus become one tool for the therapist.[3]

Cole and Sarnoff summarized much of the literature on creativity as it related to psychotherapy and mental illness.[4] Their emphasis was on counseling with clients who are functioning reasonably well, rather than therapy for those who exhibit severe neuroses and psychoses. That is, therapy is focused on returning clients to their former level of functioning, while counseling is concerned with promoting growth. The

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[1]Frederick A. Weiss, "Introduction," in Psychoanalysis as Creative Process: A Symposium, American Journal of Psychoanalysis 23 (1963): 132.

[2]Martti Siirala, "Self-Creating in Therapy," in Psychoanalysis as Creative Process: A Symposium, American Journal of Psychoanalysis 23 (1963): 164-172.

[3]Judith R. Bunney, "Dance Therapy and Notes on Task Panel on 'The Role of the Arts in Mental Health,'" Art Psychotherapy 5 (1978): 7-9.

[4]Henry P. Cole and David Sarnoff, "Creativity and Counseling," a paper prepared for and presented at the 25th Annual Creative Problem Solving Institute, Buffalo, New York, June 24-29, 1979.

creative process is at the very core of the growth process, playing the leading role in developing the uniqueness and integrating the polarities of human personality. Those persons who have so tapped their creative potential and are self-actualizing have a tendency to exemplify certain personality characteristics. These are presented in the next section.

Persons

Long before there was any significant understanding of creative process, interested persons were analyzing the creative personality. The early students of creativity were struck by their observations of the seeming relationship between creative genius and mental illness. In the late 1800s, Lombroso proposed a theory of the involvement of brain degeneration in both neurosis and genius.[1] He identified the following traits as occurring frequently in genius as well as in mentally defective persons: small stature, rickets, pallor, emaciation, cretin-like facial features, lesions of the head and brain, stammering, left-handedness, sterility, dissimilarity to parents, precocity, delayed development, rejection of other's ideas, vagabondage, unconsciousness, instinctiveness, somnambulism, genius in inspiration, double personality, stupidity, hyperaesthesia, paraesthesia, amnesia, originality, and fondness for special words. For a time his theory gained credence, but later was found inadequate to describe genius.

In a more recent attempt to relate mental illness to creativity, Pickering examined the lives of several creative individuals who

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[1]Cesare Lombroso, "The Man of Genius," in The Creativity Question, ed. Albert Rothenberg and Carl R. Hausman (Durham, N.C.: Duke University Press, 1976), pp. 79-85.

suffered mental illness and rose to greatness.[1] He believed that the mental illness contributed to their eventual creativity, just as a physical illness might do, by either forcing them to find other than normal social outlets, or by removing them from the mainstream where they were not diverted from utilizing their creative potential. It could perhaps be argued that they were not effectively socialized by the schools and other institutions because of their isolation.

The validity of these observations, which appear to contrast with the more recent line of thought correlating creativity with mental health and not illness, may be more readily understood in light of Rank's observations.[2] He described three levels of individual functioning. The lowest level is the adapted individual, who is reasonably content with day-to-day existence as long as a minimum of frustrations occur. Adapted persons go about their daily routine with little questioning of the status quo. The middle level is the conflicted person. He is wracked with questions and concerns, aware of the conflicts within him, but not very effective in confronting and dealing with the conflicts. At the upper level is the creative person, who has achieved a degree of integration of the conflicts with the help of creative synthesis. The degree of creativity between persons, however,

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[1]George Pickering, Creative Malady: Illness in the Lives and Minds of Charles Darwin, Florence Nightengale, Mary Baker Eddy, Sigmund Freud, Marcel Proust, Elizabeth Barrett Browning (London: Oxford University Press, 1974; Delta, 1976), p. 18.

[2]Otto Rank, "Life and Creation," in The Creativity Question, eds. Albert Rothenberg and Carl R. Hausman (Durham, N.C.: Duke University Press, 1976), pp. 114-120.

is not related to the functional levels. Persons with highly developed creative process skills may yet be conflicted, but are motivated to the degree that they create in spite of conflicts. These persons are frequently seen in the arts, where artistic expression may provide an alternative to direct confrontation.

Persons with less well-developed talent may be using their creative skills to deal with mundane problems and achieving a self-actualizing state. The results of their creativity are not striking, except to themselves. What this implies, however, is that conflicted persons showing noteworthy creative talents should be even more creative as they resolve their conflicts. Anshin, a psychiatrist, supported this idea as he reviewed the biographical story of Herman Hesse, a creative writer.[1] Those who experienced the mental illness in Pickering's descriptions appeared to be in the conflicted stage and used the involuntary isolation to work toward a higher level of functioning.[2]

The case for associating creativity with increasing mental health has gained extensive support in recent years. A survey of the traits of creative persons provides evidence for this support. These traits are frequently descriptive of the self-actualizing, fully-functioning individual.

Peavy identified a number of characteristics of creative and non-creative persons.[3] These characteristics of creative persons

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[1]Roman Anshin, "Creativity, Mid-Life Crisis, and Herman Hesse," Journal of the American Academy of Psychoanalysis 4 (1976): 215-226.

[2]Pickering, p. 17.

[3]R. Vance Peavy, "Therapy and Creativity: A Dialogue," Journal of Creative Behavior 13 (1979): 60-72.

included: openness to experience, internal locus of evaluation, spontaneous play, reduced inhibitions, ability to let capacities flow, understanding self-awareness, realistic self-appraisal, self-discipline, wide interests, ability to elaborate, ability to improvise, dance, and dramatize, and increased self-expression with materials. Non-creative persons exhibited undue concern with external evaluation, internal prejudices, rigidity of behavior, fear of risk-taking, psychopathology, evaluative attitude, need for quick solutions, excessive involvement with others, neglect of own needs, intolerance of playfulness, worries, anxieties, and internal dialogues with foes, real or imaginary.

Alamshah looked at creativity and its blockages in three categories: socioeconomic, psychological, and characterological.[1] He found that creativity was suppressed in those who lacked self-discipline, commitment, and inner quietude. Also, creativity was not readily expressed in those who were not risk-takers, had limited conceptions of human intelligence and their own talents, and had excessive attachments. In an earlier paper, he emphasized the importance of motivation (which can be acquired), receptivity, competence, and selectivity.[2]

Another researcher looked at creative persons as paradoxical personages. McMullen described these persons with terminology

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[1]William H. Alamshah, "Blockages to Creativity," Journal of Creative Behavior 6 (1972): 105-113.

[2]William H. Alamshah, "The Conditions of Creativity," Journal of Creative Behavior 1 (1967): 305-313.

exemplifying the polarities. According to him, creative persons demonstrated delayed closure, convergence/divergence, mindless perception, constructive discontent, detached involvement, disinterested selfishness, confident humility, and relaxed attention.[1]

According to MacKinnon, another psychiatrist who described creativity in terms of polarities was Jung.[2] Jung proposed four personality dimensions: extraversion-introversion, sensory-intuitive, thinking-feeling, and perceiving-judging. Creative persons tend to be intuitive rather than sensing. That means they see the world holistically rather than in detail. This dimension may relate to the brain hemisphere functions. Creative persons also have a preference for perceiving rather than judging. Perceiving is the tendency to withhold judgment or delay closure, a necessary element in divergent thinking with brainstorming.

The use of Jung's theory of personality type to describe persons can lend some support to theories of creativity and mental health. Jung believed that each person has elements of all eight types, but in the early years develops a preference for one of each pair. He also believed that the person who moves toward the middle years in a reasonably healthy manner, that is, not stalled in one stage of growth, would eventually develop his non-preferred abilities, and be able to alternate between them in appropriate situations. If this theory is

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[1]W. E. McMullen, "Creative Individuals: Paradoxical Personages," Journal of Creative Behavior 10 (1976): 265-275.

[2]Donald MacKinnon, "Creativity and Transliminal Experience," Journal of Creative Behavior 5 (1971): 227-241.

true, it suggests that those who exhibit creativity in the early years are endowed with the preferred types. There are many examples of persons with high creative tendencies unable to follow through on the fourth stage of creativity-implementation. On the other hand, there are many productive persons who are wont for original ideas. With the potential integration of the personality polarities, creative persons may achieve greater productivity and productive persons greater creativity. Persons with very strong creative characteristics, developed early, may be able to overcome inadequacies of other areas, but may also experience more frustration and conflict. The integration of personality polarities brings about a higher level of self-actualizing behavior.

Other researchers looked at specific traits associated with creativity. Torrance and Torrance found that a number of creative traits obviously were present in culturally disadvantaged persons.[1] They identified these traits as the ability to express emotions, improvise with common materials, and express creativity. In addition, these children enjoyed and had a preference for art, drama, dance, and music. They were articulate in story-telling, role-playing, and speech, with richness of imagery, and had fluency and flexibility in nonverbal media. They enjoyed and were skillful in group learning and problem solving, demonstrating problem-centeredness, original ideas, and humor.

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[1]E. Paul Torrance and Pansy Torrance, "Combining Creative Problem-Solving with Creative Expressive Activities in the Education of Disadvantaged Young People," Journal of Creative Behavior 6 (1972): 1-10.

There was significant responsiveness to the concrete and kinesthetic, and of the emotions with a quickness in warm-up. These characteristics were indicative of a high creative potential.

Hallman identified several other attributes of creative persons.[1] These attributes were heightened sensitivity, strong motivation, independence of judgment, and self reliance. Creative persons also sought freedom from the demands of living and from intellectual rigidity.

Several characteristics of creative persons have been identified by Cole and Parsons.[2] They found risk-taking, a preference for complexity, curiosity, and imagination or intuition to be strongly associated with creative behavior.

Taylor identified a different set of traits.[3] He emphasized the relationship of independence, receptivity, self-assertiveness, dominance, rejection of impulse suppression, and organized personal perceptions to creativity.

Halpin et al. specifically focused on one personality characteristic and creative teachers.[4] They related the pupil-control orientation and pre-service teachers with their level of creativity,

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[1]Ralph J. Hallman, "Human Relations and Creativity," Journal of Creative Behavior 8 (1974): 157-165.

[2]Henry Cole and Dennis E. Parsons, "The Williams Total Creativity Program," Journal of Creative Behavior 8 (1974): 187-207.

[3]Irving A. Taylor, "A Transactional Approach to Creativity and Its Implications for Education," Journal of Creative Behavior 5 (1971): 190-198.

[4]Gerald Halpin, Ronald Goldenberg, and Glennelle Halpin, "Are Creative Teachers More Humanistic in Their Pupil Control Ideologies?" Journal of Creative Behavior 7 (1973): 282-286.

based on fluency, flexibility, and originality measures. The results demonstrated that creative teachers preferred significantly less domination or control as a means of relating to their students.

Taylor et al. found five creativity dispositions.[1] In creative persons, there was a disposition toward expressiveness, that is, spontaneity and freedom. There was also proficiency in technical skills, inventiveness, innovativeness, and originality.

Holland and Baird used the Preconscious Activity Scale to identify characteristics of creative persons.[2] They found radicalism, a tolerance for ambiguity, low super-ego strength, low socialization, preference for complexity, dominance, risk-taking, a social presence, a sense of destiny, and acquiescence. Acquiescence is defined as uncritical exuberance. Socialization refers to response to peer pressure.

A preference for complexity, novelty, openness to new experiences and information, and independence were the traits identified by Eisenman.[3] In contrast, non-creative persons were found to prefer simplicity, order, and dependence. He equated simplicity with dogmatism, as defined by Rokeach's dogmatism scale.

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[1]Irving A. Taylor, Dorothy Sutton, and Shirley Haworth, "The Measurement of Creative Transactualization: A Scale to Measure Behavioral Dispositions to Creativity," Journal of Creative Behavior 8 (1974): 114-115.

[2]John L. Holland and Leonard L. Baird, "The Preconscious Activity Scale: The Development and Validation of an Originality Measure," Journal of Creative Behavior 2 (1968): 217-225.

[3]Russell Eisenman, "Complexity-Simplicity Preferences, Involvement, and Attitude Change," Journal of Creative Behavior 2 (1968): 128-132.

Lieberman focused on one facet of creative thinking.[1] She suggested that there is some evidence that playfulness is related to divergent thinking, one skill of creative process.

White also discussed traits related to divergent thinking.[2] He found an inverse relationship between anxiety and divergent thinking. He pointed out also the relationship of rigidity, introversion, and anxiety, suggesting that all three suppress divergent thinking abilities.

Renzulli and Smith found creative persons to be of above average intelligence, with high level task commitment.[3] Khatena identified effective imaging in creative persons.[4]

Creativity in children was of interest to Meeker.[5] She found spontaneity and curiosity to be forerunners to creativity. Other characteristics included unusual sensitivity and perceptiveness to people and problems, fluency, flexibility with social, verbal,

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[1]J. Nina Lieberman, "A Developmental Analysis of Playfulness as a Clue to Cognitive Style," Journal of Creative Behavior 1 (1967): 391-397.

[2]Kinnard White, "Anxiety, Extraversion-Introversion, and Divergent Thinking Ability, Journal of Creative Behavior 2 (1968): 119-127.

[3]Joseph S. Renzulli and Linda H. Smith, "Developing Defensible Programs for the Gifted and Talented," Journal of Creative Behavior 12 (1978): 21-29.

[4]Joe Khatena, "Identification and Stimulation of Creative Imagination Imagery," Journal of Creative Behavior 12 (1978): 30-38.

[5]Mary Meeker, "Measuring Creativity From the Child's Point of View," Journal of Creative Behavior 12 (1978): 52-62.

numerical and media situations, originality, ability to abstract, organize and synthesize information, high energy level, perseverance, impatience with routine, secure in risking, and vivid imagination ("fibbing").

Wade examined the relationship between intelligence and creativity.[1] She attributed the correlation between intelligence and creativity to the existence of common factors. The greater than expected variation appears to relate to the affective elements of creativity and the presence of a supportive environment.

Gowan also disputed the single trait theory that applies to concepts such as I.Q., height, or memory span.[2] He claimed that creativity has a variability ratio of about 100:1 while most traits or abilities seldom exceed a 3:1 ratio. In accord with Wade, he believed this extra variance to be related to Maslow's psychological openness.

A survey of the literature on characteristics of creative persons strongly suggests that a variety of intellectual skills and knowledge form the cognitive basis for creativity. The expression of that creativity is then enhanced or suppressed by the presence or absence of distinct personality traits. Many of these personality traits have been correlated with increasing mental health, although

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[1]Serena Wade, "Differences Between Intelligence and Creativity: Some Speculation on the Role of Environment," Journal of Creative Behavior 2 (1968): 97-101.

[2]John Curtis Gowan, "Some New Thoughts on the Development of Creativity," Journal of Creative Behavior 11 (1977): 77-90.

creativity can be expressed in persons who exhibit degrees of neurosis--the conflicted personality. Arieti, however, believed that the true psychotic cannot be truly creative.[1] He contrasted the creative and mentally ill person as two people who want to change the world. The creative sets about changing it, while the psychotic changes it in fantasy to match his or her perception of it. Many of these cognitive and affective elements are amenable to environmental stimulation or oppression.

Environment

In studying creativity, it is appropriate to consider the influence of the environment on its expression. Since creativity has been shown to involve process and a product, and to be enhanced by certain personality traits and attitudes, the question becomes: "Can a manipulation of the environment provide a person with more creative process skills, more ability to produce a creative product of his design, and/or more creative personality traits? If we define teaching as a manipulation of the environment to enhance the possibility of learning, as do some educators,[2] the question can be rephrased in the words of Torrance, "Is Creativity Teachable?"[3] The literature suggests several basic approaches to nurturing creativity. The first

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[1]Arieti, p. 225.

[2]Judith E. Henderson et al., Individual and the School: Education 200 Handbook, 4th ed. (East Lansing, Mich.: Michigan State University, 1971), p. 13.

[3]E. Paul Torrance, Is Creativity Teachable? (Bloomington, Ind.: Phi Delta Kappa, 1973), p. 8.

approach is the removal of existing obstacles that prevent creative expression. The second is the recognition, acceptance, and approval of existing creative attitudes and behavior. The third, and more controversial, is the actual development of curricula that teach the various processes and skills, and even attitudes, that compose creative behavior. Many investigators supported more than one approach.

Taylor recommended several changes in the environment to enhance creative expression.[1] He specified the reduction of frustration, elimination of win-lose competition, and minimization of both coercion and enforcement of behavior norms. For the positive approach to enrichment, he suggested the provision of support, encouragement of divergence, maintenance of an open environmental structure, free communication, and allowance for and exposure to risk-taking. The curricular implications Taylor suggested include the provision of competent group leadership, sensory stimulation, flexible and suitable materials, and individual tutoring, in addition to the recognition of different types of creativity.

The creativity of women was investigated by Schwartz because of the distinct discrepancy in the ratio of creative men to women.[2] She posited that there are traditional barriers to creative expression in women in addition to the general obstacles. Some of these barriers

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[1]Taylor, "A Transactional Approach to Creativity."

[2]Lita Linzer Schwartz, "Can We Stimulate Creativity of Children?" Journal of Creative Behavior 11 (1977): 264-267.

include the cultural belief that creativity is a rare male characteristic, and unrelated to domestic responsibilities. This is reinforced in the "vicious cycle" mode by the lack of female role models. Her proposal for providing a creative environment include the recognition of creativity, building of self-confidence, identification of role models, and the implementation of productive thinking programs. Although she focused on creativity in women, certainly these factors may be operating in some subgroups of the male population as well.

Goodale cautioned against presuming that increasing the fine arts programs in the schools or giving students carte blanche in open classrooms will provide the nurturance of creativity needed.[1] He proposed that attention must be given to fostering the personality traits characteristic of creative persons. Activities should be included which increase self-confidence and persistence, and encourage creative behavior. The teachers must then tolerate non-conformist behaviors and not interfere with the process. Testing should be designed to challenge students to find solutions to problems that have no right answers.

Creative teaching strategies were also enumerated by Brunswick.[2] She recommended that teachers encourage pursuit of increasing levels of understanding with questions, refrain from giving answers, listen for opportunities to identify student's areas of interest and motivation,

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[1]Robert A. Goodale, "Methods for Encouraging Creativity in the Classroom," Journal of Creative Behavior 4 (1970): 91-102.

[2]Joan M. Brunswick, "My Ten Commandments for Creative Teaching," Journal of Creative Behavior 5 (1971): 199-200.

remember that learning is based on the child's interests, limit use of time constraints, accept their own "wild" ideas, take advantage of the "teachable moment," be supportive, be flexible, and practice what they preach.

Halpin et al. tested the hypothesis that external motivation affects creative thinking abilities. They tested two groups of students on the Torrance Tests of Creative Thinking.[1] Both groups were given Form A, and then seven days later Form B. No instruction was provided between administrations. The experimental group was given an additional motivational statement with Form B and did significantly better than the control group. Their research was directed toward determining the significance of pre-administration instructions on performance levels, but possibly suggests the value of a motivational environment in classroom instruction as well.

Similar supportive strategies were identified by Weininger.[2] He emphasized the importance of play, the encouragement to express emotions, the freedom to explore inner conflicts, and the provision of "creative" models. He cautioned, however, against the danger of students mimicking the models rather than developing true originality.

Renzulli and Smith, specializing in education of the gifted, were unequivocal in their support of an inquiry approach in problem solving as an instructional strategy for the gifted.[3] They stressed,

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[1]Halpin et al., pp. 282-286.

[2]O. Weininger, "Some Thoughts on Creativity and the Classroom," Journal of Creative Behavior 11 (1977): 109-118.

[3]Renzulli and Smith.

however, that it is unknown whether or not such an approach is appropriate for other students.

An extensive list of environmental strategies was presented by Hallman.[1] He described the teacher that nurtures creativity as the facilitator of self-initiated learning, intellectual flexibility, psychologic and symbolic freedom, spontaneous expression, self-evaluation, sensitivity, creative thought processes, and the opportunity for manipulation of materials, ideas, concepts, tools, and structures. In addition, that teacher encourages over-learning, makes use of questioning, defers judgment, assists students in coping with frustration and failure, and urges students to consider problems holistically.

Christie emphasized the importance of asking questions that require divergent thinking.[2] This study recommended the discovery method as an effective strategy to teach creative thinking. It is important, also, to encourage the child to pursue his/her own interests with only minimal constraints.

Peavy provided an extensive description and review of the environmental factors that inhibit and enhance creativity.[3] He cited the following inhibitors: overemphasis on the verbal-logical-analytic cognitive mode (left-brain); punishment of emotional

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[1]Hallman, "Human Relations."

[2]T. Christie, "Environmental Factors in Creativity," Journal of Creative Behavior 4 (1970): 13-31.

[3]Peavy.

sensitivity, intellectual skepticism, playfulness, guessing, and idealism; undue emphasis on practicality and usefulness; pressure to conform; time limits and performance pressures; doing "work we hate"; organizational constraints; overemphasis on cleanliness, order, and discipline; depreciation or underestimation of the importance of creativity in everyday activities; and socioeconomic blockages. In order to nurture creativity, it is necessary for those responsible for the environment to establish a playful, gamelike, non-competitive atmosphere; to provide a non-evaluative context; to reduce mental and bodily tension; to encourage openness to new ideas and experiences; to engage the learner in effortless, no-thought, free-flowing experiences; to reduce fears, inhibitions, defensiveness, and increase spontaneity; to encourage realistic self-appraisal; to increase self-esteem and self direction; to encourage identification, expression, and control of emotions; and to stimulate the deliberate use of fantasy, playfulness, humor, and dreaming.

The acceptance of the personality characteristics of creative persons by educators was stressed by Meeker.[1] These characteristics must be recognized, allowed expression, and rewarded if creativity is to be a valued element of education. To provide nurturing conditions, it is important to make materials and resources available, avoid setting limits, allow a child to be alone and satiate his/her curiosity, provide opportunity for one-to-one relationships, understand frustration, provide help, make models available, permit free use of materials

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[1]Meeker.

(not including destruction of other's property), encourage problem-solving for social problems, and listen frequently and well.

Cheyette emphasized the importance of human relationships in nurturing creativity.[1] The richer a child's environment in both material resources and affection and care, the greater will be the potential for sensitivity and sensory experience, an important factor in aesthetics.

Although she focused on the home environment, the factors stressed by Foster may be found in schools as well.[2] She stated that for authoritarian homes, where love relationships are distorted to power relationships, creativity is less likely to find expression. Democratic homes, where each family member is respected as a significant individual with some self-determination, give creativity a greater chance of emerging. There appears to be a parallel in school settings. The traditionally authoritarian classroom has shown little evidence of successfully nurturing creativity.[3] The practice of democratic process in educational environments has been generally neglected with notable exceptions of Glasser's school for emotionally impaired children[4] and Neill's Summerhill.[5]

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[1]Irving Cheyette, "Developing the Innate Musical Creativity of Children," Journal of Creative Behavior 11 (1977): 256-260.

[2]Florence P. Foster, "The Human Relationships of Creative Individuals," Journal of Creative Behavior 2 (1968): 111-118.

[3]Weininger.

[4]William Glasser, Schools Without Failure. (New York: Harper & Row, 1969), p. 37.

[5]A. S. Neill, Summerhill: A Radical Approach to Child Rearing (New York: Hart, 1960), p. 45.

Hutchinson compared traditional teacher-centered classrooms with classrooms in which thinking process skills were taught and emphasized.[1] He found that in three of the four traditional classrooms, verbal responses were primarily cognition-memory level. In the experimental classrooms where instructional strategies and objectives were modified, there was a significant increase in convergent, divergent, and evaluative responses. Students in three out of four experimental groups showed greater increase in subject matter knowledge as well as process skills and the experimental students also demonstrated increased creativity on four of ten creativity measures, while the controls gained on none. He concluded with the observation that students who measured high on creativity tests did not have much opportunity to use their creative skills in the typical control (and controlled) classroom.

Reynolds and Torrance supported the observation that thinking styles can be altered.[2] They found that after six to twelve weeks training it was possible to change hemispheric learning styles, that is, to develop divergent production and holistic-imagery ability.

DeBono described the two basic thinking styles as vertical and lateral.[3] He observed that vertical thinking, the linear search for an answer, is the only one taught in schools. He proposed that lateral

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[1]William L. Hutchinson, "Creative and Productive Thinking in the Classroom," Journal of Creative Behavior 1 (1967): 419-427.

[2]Cecil R. Reynolds and E. Paul Torrance, "Perceived Changes in Styles of Learning and Thinking (Hemisphericity) Through Direct and Indirect Training," Journal of Creative Behavior 12 (1978): 247-252.

[3]Edward DeBono, "Information Processing and New Ideas," Journal of Creative Behavior 3 (1969): 159-171.

thinking, the search for possibilities, is the basis for creative thinking and needs to be addressed in the schools as well. Four techniques basic to lateral thinking are amenable to teaching: (1) Awareness can be developed by practice and cognitive understanding of its function; (2) Random stimulation can be structured by brainstorming, discussions, and planned exposure to irrelevant stimuli; (3) Alternatives can be sought by explicit expectation; and (4) Alteration can be taught by giving examples of it and practicing altering existing resources.

A key factor in lateral or right hemispheric thinking is imagery. Khatena suggested that an improved ability to use the imagination can be developed.[1] To stimulate creative imagery he suggested working on breaking perceptual set, learning to restructure, that is, analysis and then synthesis, and analogical thinking.

Gowan, in a review of the self-descriptions of creative persons, proposed the conditions under which creativity might occur.[2] Imagery occurs spontaneously under hypnosis, in trance, dreams, and other altered states of consciousness. It is also found in daydreaming, fantasy, meditation, creative spells, relaxation, and sensory deprivation. The key elements for successful imagery that he identified are (a) reduced sensory input and (b) cessation of internal verbal chatter.

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[1]Joe Khatena, "Creative Imagination Imagery: Where Is It Going?" Journal of Creative Behavior 10 (1976): 189-192.

[2]John Curtis Gowan, "The Production of Creativity Through Right Hemispheric Imagery," Journal of Creative Behavior 13 (1979): 39-51.

He proposed that right hemispheric activity is always active, that it merely needs to be attended with a concurrent ignoring of left brain data. Some instructional techniques are available to do this now, such as guided fantasy, biofeedback, facilitated relaxation, and transcendental meditation.

There have been educational methods and programs designed for stimulating creativity. Parnes summarized known programs a decade ago and Treffinger and Gowan expanded the list in a more recent publication.[1] These range from units, classes, and courses to the Master's program in Creative Studies at Buffalo (NY) State. No implementation of a comprehensive curriculum that addresses creative thinking and behavior across all disciplines has been identified.

Treffinger and Huber have made a contribution to progress toward a comprehensive curriculum.[2] They developed a set of objectives for creative problem-solving into a learning hierarchy. These objectives are process objectives that can be applied to problems in any curricular area.

The Williams Total Creativity Program is a model for a comprehensive curricular application, according to Cole.[3] The program

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[1]Sidney J. Parnes, ed., "Methods and Educational Programs for Stimulating Creativity: A Representative List," Journal of Creative Behavior 2 (1968): 71-75; and Donald J. Treffinger and John Curtis Gowan, "An Updated Representative List of Methods and Educational Programs for Stimulating Creativity," Journal of Creative Behavior 5 (1971): 127-139.

[2]Donald J. Treffinger and Jaclyn R. Huber, "Designing Instruction in Creative Problem-Solving: Preliminary Objectives and Learning Hierarchies," Journal of Creative Behavior 9 (1975): 260-266.

[3]Henry P. Cole, "Process Education and Creativity Development: Retrospect and Prospects," Journal of Creative Behavior 10 (1976): 1-11.

analyzes creative thinking into specific elements to assist teachers in designing instruction. Cole described this program as one of the most promising advances in process education that includes creativity. The program includes the affective as well as cognitive elements of creativity in curriculum design.

Cole and Parsons presented an analysis of the Williams Total Creativity Program which utilizes a three-dimensional model of a creative curriculum.[1] The environmental strategies elaborated were the study and use of paradoxes, attributes, analogies, discrepancies, provocative questions, examples of change, examples of habit, organized random search, skills of search, tolerance of ambiguity, intuitive expression, adjustment to development, creative people and process, evaluation of situations, creative reading, listening, and writing skills, and visualization skills. They also suggested that behavior modification strategies such as reinforcement be used to promote creativity. The travesty of behavior modification is that it has been used to make students conform and obey for the convenience of others, rather than used as a tool to nurture independence and self-direction. That conformity is the antithesis of creativity.[2]

Not all non-conformity is creative, however. Schubert suggests that thrill-seeking non-conformity is a non-creative response to boredom.[3] The implication is that persons with non-conformist tendencies

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[1]Cole and Parsons.

[2]Moustakas, p. 35.

[3]Daniel S. P. Schubert, "Boredom as an Antagonist of Creativity," Journal of Creative Behavior 11 (1977): 233-239.

need to be guided into productive, creative approaches to dealing with their need for stimulation. To increase creativity, he recommended the encouragement of continued pursuit of a problem, a decrease in pressure to conform, the rewarding of creative responses, and the provision of adequate free time for unprogrammed activity.

Gowan summarized the educational implications of creative research.[1] He supported the value of the cognitive process models such as the Structure-of-Intellect and Creative Problem Solving. Cognitive process is not enough, however. The theories that explain creativity in terms of psychological affect must be taken into account, including those that deal with access to preconscious material. Gowan cited relaxation of the conscious mind and incubation techniques, as well as practice in imagery, as important instructional goals. He felt that interaction in an environment that includes creative persons and accepts creativity is crucial.

The importance of understanding creativity so that it can be nurtured effectively rather than suppressed should be a high priority goal according to Gowan. He estimated that it would multiply fourfold the number of persons who could make significant creative contributions. An increase of that magnitude would pass the "critical mass point" that would mark the early twenty-first century as one of the most creative periods on record.

The question arises as to whether or not there is the possibility for the kind of growth Gowan proposed. Otto believed there

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[1]Gowan, "Some New Thoughts on the Development of Creativity."

is.[1] He pointed out that William James estimated that humans function at only about 10 percent of their intellectual potential. Otto felt that 4 percent would be a better estimate. If that is even a fair approximation, there is room for growth.

Udell et al. described part of the problem as one of polarity.[2] There are creative persons who are not very innovative (productive) and innovative persons who are not creative, both due to internal and external obstacles. By removal of the obstacles and provision of a nurturing environment, the development of the undeveloped skills can help a person express his creative nature or make his production more creative.

The conclusions to be drawn from the summary of the effects of environment on creativity, suggest ramifications for teacher education. Halpin found that creative teachers used fewer pupil control techniques.[3] Pre-service teachers who were defined as having the creative traits of fluency, flexibility, and originality, did not use authoritarian control, thus increasing the chance of nurturing creativity in their own students. Apparently their own creative personalities made them more accepting of the "unacceptable" nonconformist behavior of creative students.

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[1]Herbert A. Otto, "The Human Potentialities Movement: An Overview," Journal of Creative Behavior 8 (1974): 258-264.

[2]Gerald G. Udell et al., "Creativity: Necessary, but not Sufficient," Journal of Creative Behavior 10 (1976): 92-103.

[3]Halpin et al.

If the above can be substantiated, then there is support for Mohan's proposal to include a course in creativity in teacher education curricula.[1] He sought assessment data from six sources: local faculty, researchers and teachers in creativity, student teachers, experienced classroom teachers, research literature, and feedback from in-service workshops in creativity. He found adequate evidence to support the need for such a course. The question that comes to mind, however, is: "Can one course possibly be enough to nurture the creative behavior that for most students has been suppressed and ignored, if not punished?"[2]

Foster emphasized the added dimension of the importance of integrative human relationships, also not a major concern of schools.[3] She felt the creatively productive person particularly would benefit from increased relating skills. To quote Foster, "Whereas the creative strong survive the separateness (sometimes at considerable personal cost), the majority find that this need to relate overwhelms the creative instinct."

Summary

The literature on creativity has been reviewed as it relates to the four approaches to creativity generally used. There is a summary

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[1]Madan Mohan, "Is There a Need for a Course in Creativity in Teacher Education?" Journal of Creative Behavior 7 (1973): 175-186.

[2]Lita Linzer Schwartz, "In Response to Mohan," Journal of Creative Behavior 8 (1974): 183-186.

[3]Foster.

of creative process, as it applies to a variety of creative activities including creative problem-solving. A general process is examined, as are the intellectual processes involved.

The nature and variety of creative products are discussed. These products are categorized as the arts, science, the translation of science into art, and personality development.

Personality traits that contribute to the expression of creativity are surveyed. Many of the identifiable traits appear to be amenable to modification or are developmental.

The fourth aspect of creativity--the creative environment is reviewed. Environmental influences that appear to nurture creative behavior include the removal of factors that suppress the expression of creativity, the recognition and encouragement of existing creative behavior, and specific instruction in the skills and attitudes that are implicated in creativity.

The review of the literature has provided a foundation for responding to the questions tendered at the outset of this dissertation. The next step is to describe the methods by which these questions will be addressed.

CHAPTER III

PROCEDURES AND DEFINITIONS

The literature search on creativity revealed a multiplicity of approaches to the study of a topic that is complex and sometimes contradictory. On the basis of this search, the seven sequential questions presented in Chapter I were formulated. These questions sought to direct attention to the means by which a comprehensive curriculum to nurture creativity might be implemented successfully. Each of these questions must be answered effectively to justify response to the ultimate question of curricular implementation. Each question required an individualized procedure to produce a useful response.

Procedures

The first question addresses the problem of an acceptable definition:

> *What are the elements of agreement and disagreement across definitions of creativity, that provide a definition of creativity that is applicable to a variety of creative activities?*

There are many variations in both conceptualization and terminology concerning the definition of creativity, with some areas of consistent agreement, and other areas that were more equivocal. The need was to identify those areas of consistency, and to justify the inclusion or exclusion of those other elements that had some support.

Twenty-two articles by persons who had demonstrated interest in and knowledge of creativity were selected and examined for stated definitions of creativity. These persons published either multiple articles on creativity in referred journals, or major books, or gave presentations at major conferences on the topic. Each author's writing was analyzed and the attributes of creativity mentioned were noted. A matrix was built with the author's names on one dimension, and the identified attributes on the other. If an author mentioned an attribute, it was checked on that line. If the author made no reference to an attribute, the cell was left blank. A negative sign was used if the writer specifically rejected an attribute. Those attributes that received at least 50 percent acknowledgment and no contraindications were included as part of the basic definition derived here, that is, in the first sentence. Attributes which had less than 50 percent recognition were examined for their rationality and their utility in educational settings. The conclusions from the latter examination were summarized in a second sentence that extended the basic definition. The proposed definition is: "Creativity is the process of generating unique products by transformation of existing products. These products, tangible and intangible, must be unique only to the creator, and must meet the criteria of purpose and value established by the creator."

When the working definition of creativity was determined, it became apparent that it was not adequate to assist in the development of the process objectives integral to an effective curriculum. A

survey of the key attributes in the definitions proposed, suggested a need to understand the process of creative thinking in the context of the spectrum of intellectual or cognitive skills. Initially, it was believed that the Structure-of-Intellect (SI) model of Guilford would achieve this purpose.[1] Attempts to use this model, however, yielded frustration and more questions than answers. The SI model did not appear to be congruent with other learning hierarchies, nor did it address in adequate detail some of the cognitive processes proposed by others. In other instances, it was determined that different labels were being applied to the same skill by different authors.

The evident confusion led to the determination of a need to design a model of the cognitive skills that incorporated the work of several cognitive psychologists. Thus, the second question was posed:

> *How do the distinctive components from three major information processing models, and one intellectual development model, relate to one another to produce a comprehensive Cognitive Skills Model (CSM)?*

The definitions of the many labels attributed to cognitive processes were analyzed as they had been proposed by each author. When there were like definitions but different labels, a determination was made as to which word or label would serve as the best descriptor for these purposes. Some labels by one author or more were too inclusive, and these were broken down into subconcepts, terms often already proposed or used by another author. A few subcategory labels were,

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[1]Guilford, Way Beyond the IQ, pp. 160-161.

upon analysis, determined to be more appropriately subsumed under another category label than the ones in which they had previously belonged. A rationale was provided for the change. In some instances the labels were not inclusive enough for the purpose of describing reality. These were changed to more readily reflect a broader range of experience. A rationale was given for these revisions, also.

Because the three-dimensional model of Guilford was the most comprehensive, the same basic design was used for the newly proposed model.[1] The other hierarchies that were examined were presented as uni-dimensional and thus had limitations as a descriptive tool that could be exceeded with the three-dimensional design. Since the SI was the only model that was not hierarchical, the hierarchical or developmental formats of the others were used to arrange the CSM dimensions sequentially. The resulting CSM was supported by its ability to account for the other models, as well as by additional data on human cognitive processing, such as on the concepts of short-term and long-term memory.

When the Cognitive Skills Model was completed, it became possible to address the third question:

> *How are the primary and contributory elements of creative thinking analyzed through the Cognitive Skills Model?*

The process involved relating the stated definition of creativity to the elements of the Cognitive Skills Model.

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[1]Ibid., p. 151.

Each attribute of the definition of creativity was related to one or more cells of the CSM. Those cells which had a demonstrated relationship were specified as primary to creative thinking, while the remaining cells were considered contributory by virtue of the supporting role they play in creativity.

The next step that was necessary was to look at the cognitive process skills with their creative skills component as a part of a larger process. This cognitive processing is manifested in human behavior. In order for creative behavior to be expressed, other elements besides the cognitive skills come into play. Cognitive or intellectual skills must be examined in the total context of human activity and the environment. The fourth question that evolved was:

> *How are the processes of human behavior analyzed using the Human Ecological Systems Model (HES), a process map of human behavior?*

The literature on creative behavior, the creative environment, and the creative personality was surveyed to determine the effects other elements, in addition to thinking skills, had on behavior. A systems model was developed that appeared to include the several dimensions of human activity that contribute to the expression of human behaviors. The model, called the Human Ecological Systems Model (HES), was supported by its ability to describe graphically several distinctive models of human functioning and behavior change; for example, behaviorism, rational-emotive therapy, Freudian theory, and Transactional Analysis.

With the HES as a model of human behavior, it was possible to address the fifth question concerning the nature of creative behavior:

> *In what way might creative behavior be described using the Human Ecological System Model?*

The literature on creativity was examined again and used as a means to identify the process by which creative expression occurs.

To illustrate the ability of the HES model, or process map, to define creative behavior, various descriptions of the elements of creativity taken from the literature were superimposed on the model. The ability of the model to account for the descriptions of creative behavior from a sampling of the literature was considered adequate to establish its value as a description of the process of creative behavior in its environmental and intrapersonal contexts.

The development of a description of creative process and its attendant elements provides educators with the potential ability to translate an understanding of creativity into a curricular format. With the growing expectation of more creativity in the schools, the sixth question becomes:

> *In what ways might a curriculum be designed to nurture creativity?*

To address this question, it was necessary to examine the literature on curriculum theory.

The basic elements of a curriculum were delineated. The elements selected were those that were addressed with some consistency by educators. These elements were examined in terms of their impact on

creativity. One such element, for example, would be "learning outcomes." Examples of elements that nurture creativity were highlighted. In addition, attention was given to elements that tend to suppress creativity. Conclusions were drawn as to the value of current curricular designs, and changes that must occur to increase the nurturance of creativity. These conclusions were based on the support of three or more educators who are significant contributors to the literature in curriculum. In addition, facilitative elements were examined, such as specific teacher behaviors. The result was a list of significant outcomes of a curriculum designed to nurture creativity.

Once the nature of a creative curriculum is clarified, the most significant problem unfolds:

> *What can be done to facilitate the transformation of a curriculum to one which nurtures creativity?*

Since the transformation of a curriculum to one which nurtures creativity is both a creative process and a diffusion process, this last question was examined in relation to the principles of both processes.

The first phase which was considered was staff development. The literature on staff development was coordinated with the models of creative thinking and behavior that have been proposed. The major principles that must be incorporated in an effective staff development program were delineated. An example of an in-service program for educators planning to develop a curriculum for creativity was proposed.

In addition to a formal in-service program, there are other principles of diffusion that attend an innovation such as the one proposed in the study. Those principles were also specified, and examples of their implementation were given.

Successful long-term change frequently is dependent upon the continued infusion of prepared personnel to continue implementing the transformed curriculum.[1] This statement implies a teacher education curriculum that prepares educators to join the ranks as a creative teacher nurturing creativity in students. An example of a teacher education curriculum that prepares educators for their role as nurturers of creativity was described.

The other important human element in the development of an innovative curriculum is that of community support. Ways in which this support can be fostered were emphasized. These means were based on principles of the diffusion process.

The procedures by which each of the seven questions have been addressed were described in this section. These procedures depend heavily upon the literature on creativity, curriculum theory, and innovation. From the review of the literature, conclusions are drawn that are supported by the weight of the available evidence, or by logical arguments as to the value of given data. The proposals need to be put to the test in the real world. An initial step is made by translating the skills from the cognitive skills model to learner

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[1]Harry Bell and John Peightel, Teacher-Centers and Inservice Education (Bloomington, Ind.: Phi Delta Kappa, 1976), p. 7; and Elizabeth C. Wilson, Needed: A New Kind of Teacher (Bloomington, Ind.: Phi Delta Kappa, 1973), p. 32.

outcomes (see Appendix). Actual teacher and student impact data, however, could not be obtained as a part of this study. To do so would have made the study a project of monumental rather than manageable proportions. The next step in this study is to address the first question, concerning a definition of creativity with a clarification of the attributes of the concept.

Definition

The definitions of creativity are numerous, with variations not only in concept, but in the meaning of subconcepts and of terminology referring to similar ideas. There appears to be, however, a significant level of agreement on key attributes among those persons most closely associated with work in this field. Significantly for this study, the greater disagreements occur in relation to aspects that are less relevant to educational purposes.

Question 1:

What are the elements of agreement and disagreement across definitions of creativity, that provide a definition of creativity that is applicable to a variety of creative activities?

On the basis of the survey of the literature, the following definition is proposed: Creativity is the process of generating unique products by transformation of existing products. These products, tangible and intangible, must be unique only to the creator, and must meet the criteria of purpose and value established by the creator.

The process in creativity is a dynamic interaction of cognitive and manipulative skills as well as affective dispositions, a synthesis

of aptitudes, abilities, and attitudes.[1] The process is complex, and may result in creative products, even though there will be variations in the degree of creativity present. There is little disagreement on the fact that creativity involves a variety of cognitive process skills. The manipulative skills will vary with the nature of the creative expression, whether it be painting, dance, invention, or any other form requiring psychomotor functioning. The affective disposition involves attitudes that favor creative expression, as well as personality traits that are conducive to creativity.

The products generated by creative thinking include almost any mode of creative endeavor. These products can be described by Guilford's content dimension.[2] They may be things (sensory), representations (symbolic), ideas (semantic), and/or personal expression (behavioral). In addition, many creations involve two or more content areas. The musician creates symbols which can be transformed into sensory expression. The artist creates sensory and symbolic experiences. The writer, humorist, and dramatist create semantic, visual, and possibly symbolic material. The dancer and mime create behavioral expression. In the sciences, comparable creations are developed. Inventions are sensory products, but may have symbolic, behavioral, or even semantic components (e.g., the computer). The mathematician creates symbols to explain mathematical reality. Scientists who develop systems or taxonomies deal in semantics.

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[1]Wallace.

[2]Guilford, Way Beyond the IQ, p. 14.

In fact, in any endeavor where there is a discrepancy between what exists and what one wishes could exist, there is the potential for creative activity, frequently referred to as creative problem-solving. The fulfillment of any goal or purpose with a unique response; i.e., a creative product would be considered the result of creative behavior. The classification of this creative behavior depends on the nature of the content. In the area of technology, it would be known as an invention. In science it could be theory-building. The arts emphasize aesthetic and/or affective expression. This expression might involve a unique way of perceiving reality, or of describing solutions in aesthetic media. A special kind of expression, humor, looks at situations in unique, often ludicrous, ways that generate laughter. These expressions may be exaggerations of reality, e.g., caricatures; the fusion of word meanings, such as with puns; or images of unexpected outcomes, in addition to other humorous ways of representing the real world. In one's personal life, creativity is a means of developing and expressing one's own uniqueness, as well as solving problems that lack or have unsatisfactory prepared solutions. Piaget defined the process of creativity as a tertiary circular reaction in which children seek to find new means of dealing with their reality.[1]

Regardless of the variety of circumstances in which creative behavior may be applied to produce unique results, all types of

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[1]J. McV. Hunt, Intelligence and Experience (New York: Ronald Press, 1961), p. 149.

creative behavior appear to be dependent on the same cognitive process skills. A paradigm that describes such creative activity is a systems approach, wherein one produces a transformation from input to desired output. The input is the store of knowledge and meaning acquired by the learner and the external factors, such as the nature of the problem and its parameters, which is the basis for a desired change. The output is the solution arrived at by the learner, transforming the available data into a unique response. Land described the process of transformation as "the drive of both the physiological and psychological process of living to assimilate external materials and to reformulate them into extensions of the self."[1] He has used observations of the growth of biological organisms as a metaphorical model of the development of human personality, known as his Transformation Theory. He stated that both "the cells and the man modify their subsequent behavior based on this response or 'feedback' from the environment." Transformation Theory is a specific component of a field of study known as General Systems Theory, a systems design or approach for understanding the universe and all its subsystems.[2]

Although a systems approach to human behavior may sound mechanistic, it is a paradigm which increasingly is accepted by scholars because it emphasizes the interrelationships of the elements that define being human. Goal-setting, human values, abstract thinking

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[1]George T. Lock Land, Grow or Die: The Unifying Principle of Transformation (New York: Dell Publishing Co., 1973), pp. 8-9.

[2]Walter G. Mettal,"Cybernetics, General Systems and Creative Problem-Solving," Journal of Creative Behavior 11 (1977): 53-66.

and high-level creative behavior need not be ignored in an attempt to understand that humanness in a systematic manner.

There are a number of social scientists who approach the study of human behavior from an ecological viewpoint, by examining the dynamics of the person's interaction with his environment and its effect on him.[1] Such an approach does not imply that the person is a helpless reactor to that environment. He is, rather, capable of making informed choices in response to events. A perspective held by a school of thought in psychotherapy is that the ultimate form of creative endeavor is the development of a unique personality by each human being. The personality development occurs when the person analyzes himself and his own dynamics within his ecological setting, perhaps with the help of others, and creates novel ways of responding which provide him with more effective and satisfying life skills. These self-defining, self-creating responses appear comparable to Maslow's self-actualizing concept.[2] Furthermore, Maslow developed a hierarchy of personal needs, based on the assumption that human beings had to attend to the lower level needs before the higher level. The needs ranged from the lowest of safety and then security, to belonging, self-esteem, and the highest of self-actualization. In addition, Assagioli proposed the existence of a higher level of need that emphasized the actualization of one's productive

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[1] Robert Leo Smith, The Ecology of Man: An Ecosystem Approach (New York: Harper & Row, 1972), p. 3.

[2] Maslow, Toward a Psychology of Being, p. 152.

interaction with the world.[1] He described this as the same as Maslow's Transpersonal or Meta-needs.

The novel transformation of existing products implies producing new combinations or arrangements of what is already known; e.g., facts, perceptions, skills, tools, materials, principles, etc. Some consider the degree of creativity to be related to the remoteness of the recombinants.[2] In other words, the combination of two very different concepts is considered by some to be more creative than the combination of two very similar concepts. The ability to recombine remote ideas, a less frequent occurrence than that of combining similar ones, increases the possibility of the result being novel not only to the creator but also to society. Combining more remote concepts or ideas also would appear to increase the probability of finding a workable solution or response, because it increases the breadth of the resource pool from which elements are drawn. The recombination of more similar concepts, while not as dramatic, has value for individuals and society. The invention of the refrigerator was a giant step forward for food preservation. The development of the frost-free concept was a creative modification that, while welcomed as a blessing to those in charge of defrosting, did not have the same dramatic impact on society's life style.

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[1]Roberto Assagioli, The Act of Will (New York: Viking Press, 1973), p. 106.

[2]David Sarnoff and Henry P. Cole, "Interactive Creativity: Explorations of Basic Meanings and Their Implications for Teaching and Counseling," a paper prepared specifically for and presented at the 26th Annual Creative Problem Solving Institute, State University College at Buffalo, Buffalo, New York, June 22-27, 1980.

The level of disagreement on definition increases when there is consideration of the criteria for uniqueness. For some, creativity has not occurred unless the product is novel to society.[1] The difficulty with this criterion is the difficulty in determining whether a product is actually unique in history. The past offers many examples of creative credits given to one person, only to have it later discovered that another person actually was the creator. Similarly, there are examples of two persons separated by large distance who make nearly simultaneous discoveries without each other's knowledge. Other creations have been found to have had predecessors from cultures long since vanished. Although societally unique creations often have wider impact, this does not negate the value of developing creative responses of benefit primarily to the individual. One could argue the ultimate benefit to society of persons who are successful at creatively responding to their own needs. Most significantly, the person who has created, or is capable of creating, a unique product of benefit to society required the development and exercise of the skills and attitudes that led to that ability. These skills can be activated without a socially significant product.[2] The same skills and attitudes can be used for individually creative activity. The development of these skills and attitudes in schools and other educational environments to the degree possible in all learners

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[1]Jacob W. Getzels, and Mihaly Csikszentmihalyi, "Concern for Discovery in the Creative Process," in The Creativity Question, eds. Albert Rothenberg and Carl R. Hausman (Durham, N.C.: Duke University Press, 1976), pp. 161-165.

[2]Jensen.

seems almost certain to enhance the probability of nurturing more creative activity that will eventually benefit society as a whole. It can be argued that the creation of the unique self is a socially significant contribution.

Two other contended points are whether or not the created product has a value to society and/or is considered valuable by society. It is difficult to accept a definition that suggests that a product changes from non-creative to creative or vice versa over time, based only on immediacy of value or on social acceptance. There are examples of inventions for which society as a whole had no need, but only the inventor himself or a small peer group enjoyed the benefits. Later, the larger society developed a milieu in which the invention became useful. Many discoveries, inventions, compositions, and other creative products were once rejected by society as worthless and unacceptable, only to be re-evaluated years later and found highly creative. The designation of value appears to depend on the ability and willingness of society to perceive utility or purpose. The process by which the product was conceived did not change, but society's readiness, intellectually, and/or attitudinally, changed.

Another attribute that is sometimes applied to the definition of creativity is constructiveness. For a product to be constructive it must have positive value for society.[1] Consequently, any product that is destructive cannot be creative. By stipulating the attribute of constructiveness as necessary to creation, the emphasis is placed

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[1]Torrance; and Goldman.

on the product rather than the process. Emphasis on the product places significant restrictions on the identification of creative endeavor and may even confuse the issue. Many products, developed by creative process, can be used for both constructive and destructive purposes, for example, fire, atomic fission, microwaves, axes, and behavior theory. A sewage system which was designed to destroy sewage would be a creative solution to a problem. Thus the terms constructive and destructive are only incidental to the creative process. The opposite of destructive is not creative but constructive. Creative means can be utilized to achieve either or both. The growing awareness of the negative impact of the automobile on the environment does not negate the creativity of its development. Each new creation almost always brings new problems.[1] The ability of people to confront these problems confidently and to find creative solutions should be emphasized and given priority as a desirable skill to be learned in educational settings.

To support the rationale for selection of the specified definition of creativity, a matrix is included (see Figure 3.1). Twenty-two sources were cited which presented definitions of creativity. The relevant concepts addressed by the combined sources were noted. If a particular author specified the inclusion of a concept in his/her definition, a check was given. If a concept was ignored, there was no notation. A negative sign indicated that a particular source considered the particular attribute not appropriate to the definition.

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[1] Sarnoff and Cole.

	Process	Transformation	Learnable	Product	Unique	Purpose	Value	Social	Constructive	Evaluation	Aesthetic	Scientific	Humor
Guilford	✓	✓	✓					–		✓	✓	✓	
Torrance					✓	✓			✓				
Anastasi	✓		✓		✓	✓	✓			✓		✓	
May	✓	✓	✓		✓		✓				✓		
Dow			✓				✓				✓		
Goldman	✓				✓	✓	✓		✓				
Stein			✓		✓		✓						
Munk	✓	✓			✓								
Utah Conference			✓		✓	✓	✓	✓		✓			
Rogers	✓	✓	✓		✓	✓	✓				✓	✓	✓
MacKinnon			✓		✓						✓	✓	✓
Barron	✓	✓	✓		✓								
Roe	✓		✓				✓						
Maslow	✓		✓			✓	✓				✓	✓	✓
Mednick	✓	✓											
Kubie	✓	✓	✓										
Skinner	✓		✓			–							
Getzels	✓		✓		✓	✓		✓			✓	✓	
Rothenburg	✓	✓	✓		✓		✓						
Koestler	✓	✓	✓	✓	✓						✓	✓	✓
Gordon	✓	✓											
Tasman	✓	✓											

✓ Included in definition

– Excluded from definition

Ignored

Figure 3.1 Creativity Defintions.

In the 22 definitions of creativity analyzed in Figure 3.1, those concepts with at least 50 percent emphasis and no negation were considered to be strongly associated with creativity. These concepts include the implementation of a process which results in a unique product resulting from a cognitive transformation. Value and purpose received just under 50 percent. One of only two negative votes given was by Skinner, who declared a lack of purposefulness in creative endeavor.[1] This stance was significantly disputed by seven others,[2] thus giving Skinner's perception questionable validity. The majority of those commenting believed that creative endeavor is goal-oriented and not an accident of nature.

The nature of the products was less emphasized. In many instances, writers focused on one or more products, while ignoring others. The three concepts that received equivocal votes were social value, social uniqueness, and evaluation. The first two refer to a product being creative, that is, unique and valuable, in the eyes of society, as opposed to unique and valuable only to the individual. These two concepts were often used interchangeably or paired, thus they were combined under the column 'social criteria.' There is little unanimity in this area. Since evaluation is frequently defined as a determination that the product fulfills the intention of the creator,

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[1]Skinner, pp. 267-273.

[2]Torrance, pp. 493-496; Anastasi and Schaefer, pp. 267-273; Goldman, pp. 5-21; Research Conference on the Identification of Creative Scientific Talent; Rogers, pp. 249-260; Mednick, pp. 227-237; and Getzels and Dillon, pp. 689-731.

it can be considered an integral part of creativity, even though it seldom was mentioned overtly as evaluation.

Since there appears to be little difference between the cognitive processes used by those who enrich all of society with their creations, and that used by those who create only for their own needs, the definition previously stated is maintained as appropriate for educational purposes. To reiterate, creativity is the process of generating unique products by transformation of existing products. These products, tangible and intangible, must be unique only to the creator, and must meet the criteria of purpose and value established by the creator. The analysis of various authors' conclusions, as described above, supports this definition. For many, because there is an intention (or 'what could be') and the status quo, with an implication of finding a means or solution to fulfill the intention, there is a preference for referring to this creative process as creative problem-solving.

With an established definition of creativity upon which to build the next step now is possible. That step is to diagram intellectual or cognitive skills in a manner which lends itself to the development of learner outcomes in the creative cognitive skills, as well as in general cognitive skills. The next chapter will address this challenge.

CHAPTER IV

MODELS OF CREATIVITY

An established verbal definition of creativity is helpful in clarifying the concept. It frequently does not, however, provide an analysis which would expedite the identification of specific learning outcomes for instructional purposes. A more graphic means of describing creativity is an intermediate step to the process of curriculum development. Models of creative thinking and creative behavior have the potential of providing clarity of direction. The development of an acceptable definition of creativity serves as the basis for creating a model of cognitive process that can be applied to an explication of the creative process. The Cognitive Skills Model needs to incorporate the existing theories of several educational psychologists who address creativity to some degree in their own work. The model must also be translatable to educational purposes. The Cognitive Skills Model (CSM) is designed to meet these requirements.

Cognitive Skills Model

Three psychologists, among others, who have emphasized cognitive processes in their work and pointed out the relationship of creativity to those processes, are Guilford, Gagné, and Bloom.[1]

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[1]Guilford, Way Beyond the IQ; Robert M. Gagné and Leslie J. Briggs, Principles of Instructional Design (New York: Holt, Rinehart & Winston, 1974), pp. 23-31, 36; and Bloom, p. 165.

Although each addresses cognitive process from a slightly different perspective, there are many similarities. In some instances the same concept has a different label. By comparing and contrasting these three models, it is possible to develop a single model of cognitive processing which incorporates the concepts of all three.

The most comprehensive model of cognitive processes of the three psychologists is Guilford's.[1] He synthesizes cognitive process, product, and content in a three-dimensional model referred to as the Structure-of-Intellect (Figure 2.1). Although all of his concepts appear valid, there is some ambiguity in their arrangement and categorization -- an ambiguity that surfaces when comparing them with the other models.

Gagné described five categories of learning outcomes: intellectual skills, verbal information, cognitive strategies, motor skills, and attitudes.[2] He further subdivided the intellectual skills into mental processes involved in learning them in a hierarchical manner. These processes range from the lowest level stimulus--response connections, chaining, verbal associations, discriminations, concepts, and rules, to problem-solving (higher order rules).

Bloom developed a taxonomy of educational objectives to assist educators in the process of identifying the levels of mental skills that need to be addressed in instruction.[3] These levels are also

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[1]Guilford, Way Beyond the IQ.

[2]Gagne and Briggs, pp. 23-31, 36.

[3]Bloom.

hierarchical and include: cognition, knowledge, comprehension, application, analysis, synthesis, and evaluation.

The three models of cognitive processes just summarized become the basis for the development of a comprehensive model of cognitive skills to answer the second question:

Question 2:

How do the distinctive components from three major information processing models and one intellectual development model relate to one another to produce a comprehensive cognitive skills model (CSM)?

Content

The one recommendation for change in the content dimension, to which Guilford himself alludes, is in the categories of visual-figural and auditory-figural (Figure 2.1). The concern here is for the limitation to only two of the five senses. These two, however, are the only ones he has researched by his factor analysis and are the ones usually emphasized in traditional education. By substituting any stimulus from one of the other senses, such as tactile, the parallels suggest the similarity of attributes. For the purpose of this study, it is suggested that all senses be combined into one area designated "sensory" in lieu of the visual-figural and auditory-figural categories. This category would include the five exteroceptor senses: visual, auditory, olfactory, gustatory, and tactile; the interoceptor senses which respond to hunger and fatigue, for example; and the proprioceptor senses of the muscles which respond to movement.

On the basis of the order in which the ability to use concepts develops, it is suggested that the order of the content categories be

sensory, behavioral, symbolic, and semantic (Figure 4.1). The justification for this decision is based on Piaget's developmental theory.[1] This will be discussed at the conclusion of the section describing the revision of Guilford's model. There is also some apparent correlation with increasing levels of coding of reality.

In contrast to Guilford, Gagné and Bloom do not emphasize content to any extent. Discussions of their concepts are replete with examples of semantic (verbal) and symbolic (particularly mathematical) content. They appear to confine their efforts to the more traditional academic curricula. They do not dispute Guilford's content areas; they are just not as comprehensive.

Product

The product dimension of the SI describes the complexity of the contents. Guilford proposed six categories: units, classes, relations, systems, transformations, and implications. The discrepancy here is in the characteristics of the first four compared to the last two. Transformations and implications imply change over time, while the other four are static products. If transformations and implications are change, it seems that they would be more appropriately designated process. Comparing them to Bloom's taxonomy in relation to this model will hopefully clarify this revision. This comparison will be made in the process section. It is proposed that the product dimension include only Guilford's first four categories (Figure 4.2).

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[1]Hunt, pp. 170-247.

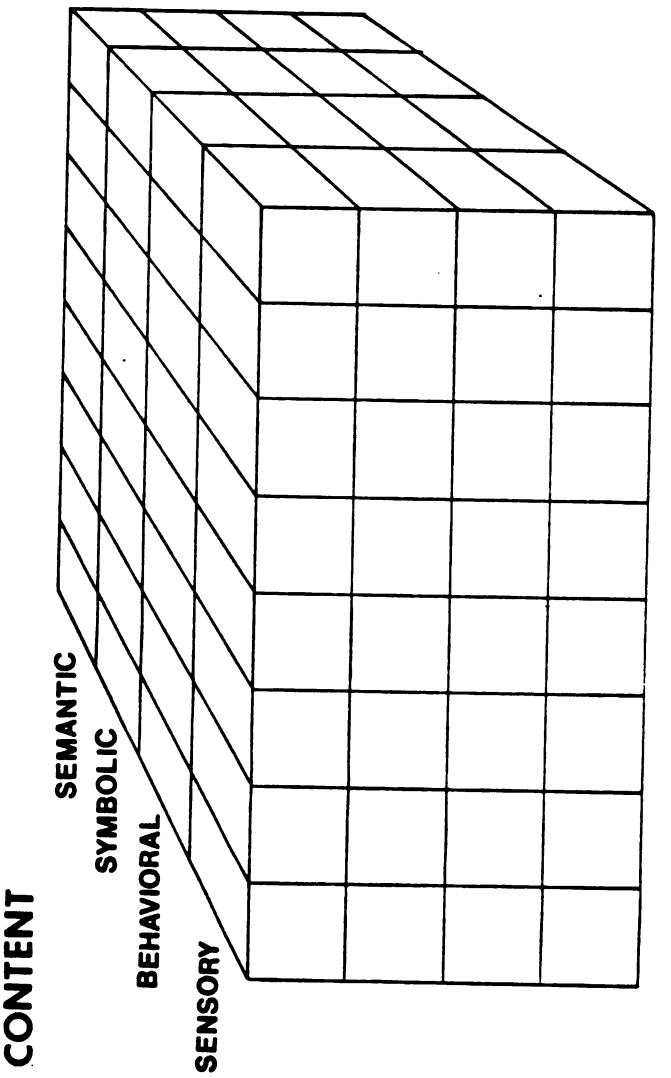

Figure 4.1 Cognitive Skills Model: Content Dimension.

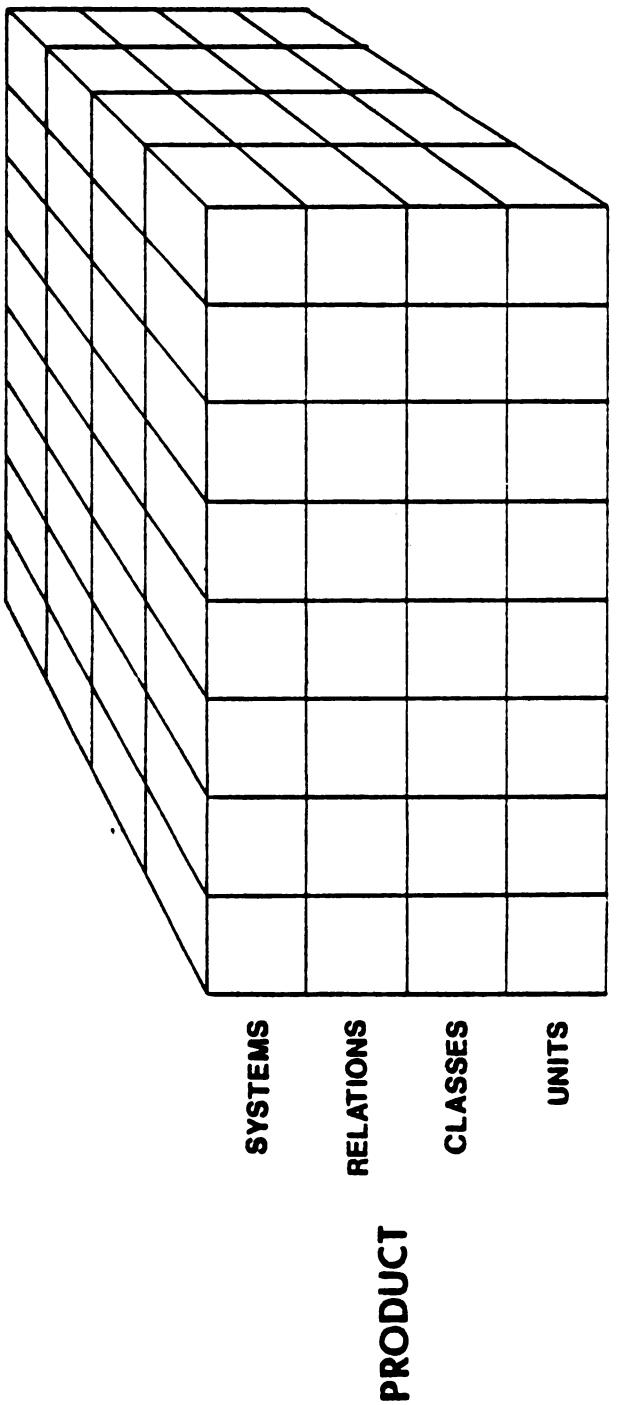

Figure 4.2 Cognitive Skills Model: Product Dimension.

Gagné's and Briggs' seven types of intellectual skills apparently have some relationship to Guilford's product dimension.[1] They also appear to include process information, which will be addressed in the discussion of the process dimension. Although Gagné's and Briggs' categories of stimulus-response learning, chaining, verbal association, and discrimination suggest primarily a process orientation, they also seem to suggest that they deal with "units" of information. The concept level of Gagné and Briggs deals with classification, which Guilford labeled "classes." Gagné's rule-learning is defined as "showing the relation of the component concepts to one another." Guilford called this category the product "relations." In addition, Gagné described a problem-solving category which is essentially higher-order rules, that is, complex combinations of simpler rules. Guilford gave a clearer line of demarcation by saying that "systems" involve the relationships of three or more concepts and two or more relationships.

Bloom's taxonomy, on the other hand, made no discrimination among the different kinds of content. His taxonomy specifically addresses the cognitive processing involved in learning.

Process

The process dimension is the dimension that requires the most significant revision for several reasons. Guilford's process dimension has a distinct omission that becomes apparent when compared to Bloom and Gagné and Briggs. Gagné's and Briggs' concepts also are somewhat

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[1]Gagné and Briggs, p. 23.

confusing, because, as mentioned before, they sometimes imply both process and product.

For the purpose of this study the dimension on Guilford's model that requires the major adjustment is that of "process." The greatest difficulty seems to be that the process levels appear to describe only the path of information flow which ignore any restructuring of knowledge, i.e., application, analysis, synthesis. Perhaps, this omission exists because he accounted for this restructuring in the product categories of transformation and implication. The disparity arises here in realizing that, if these two concepts were to remain as products, it seems likely that a coupling of transformation must occur with one of the other products. In other words, what product is being transformed? A system? A class? Guilford himself hinted at this flaw in the model by suggesting that transformations and implications could incorporate one of the other four product categories. The problem can be resolved by recognizing that transformation and implication are cognitive processes, not products per se. There is nothing to preclude more than one category in any one dimension being involved, but if two categories in any one dimension are required to explicate a skill, it seems legitimate to question the validity of that dimension, as it is structured.

Since Bloom has a process taxonomy that, on first examination, seems the most thorough, it seemed most feasible to begin with those levels and then relate Guilford's and Gagné's and Briggs' concepts to them.

Knowledge is the first level of Bloom's taxonomy. As Bloom defined this term, it is apparent that it is stored knowledge, that is, memorized information.

Comprehension represents the lowest level of understanding, demonstrated by translation, interpretation, or extrapolation. Translation identifies the meaning of a communication by the use of different words with comparable meaning. Interpretation goes beyond literal translation to other ways of describing meaning. Extrapolation suggests implications, predictions, and expectations of cause-effect.

Application is the use of abstractions that account for various concrete events. The application of the abstract rules, theories or methods usually produce expected results. Thus, the demonstration of knowledge in a contextual setting is considered application.

Analysis is the ability to break down complex ideas, events, and systems into their component parts. The process of analyzing involves the identification of the elements, the relationships between them, and the organizational principles which undergird the system being analyzed.

Synthesis is the opposite of analysis. It includes the combination of elements to form a whole. These are to be combined into a pattern or structure not previously known or existing. The result might be a unique way of communicating ideas, the production of a plan, or the development of a set of abstract relationships.

Evaluation is the highest level on Bloom's taxonomy. This process involves decision-making as to the value of experiences and

cognitive outcomes. That is, it is the process of determining whether or not processed knowledge meets the cognizer's purposes, the final step in problem-solving.

In examining Bloom's taxonomy there is support for this suggested revision of Guilford's process dimension. Parts of Bloom's taxonomy are already congruent with Guilford's model. Guilford's process dimension begins with cognition, a process omitted by both Gagné and Bloom. As Guilford discussed cognition, he used the terms perception and cognition interchangeably. Examples of cognition in his material and studies of cognitive processes[1] suggest to this writer that there may well be two independent processes within the term "perception." The first, strict perception, is the ability to actually experience the stimulus correctly. The term sensory-information storage would be the technical term for the process. The stimulus remains for a split-second on the sensory receptors, just long enough for the brain to record what was taken in through sensory organs. Physiological abnormalities would be the major reason for difficulties at this level, such as imparied vision or hearing. There may also be a factor operative at this level that selects the stimuli which will be perceived. Accurate perception is undoubtedly very important to the successful functioning at higher levels in relation to that stimulus. Combs and Snygg have been particularly cognizant of the role played by perception.[2] Their definition of perception, however, correlates more

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[1]Guilford, Way Beyond the IQ, pp. 48-72.

[2]Arthur W. Combs and Donald Snygg, Individual Behavior: A Perceptual Approach to Behavior, Rev. ed. (New York: Harper, 1959), pp. 18-36.

readily with the concept of cognition proposed by Guilford. One of their examples is that of the paranoid patient who reads ideas into a letter that fit with his view of reality. That does not mean he will read words not there, but he will put his own interpretation on them. This would be cognition. There are also instances when words are read or heard that are not there, but that one might expect to be there. In that case, the initial perception is altered by cognition. This often occurs as an incompletely perceived stimulus, and then transformed on the basis of past experience. Since perceptual skills are important to learning, it seems valuable to specify perception as a distinct category. That is done on the CSM.

The concept that Guilford and Combs and Snygg appear to be describing in most examples is cognition, which assumes correct perception of stimuli first. Cognition takes what is perceived, and, using past experience as well as immediate explanations, commits it to short-term memory.[1] With a cue from that association, the learner may recognize and repeat what he has just seen and been told. He has made a brief association. He may not, however, have had adequate time to relate it to his more complex system of stored memories. Unless this happened, the information will most likely be forgotten readily.

The storage of information or knowledge for later recall occurs in what is called long-term memory.[2] Memory assumes storage and retrieval with no transformation. Bloom's taxonomic category of

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[1]Peter H. Lindsay and Donald A. Norman, An Introduction to Psychology and Education (New York: Academic Press, 1977), p. 305.

[2]Ibid., p. 306.

knowledge level appears compatible with the definition of memory used here; namely that memory is the process of storage and retrieval of knowledge. Knowledge which is processed at a higher level may be memorized, but memory itself does not restructure that information, strictly speaking. Memory only codes to expedite storing in a manner which permits ready retrieval. The label "memory" is proposed because knowledge is less specific and also less representative as a process word.

The level above memory is the first one in which information, stored and cognized, can be restructured or transformed in some manner. Guilford's concepts of transformation and implication refer to this processing. Bloom's concepts, however, appear to be most useful in this regard. His four levels include comprehension, application, analysis, and synthesis.

In examining these concepts of Bloom's, there is a distinct parallel with Guilford's concepts of transformation and implication. To comprehend is to translate and interpret or transform a communication. To extrapolate involves the use of implications or predictions. Application involves the implications that an abstraction has for the outcome of a concrete event. To analyze a whole into its parts is to transform perhaps a system into concepts, units, or other products. To look at subsystems and synthesize a novel system is to see implications. Given the similarities between these theoretical constructs, the proposed model (CSM) has four designated levels of information restructuring, using Bloom's concepts: comprehension, application, analysis, and synthesis.

Two concepts proposed by Guilford, convergent and divergent production, which are on the SI process dimension, are important concepts to consider and include. Guilford described these two types of production as focused search and broad search. They refer to the way stored and restructured knowledge is retrieved and evaluated for its adequacy in fulfilling the purpose in it. Examination of Guilford's examples of these concepts suggests that they appear, instead, to be two different evaluative techniques, rather than concepts distinct from evaluation. Convergent production involves looking for a single answer, evaluating it and either accepting or discarding it and then searching for another. Divergent production involves the search for multiple possible ideas, using deferred judgment. Both definitions are based on the element of judgment, i.e., either immediate or deferred evaluation or decision-making.

Thus, a synthesis of Bloom's taxonomy and Guilford's process dimension, with a modification to account for the perception and cognition concepts, provides the process dimension for the proposed Cognitive Skills Model. The categories include: perception, cognition, memory, comprehension, application, analysis, synthesis, and evaluation. To verify this revision, Gagné's concepts may be shown to be related.

First, Gagné and Briggs proposed a skill called discrimination. They define it as "the capability of making different responses to stimuli that differ from each other along one or more physical dimensions."[1] This definition is consistent with the meaning of "perception"

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[1]Gagné and Briggs, p.

on the CSM. Gagné and Briggs placed discrimination as a higher level activity than S-R connections, chains, and verbal associations. In their examples, however, the prerequisite skills are auxiliary to the specific information being learned. For example, they state that "the individual S-R connection must be recalled in order for the individual to indicate the distinction which has been learned."[1] They appear in this instance to be describing cognition. The word "recall" also suggests memory. In the example of the child identifying an "E," he must first be able to discriminate between two and three horizontal lines. They state that the former skill is concept learning. It could be argued that the perception of the distinction between two and three lines is fundamental. Then a stimulus-response connection can be made, labeling the perceived letter as an E. This would be cognition, with repetition assisting in committing it to long-term memory. Another means of assisting in committing it to long-term memory is to learn the attributes of an "E." Then novel "E's" can be identified. The attributes, however, must be remembered to be able to classify examples. In other words, the rationale for the order of placement on the CSM, in contrast to Gagné's and Briggs', is based on the observation that the learner must first perceive it correctly (discriminate the attributes), cognize it by attaching a label or linkage cue to make a connection, then commit it to memory.

The first four levels of Gagné's and Briggs' learning hierarchy are related to lower level learning processes. It is not appropriate

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[1]Gagné and Briggs, pp. 36-40.

to consider them the equivalent of memory processing. At least the first three involve affective components, usually externally applied, which enhance the possibility of memorization of an event or knowledge that otherwise might have no meaning. The same material can be memorized by processing it cognitively in such a way that it interfaces with previously stored knowledge. Thus, although these concepts can be classified under memory, they are not the equivalent of memory.

Gagné's and Briggs' concept, rule, and problem-solving levels involve higher level thinking--the ability to apply the information to new situations. Because these higher level concepts include several types of cognitive processing skills, their utility in curriculum development is limited in their present form. To increase their usefulness, they need to be analyzed for subconcepts. The process in memorization of a rule is different from the application of a rule or the generation (synthesis) of a rule. The CSM addresses these limitations. Incorporated into these levels are Gagné's and Briggs' concept and rule learning and the major elements of problem-solving. Concepts and rules, as Gagné and Briggs define them, appear to equate with Bloom's comprehension, while his problem-solving involves application (finding solutions to novel problems). The three highest levels of thinking on the CSM are incorporated in the category of cognitive strategies, as defined by Gagné and Briggs. Also, Guilford's transformations and implications are accounted for in these levels.

At the highest level, Guilford places evaluation, as does Bloom, in his taxonomy. Gagné refers to evaluation as a component of problem-solving, his highest level. In the CSM, the placement of the evaluation

category is consistent with Guilford's and Bloom's models, and does not conflict with Gagné's and Briggs'. Evaluation is a decision-making process that determines whether or not processed knowledge meets the cognizer's purposes. The completed process dimension is illustrated in Figure 4.3.

In summary, the Cognitive Skills Model (CSM), a synthesis of several extant models, will have the following dimensions and concepts, using the specified identifying notations (Figure 4.4):

Process		Content		Product	
Perception	P	Sensory	S_1	Units	U
Cognition	C_1	Behavioral	B	Classes	C
Memory	M	Symbolic	S_2	Relations	R
Comprehension	C_2	Semantic	S_3	Systems	S
Application	A_1				
Analysis	A_2				
Synthesis	S				
Evaluation	E				

The notation system will occur in the order listed above, a set of three letters, the first--process, the second--content, and the last--product. For example, C_2 S_2 S represents the 'comprehension of symbolic systems.' The three-dimensional model is represented in Figure 4.4. Objective examples of each cell are found in the Appendix.

One test of a good theory is that it incorporates the elements of existing theories that have a modicum of acceptance within the discipline. The new theory also should be consistent with the details of parallel theories. A third test is a theory's usefulness, in this

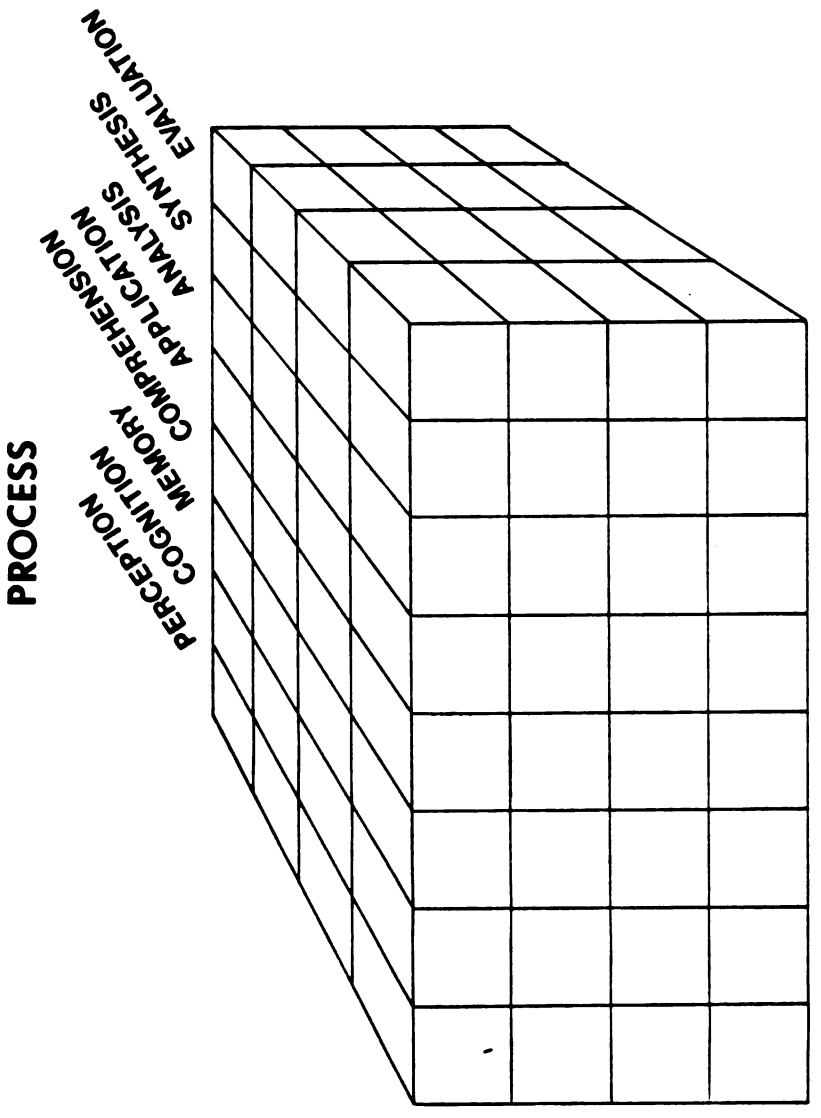

Figure 4.3 Cognitive Skills Model: Process Dimension.

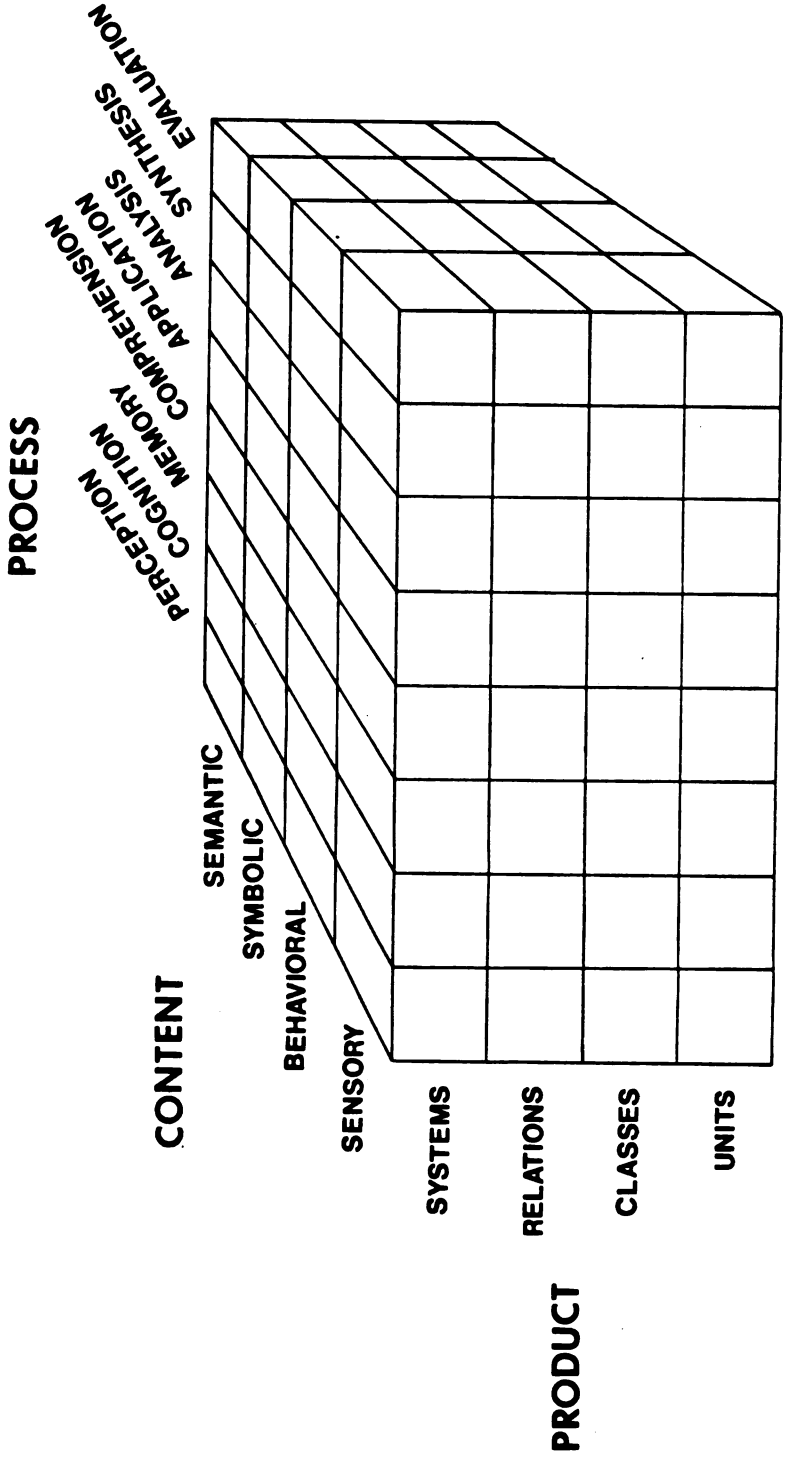

Figure 4.4 Cognitive Skills Model.

case as a tool for curriculum development. The proposed CSM appears to achieve these criteria. The CSM incorporates the salient features of Guilford's, Bloom's, and Gagné's models. Secondly, the new theoretical model is consistent with Piaget's developmental theory.[1]

Piaget proposed four stages of cognitive development. The first stage is the sensori-motor period, from birth to about two years, followed by the preoperational period that extends to about the age of seven. The child then may move into concrete operations and then proceed to the period of formal operations, around eleven years of age.

The sensori-motor stage involves the infant's exploration of his sensory world. Very early on this also begins to include behavioral content to which he learns to respond. Soon he acquires knowledge of symbolic cues which represent reality, such as the expectation that his bottle is a symbol for hunger satisfaction. Then he proceeds to language development. Thus, the content dimension develops from sensory to behavioral, to symbolic, to semantic (Figure 4.5).

On the product dimension, the sequence selected: units, classes, relations, and systems, finds support from Piaget's conceptions of development.[2] He described the ages of about two to four as the preconceptual phase, in which he would not yet be ready to deal with concepts and causalty. As the child moves into concrete operations he can begin classifying and then learn simple relationships

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[1]Hunt, pp. 170-247.

[2]Ibid., p. 114.

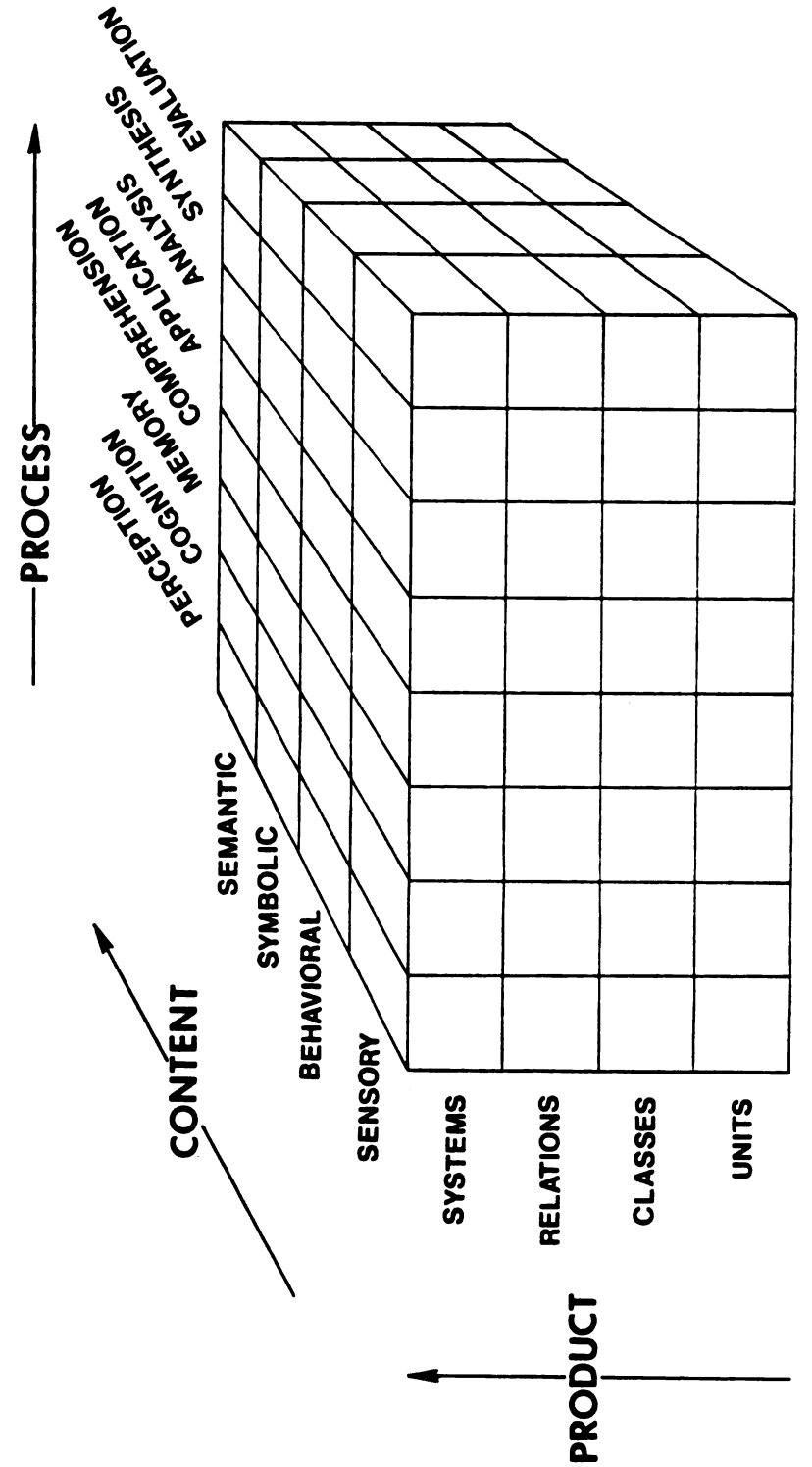

Figure 4.5 Cognitive Skills Model: Developmental Progression.

such as order. Simple relationships then proceed to the complex ones known as systems. Thus, Piaget's theory would appear to also support the product dimension of the CSM.

Piaget also spoke to the development of cognitive processes.[1] He stated that the sensory perception abilities are present at birth, although, as in the case of the vision, not fully developed. In the second stage of sensori-motor development, repeated stimulation leads to "perceptual recognitions," i.e., early cognition. These "perceptual recognitions are precursors to "recognitory assimilations." His description of this concept suggests early memory, as the child is able to respond with a smile upon seeing the bottle.

According to Piaget, the child is basically a responder to stimulation through the first and second stages of the sensori-motor period.[2] During the third stage there is a new development which is the beginnings of intentionality and differentiation of means from ends, which Piaget associated with what he called secondary circular reactions. The child begins to act on his environment. The ability to choose to influence his environment implies first a comprehension or understanding of that environment and then the application of his understanding.

The concept of causality has its beginning in the third stage, but without any awareness of the reasons for the cause-effect relationship.[3] The child, however, can analyze the activity and make a simple

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[1]Ibid., p. 118.

[2]Ibid., p. 124.

[3]Ibid., p. 131.

connection between one event and another. In comprehension, he would be told the stove is hot. If he believed the source and knew the meaning of stove and hot, he could comprehend by saying, "stove will burn fingers," and then apply that knowledge by avoiding contact. If, however, he had never been told that pushing the doorbell makes a ringing noise, and after several trials, made the connection, he makes an analysis of a cause-effect relationship. This generally occurs in Piaget's stage four of the sensori-motor period.

Indications that Piaget was observing rudimentary synthesis in stage four are his references to "construction of reality" and the absence of defining objects by their use.[1] The child is beginning to organize his many experiences into a structure of meaning. He may see objects that can be put to other uses, a skill Torrance included as a creative skill.[2]

In stage five, the tertiary circular reactions begin.[3] In this stage, Piaget observed "deliberate variation." The child begins to create his own means through active experimentation. This type of synthesis or transformation utilizes the sensory and behavioral activities. In the sixth and last stage, the child moves to invention of new means through mental combination. Thus, by the sixth level, the child has begun to exhibit rudimentary creative abilities.[4]

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[1]Ibid., p. 138.

[2]E. Paul Torrance, "Examples and Rationales of Test Tasks for Assessing Creative Abilities," Journal of Creative Behavior 2 (1968): 165-178.

[3]Hunt, p. 145.

[4]Ibid., p. 159.

The active experimentation and mental combination requires the child then to develop the skills of evaluation. The decision to place evaluation as the highest level process skill was the most difficult. The acquisition of intentionality, on one hand, suggests the need for evaluation. The comparison of intention with accomplishment may not always require evaluation, which implies value. That process may be, instead, a simple comparison of intention and action. Evaluation suggests a determination of the value of a problem solution. In that case, "evaluation" is appropriately placed at the highest level. The difficulty in making this determination is related to the lack of clarity of the meanings of evaluation as used by Guilford, Bloom, and Gagné and Briggs.

Piaget did not give the age ranges as distinct divisions between stages. They are estimates of the ages at which the child begins to use those skills with some facility. There is, however, an overlap. The most significant implication is the directional development of these abilities (see arrows in Figure 4.4). Acquisition of the skills at each stage depends on reasonable facility in the previous level.

The Cognitive Skills Model is proposed as a comprehensive description of cognitive processing as it is presently understood. Creative thinking, at least its intellectual elements, can then be identified as a component of the CSM. The value of the analysis of creative thinking in this way is that it then permits identification of specific objectives and strategies in an educational curriculum for nurturing creative potential.

Creative Thinking

Question 3:

How are the primary and contributory elements of creative thinking analyzed through the Cognitive Skills Model (CSM)?

Since creativity has been defined as the process of generating purposeful, unique products by transformation of existing products, the cognitive elements of the process can be specified in accord with that definition. The primary cognitive activities in creative thinking appear to be synthesis and evaluation. A survey of a variety of definitions supports the elements of synthesis and evaluation in the CSM as crucial to creativity.

The concept of bisociation proposed by Koestler and the remote association theory of Mednick specify synthesis of existing knowledge.[1] Rothenburg's Janusian thinking and homospatial thinking both involve synthesis of two opposite or separate entities.[2] Guilford proposed that transformations and implications are key factors in creative thinking, which suggests altering a given in some manner by combining it with a different concept.[3] The humanistic psychologists are proposing that the synthesis of new behavior patterns is the means by which people develop their own unique personalities.[4]

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[1]Koestler, p. 35; Mednick, pp. 227-237.

[2]Rothenburg,"The Process of Janusian Thinking," pp. 311-327; and Rothenburg, "Homospatial Thinking in Creativity "

[3]Guilford, Way Beyond the IQ, p. 160.

[4]Abraham H. Maslow, The Farther Reaches of Human Nature (New York: Viking Press, 1972; Penguin Books, 1976), p. 71.

To assure that a created product has a value or serves its purpose, the creator must also evaluate the result by comparing it to the desired goal or purpose. This occurs in the evaluation process. Without this step, the resulting products are only fantasies, "brainstorms," or ideas. Criteria need to be identified and compared to the end product to determine value. Such a process may occur either convergently or divergently. The best results in creative thinking, however, are obtained with deferred judgment.[1] Guilford also stressed the value of divergence in creative thinking.[2]

Although the skills of creativity are those of the highest levels of cognitive processing, facility in the lower skill levels is important to the development of creative thinking skills. The person who receives and cognizes accurately will have better data about reality that will permit him to function effectively in the cognitive realm.[3] The more data stored in the memory, also, the more prepared the person will be to create something of value.[4] In addition, the greater the comprehension and ability to apply information to real world experiences, the more useable the data will be. Analysis of all of these processes as well as the stored information provides the foundation for identifying the discrepancies between what is and

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[1]Alex F. Osborn, Applied Imagination: Principles and Procedures of Creative Thinking, Rev. ed. (New York: Scribner's, 1957), p. 45.

[2]Ibid., p. 160.

[3]Arthur W. Combs and Donald Snygg, Individual Behavior: A Perceptual Approach to Behavior (New York: Harper, 1959), pp. 18-36.

[4]Robert M. Olton, "Experimental Studies of Incubation: Searching for the Elusive," Journal of Creative Behavior 13 (1979): 9-22.

what could be. This is the key to synthesizing solutions or expressions of problems that manifest themselves in science (knowledge) or art (aesthetic and expressive value). In other words, creativity utilizes directly the process skills of synthesis and evaluation, but its development is contingent upon facility in the lower level skills.

In the content dimension, creativity may occur in any one of the four categories. An artist primarily deals in the sensory and symbolic areas. The playwright and social scientist generally combine behavioral and semantic content. The mathematician creates symbolic means of describing mathematical theories. The musician works with sensory and symbolic content, and if words are set to music, the semantic element is incorporated.

The product dimension contributes to creative thinking by describing the various ways knowledge can be arranged. It may stand alone in units or be grouped by similar attributes into classes. Knowledge may also be described as it relates to one other piece of knowledge--a relationship, or as it relates to more than one other unit of knowledge--a system. The creative person may use units to create taxonomies (classes) of knowledge. New relationships and systems developed from existing units, classes, relations, or systems are also creative endeavors.

On the basis of the developmental aspects of the CSM, it can be asserted that the earlier stages, i.e., lower levels, are the foundations of facility at the higher levels. On the process dimension, since synthesis and evaluation are the creative components, the degree

of skill in the prerequisite skills should enhance creative thinking. The content dimension differs in that any one category, or a blend of two or more, may be creative. Perhaps the person who functions primarily in the sensory mode may be creative without skill in the other content areas. The semantic creator, however, would need to be adept with the symbols that form words and the non-verbal behaviors and sensory experiences the words describe. The same may well be true of the product area. A creator of classes may lack expertise in systems and relationships. This, however, is questionable. A simple class grouping might not require systematizing, but most useful classifications, such as Bloom's taxonomy or the taxonomy of biological systems, are organized by establishing the relationships of individual classes to each other. Thus, it seems reasonable to assert that, although creativity can occur in persons who lack facility in working with one or more of the 128 cells of the CSM, increasing that facility may well enhance their creative ability.

Today's world has become one where right answers are not always self-evident or even available. The skills of creative problem-solving and decision-making have always been necessary to effective living. Traditional IQ tests generally fall short of assessing all of these categories. They tend to favor intelligence and ignore creativity.[1] The intellectual skills focus on the memory and understanding of knowledge. This would include at least application and perhaps

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[1] Guilford, Way Beyond the IQ.

analysis of content. Creativity is the generation of original ideas and thus cannot be measured as right or wrong, thus precluding its inclusion on I.Q. tests.

The creative skills are in and of themselves not adequate to the expression of creative behavior, however. They can only be considered in the holistic view of human functioning. Attitudes and motivation toward creative activity as well as manipulative and technical skills are an integral part of creative behavior. Environmental factors also contribute to the expression of personal creativity. To see it in this context, a process map that attempts to describe the critical dynamics involved in human behavior is proposed (Figure 4.6). Because there is much yet to be understood about the complexities of human functioning, this map does not purport to be all-inclusive. Instead it focuses on the critical factors that lend themselves to amelioration in educational settings.

Human Ecological System Model (HES)

Question 4:

How are the processes of human behavior analyzed, using the Human Ecological System Model (HES), a process map of human behavior?

It is obviously beyond the realm of possibility to diagram exactly what occurs in human behavior. Although human functioning is a cybernetic system, the processing occurs so rapidly, with a portion of the activity occurring at preconscious levels, that it is difficult, if not impossible, to analyze with confidence. The

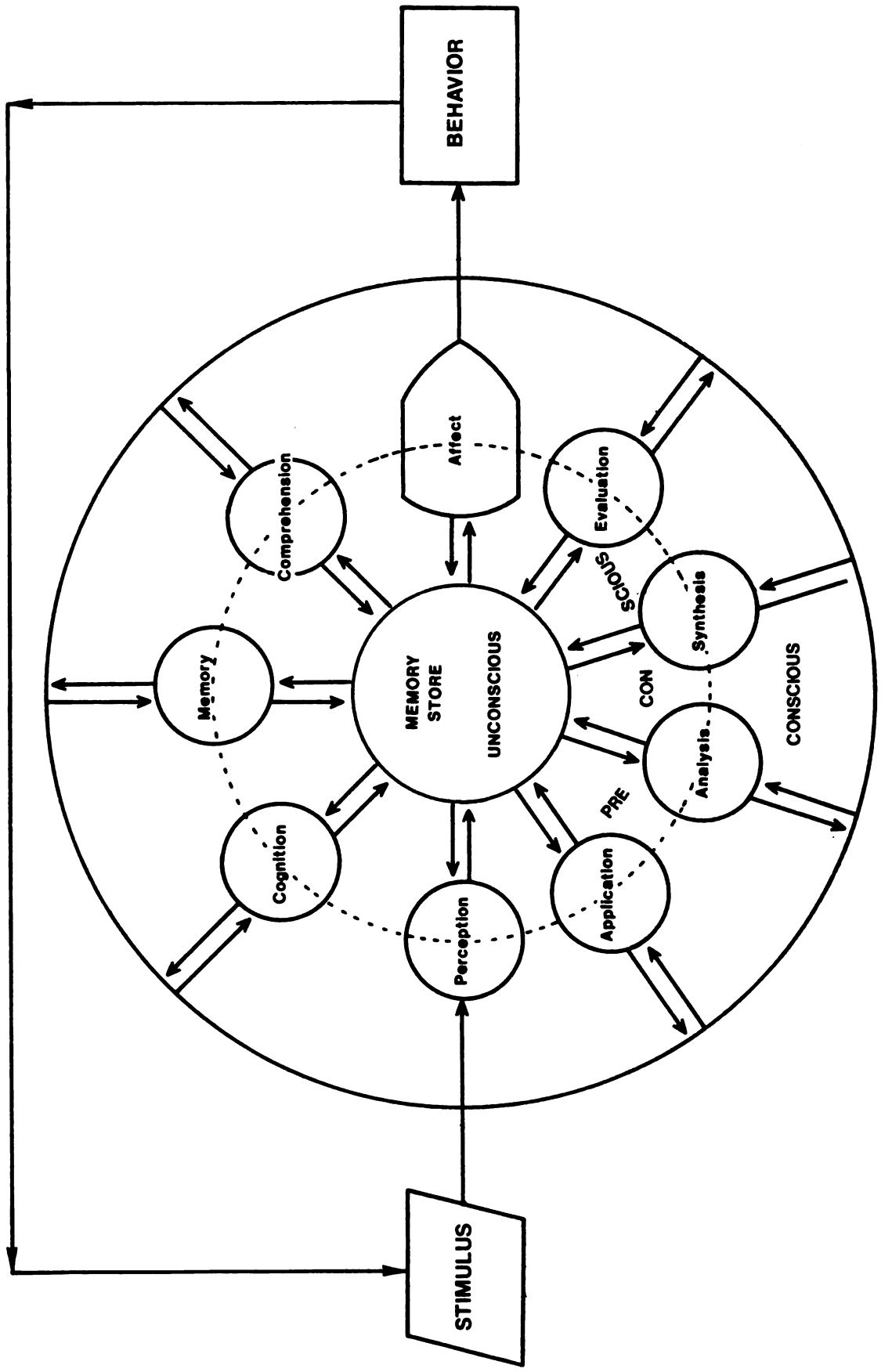

Figure 4.6 Human Ecological System Model: A Process Map.

other difficulty is that the analyst can be only the subjective observer of his own internal and external experiences. The best that can be done is to propose a model that appears to explain a variety of extant theories adequately. If it does that, it may serve the purpose of describing other concepts, such as creativity.

To elucidate the process map, the assumption is made that there are triggering stimuli, both internal and external, that initiate a behavioral event. A stimulus may occur as a result of previous processing or may issue from the internal or external environment. An example of each would be that either a memory itself may be the stimulus to further processing or a hunger pang or a phone call may generate processing. Planned or incidental environmental events which occur either simultaneously or consequently to an emitted behavior may be perceived of as natural sequels to the processing. They may then be incorporated into the memory store as significant factors in that behavioral event. Later occurrence of those environmental factors serve as stimulus cues to encourage repetition or avoidance of the behavior. As these behaviors obtain results in some form, they take on meaning for the organism.

Combs and Snygg, proponents of the phenomenological approach to human behavior, have stressed the importance of the perceptual field in human behavior.[1] According to them, a stimulus is perceived through a perceptual "filter" that selectively notes certain elements and ignores others. The perceptual filter is affected by memory of past

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[1] Coombs and Snygg, pp. 18-36.

events and their interpretation. With other phenomenologists, they feel that the significant influence on behavior is not the environmental stimulus but the perception of that stimulus, which will vary with individuals. The way in which the stimulus is perceived is based on previous experiences that influence the elements which will be noted. This is, in effect, the filtering process.

The perceptions that are registered are also interpreted on the basis of past experience according to Combs and Snygg.[1] In the proposed CSM, this function is separated and labeled cognition. This cognition may be conscious or preconscious and is processed for storage in the memory. Since some data is introduced to the memory without previous experience to relate to, it is possible that there is some direct memory storage from perception. An example might be nonsense syllables and images. Such memory is difficult to retrieve unless there is a related strong affect, i.e., classical conditioning.

A perceived stimulus (perception) evokes recall of similar material from the memory. This recall may be verbal or nonverbal, with the related affect. It also may be strongly conscious or occur primarily in the preconscious. The recall of associated material enables the mind to cognize the stimulus and then to code it for storage in long-term memory. The coding also facilitates the retrieval or recall of the newly cognized and stored information. In the case of preconscious material there may be reticence in calling it "recall" because it is not brought to consciousness, but evidence that preconscious material affects behavior suggests

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[1]Ibid.

that it is no longer in storage, but is available to the processing mind.[1] This is illustrated in the hypnogogic state which is the state that exists between waking and sleeping.[2] It also is difficult to interpret because it is often in images and the conscious mind tends to ignore the imagery, probably because it is well-trained to do so. This may well be the result of emphasis on left-brain dominance of thought.[3]

Any perceived, cognized, recalled, or restructured data will usually evoke some degree of affective response, whether positive, negative, or a mixture of feelings. These feelings may derive from earlier learning experiences, including respondent associations or possibly material from the collective unconscious described by Jung.[4] The combination of the feelings with cognitive ideas produces attitudes with positive or negative valences.[5] The resulting affect may provoke a new recall and subsequent repeat of the sequence one or more times, until the cognitive decision with sufficient motivational affect generates either approach or avoidance behavior.[6] At the same time, these new and recalled affective responses are stored or reinforced,

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[1]West, pp. 219-231.

[2]Simon.

[3]Garrett.

[4]Wallace.

[5]Lindsay and Norman, p. 565.

[6]Ibid.

respectively, in the memory store. The behavioral response is made, then, not only to the stimulus, as pure behaviorists prefer to believe, but to the complex cognitive and affective processing that relates to that stimulus. The person chooses to respond behaviorally in a certain way, based on the stored data concerning past experiences, his needs, values, interests, abilities, and meanings. This behavior then will be followed temporarily by various internal and external stimuli (consequences) that will cause him to evaluate the value of that behavior in his repertoire. This also will be stored in his memory.

One value of this process map is that it may be used to describe a variety of theories of learning, i.e., behavior change, and, therefore, act as a guide for understanding the elements involved. The analysis of these cognitive, affective, psychomotor elements and environmental influences also highlights the variety of elements that may be altered to facilitate behavioral change. The various existing theories approach behavior change in differing ways. If this map accounts for many theories, then it should also give direction to intervention plans of an eclectic nature. A selection of the more prominent theories are presented to demonstrate this utility.

The school of behavioral psychology proposed three major types of language: classical conditioning or respondent learning, instrumental or operant learning, and social learning or modeling.[1] Respondent learning involves the continguous association of two events, such that

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[1]John P. DeCecco, The Psychology of Learning and Instruction: Educational Psychology (Englewood Cliffs, N.J.: Prentice-Hall, 1968), pp. 265-266; and Albert Bandura, Social Learning Theory (Englewood Cliffs, N.J.: Prentice-Hall, 1977).

the affective response to one stimulus becomes associated with a concurrent stimulus. When the original stimulus that produced an expected affective response is removed, the other stimulus may provoke that same affective response and possibly a consequent behavior. The Pavlovian experiment with dogs, food, and bells was the classic example of this type of learning. The map would exemplify this by the flow of two parallel experiences sharing the common affect. Transfer of the affective response from one chain to the other probably occurs in the preconscious. Gagné denoted this as signal learning.[1] Behaviorists tend to play down internal processing. There is evidence, however, that processing may occur in the preconscious without real conscious awareness of the cognitive activity.[2] The learner is often unable to say what caused his feelings and/or behavior.

Operant learning occurs when, in response to a stimulus, the learner emits a behavior and that behavior is perceived as generating an internal or external consequence. That perceived consequence then initiates the behavioral chain of events again, with the results stored in the memory to be recalled when the learner seeks the same consequence. He recalls the previous events and their affect and effects and then emits the behavior to obtain the desired results. Again, because much of this is in the memory store, it is only brought to the preconscious level to catalyze the behavior. Thus, the cognitive activity is ignored

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[1]Gagné, p. 36.

[2]Joy P. Guilford, "Some Incubated Thoughts on Incubation," Journal of Creative Behavior 13 (1979): 1-8.

in the model of operant learning. Gagné refers to this learning as stimulus-response learning. It does not appear to include any cognitive restructuring, only cognition and memory. Gagné's chaining is also stimulus-response in which multiple sequential S-R activity occurs.[1] The successful completion of one behavior provides the stimulus cue to the next behavior in the sequence. Gagné's verbal association appears to be a specialized category of stimulus-response learning in which the given word is the cue and the associated word is the expected response which is rewarded.

Social learning theory describes learning which occurs when a learner observes the response of a significant other to a stimulus cue and then the consequence of that response.[2] If the consequence is seen as a rewarding one, the observer may use the behavior himself. If it is seen as punishing, the observer may avoid the behavior. This theory also minimizes the internal processing that occurs that determines what makes the consequence rewarding or punishing.

In Freudian psychology, the three major concepts which control behavior are the ego, superego, and id.[3] The id is the instinctual self driving to have its needs fulfilled. These needs are evidently a part of the unlearned memory store, perhaps similar to the collective unconscious, and perceived by the interoceptor senses. These needs are

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[1]Gagné, p. 42.

[2]Bandura, pp. 22-55.

[3]James C. Coleman, Abnormal Psychology and Modern Life, 3rd ed. (Glenview, Ill.: Scott, Foresman, 1964), p. 96.

probably the controllers of the affective responses to stimuli. If a stimulus is perceived as a felt need, the person responds in a way that he feels will reduce that need, on the basis of past learning experience. Freud saw these needs as primarily libidinal.

The nature of these needs was more extensively described by Maslow, who proposed need levels.[1] The need levels in order of priority are survival, safety, belonging, self-esteem, and self-actualization. A reasonable degree of need satisfaction is considered necessary to permit behaviors designed to meet needs at the next level. In addition, Assagioli proposes a sixth need level, concern for satisfying interdependence with others.[2]

Freud's second concept, the superego, is sometimes called the conscience. This is the collection of values, mores, and admonitions learned from very early in childhood. These rules of behavior are stored in the memory by simple reinforcement, as well as memories of modeled examples and reinforcements of conformity or punishment of transgressions. Bloom would probably categorize this under knowledge of conventions and/or knowledge of principles.[3] Either way, these rules of behavior are recalled and applied to immediate situations without examining the value of their impact cognitively.

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[1]Maslow, Toward a Psychology of Being, p. 152.

[2]Assagioli, p. 106.

[3]Bloom, p. 62.

The third concept Freud proposed is the ego. This is the logical, intellectual function which examines the data from both the id and superego to determine the value of its message for a given situation. The ego involves both evaluation of recalled superego content and the affective id content as well as possible transformation of it with other information. These three different modes vary in their ability to determine behavior in any one person. The person who tends to hedonism and impulsiveness has a very dominant id while the rigid, compulsive person has a very dominant superego. Both lack the ability and/or motivation to cognitively process the internal and external functions to determine the true value of a behavior.

The function of Berne's ego states in transactional analysis is quite similar to that of Freud's concepts of ego, id, and superego.[1] Berne's parent ego state is comparable to the superego. The id is similar to the child ego state and the ego is congruent with the adult ego state. The cognitive processing would be related, also. The child ego state appears to arise from the interoceptive and proprioceptive stimuli and the memory store of instinctual response. The parent ego state is the collection of "shoulds" and "oughts" as Berne called them, learned in early childhood primarily by stimulus-response techniques. The adult ego state processes intellectually both previously learned and new data in a rational manner, thus using evaluation and cognitive restructuring. The events of a person's past are stored in the memory.

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[1] Berne, pp. 29-36.

Some of it has so little meaning, such as irrelevant academic learning, and insufficient links to previously learned data, that it is almost "forgotten"--probably forever irretrievable. Other events from the past are so painful that in order to avoid the intense pain, the person represses it deeply in the subconscious. These memories, however, continue to affect behavior.

The process map can also serve to organize and describe what is known about the psychological defense mechanisms. The person who harbors painful memories may use a variety of psychic techniques to deal with them--known as ego defense mechanisms.[1] In denial of reality a person may either physically avoid or ignore unpleasant stimuli or cognitively avoid reality by altering the belief system about a perceived stimulus. The use of fantasy as a form of escape rather than a means to produce results is also a denial of reality. This type of fantasy could be recall of earlier pleasant memories or a creative synthesis of what one wishes to exist. Rationalization appears to be the application of previously learned principles to a given situation, whether logical or not, that are selectively chosen from memory to "fit" with the situation.

Another defense mechanism used is projection onto others those characteristics which they do not like in themselves. This may be simply transferring blame or seeing the actual characteristics in others or it may involve imagining these short-comings in others to the point of paranoia. The rationale is similar, however. People

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[1]Coleman, p. 96.

cannot accept the characteristics as their own, thus they project them on others, finding real or imagined similarities. This requires both rather acute perception and cognition as well as analysis of the dynamics involved and synthesis of imagination with reality.[1]

One of the mechanisms frequently used is repression.[2] The person only selectively remembers what he wishes and represses the rest in the unconscious. This may be partial or complete. This selective remembering is not consciously controlled as it is in suppression, however.

Another type of ego defense is reaction formation.[3] The person will consciously espouse a belief system and become a fanatic in this regard to negate unconscious feelings and desires that are generally opposed and considered unacceptable. This person is conflicted, as his cognitive beliefs, reinforced by repeated verbalization and behavior, do not match his affective experiences. These beliefs, generally based on social values, are memorized for later application with little question as to their consistency with reality.

In the cognitive area, isolation or intellectualization is often used as a defense mechanism.[4] When there is an event in which it is difficult to handle the emotions, the person talks about it as if it had no emotional impact. Or different beliefs and ideas that would

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[1]Ibid., p. 99.

[2]Ibid., p. 99.

[3]Ibid., p. 100.

[4]Ibid., p. 106.

cause conflict, if brought together, are kept compartmentalized. In other words, there is an effort to keep from linking together those kinds of knowledge that are related but contradictory. These ego defense mechanisms are all primarily cognitive in nature. They use the cognitive skills to maintain the ego-ideal or self-esteem needed. They may use any of the cells in the CSM to accomplish this goal.

In addition to describing psychological theories and defense mechanisms, the process map can also illustrate the nature of the therapeutic process employed by clinicians of various psychological persuasions. Each theoretical stance appears to emphasize selected components of the process map. Strategies for initiating/facilitating learning tend to relate to the selected areas of emphasis of each therapeutic approach. The viability of the process map as an eclectic tool for understanding these various approaches suggests that behavior change can be facilitated by addressing any one or more of the elements described on the map. For example, creative behavior could be enhanced by more appropriate stimuli, improved perception, cognition, and memory, more practice in application and other high level skills, change in attitude, or altered responses to an emitted behavior. Attention to more than one variable might increase significantly the probability of more creative behavior.

Although the ego states in Berne's model are comparable to Freud's concepts, the use of transactional analysis as a therapy involves the analysis of the ego states which function in the present as they interact with another person's ego states.[1] The emphasis is

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[1]Berne, pp. 90-97.

on discovering the person's preferred mode of interaction and working toward the ability to function with the adult ego state determining which parent admonitions and child desires are useful and which are not. Thus, if one were to describe transactional analysis by using the CSM, one would say that transactional analysis focuses on using analysis, synthesis, and evaluation in conjunction with recall of past experience and perception of feelings. This is the processing of the adult ego state.

Humanistic psychology also focuses on present circumstances.[2] There is a strong emphasis on identifying feelings related to memories and new ideas and experiences. The purpose of identifying the feelings is to help the person clarify for himself the meaning that memories and events have for him, so he can make conscious decisions based on understanding rather than on "hidden persuaders." By using the process map, the humanistic therapist may be described as relying heavily on perception and cognition of affective responses, comprehension of their meaning, and application to everyday experiences.

A specialized form of humanistic therapy is Gestalt.[2] The Gestalt therapist functions similarly to the humanistic therapist except that he uses some techniques more closely related to creativity. Synthesizing imaginary roles, a strategy known as role-playing, reverse

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[1]Otto, pp. 25-264; Joseph Zinker, Creative Process in Gestalt Therapy (New York: Random House, 1977), p. 92; and Maslow, p. 9.

[2]Zinker, p. 92.

role-taking and guided fantasy are examples of techniques used to effect self-understanding. The guided fantasy or imagery (synthesis) as well as free association (memory), are means of perceiving reality in a symbolic form, somewhat similar to Freud's dream interpretation. The recalled material is then analyzed and integrated (synthesized in CPM terms) with related behavior. This form of therapy, particularly, appears to utilize right-brain function to obtain the intuitive Gestalt or holistic view of a situation, rather than reliance on verbalized analysis.

Another current school of psychological thought encompasses both behavioral psychology and cognitive psychology. This is the rational-emotive therapy of Ellis.[1] His theory uses the behaviorist paradigm, A-B-C, in a manner which incorporates cognitive processing. In behaviorism, A is the antecedent event; B, the behavior; and C, the consequence which maintains, reinforces, or reduces behavior B. In rational-emotive therapy, the A is also the antecedent event, but B is the cognitive belief and C, the consequent emotion which leads to a behavioral effect E. When the belief is rational, C is a beneficial emotion. The need for change occurs when B is an irrational cognitive statement that results in an inappropriate emotional consequence, C. To effect the change in the inappropriate behavior, the person is taught to address the irrational belief B by disputing it with rational statements until the emotional effects are desirable and produce behavior that is constructive for the individual.

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[1]Albert Ellis, Humanistic Psychotherapy: The Rational-Emotive Approach, ed. Edward Sagarin (New York: McGraw-Hill, 1973), p. 4.

Using the process map, the stimulus would be the antecedent event, A. The beliefs, B, rational and irrational, reside in the memory store and may be brought to either the preconscious or conscious level in response to A. These thoughts or beliefs evoke an emotional consequence, C, or affective response. A subsequent behavior, E, may result, based on the value determined by the affective response. The disputing step is accomplished by analysis, synthesis, and evaluation of stored and new information, that is, making decisions as to inappropriate verbalizations of beliefs and transforming them to more effective ones. Ellis emphasized the importance of bringing cognitive material to a conscious level and labeling the consequent feelings as a means to facilitate the transformation.

Thus, the process map can describe the cognitive, affective, and behavioral response to environmental stimuli. Unless the process map can adequately describe how other's theories function, it would be of little value in explicating creative behavior. The descriptive map does incorporate several varied approaches to psychological theory and therapy. Using the process map, then, the elements of creative behavior can be identified.

Creative Behavior

Question 5:

In what way might creative behavior be described using the Human Ecological System Model?

Creativity requires the ability not only to perceive stimuli in the environment, but also to match perceptions with reality. The

memory store which contributes to perceptual filtering does affect this ability. Problem sensitivity is related to the ability to perceive reality and any undesirable consequences which arise out of the reality situation. Festinger calls this a sensitivity for cognitive dissonance.[1] In other words, the person who is distinctly creative perceives and cognizes more of his environment, internal and external, and does so more effectively, accurately, and often with more sensitivity.

The process of creative thinking also uses data stored in the memory to be retrieved when needed to contribute to the higher level thinking processes. The greater the store of knowledge and, more importantly, the ability to retrieve it, the more likely the creative potential will be actualized.[2] Information need not be brought to the conscious level, however, for it to be used. Creative activity involves the preconscious material as well.[3]

If information is only memorized with no comprehension of its meaning or ability to apply it to given situations, it is doubtful that that information has much value in creative thinking. Comprehension and application of knowledge seem to be necessary for that knowledge to be incorporated into higher level processes.

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[1]Leon Festinger, A Theory of Cognitive Dissonance (New York: Harper, 1957), p. 13.

[2]George M. Prince, "The Mindspring Theory: A New Development from Synectics Research," Journal of Creative Behavior 9 (1975): 159.

[3]Olton.

Since creative thinking is usually a response to a perceived gap between what is and what is desired, analysis is often the key to accurate "problem definition."[1] In addition, analysis is used to examine component knowledge of complex events that could contribute to "solutions." The analysis of attributes, for example, expedites the synthesis of a new knowledge based on the components. It is possible to conclude that all of the levels below synthesis contribute to the effectiveness of creative behavior. The developmental progression proposed by Piaget supports this contention.

By definition, creative thinking, seeks to develop unique ideas, attitudes, tools, works of art, etc., using the recombination of existing knowledge. Thus, the key to creative activity is the synthesis of elements into a unique product. In order for purpose to be achieved, however, there must also be evaluation of the product against the criterion of purpose, in accord with the definition established earlier. This evaluation may occur convergently or divergently, with divergent evaluation (deferred judgment) enhancing the possibility of obtaining creative outcomes, as stated earlier.

Creativity is sometimes used interchangeably with the term problem-solving or in conjunction with it. There appears to be some confusion in this regard. Problem-solving implies finding solutions to discrepancies in what is and what is sought. In some cases, as in mathematical problems, there is a right answer and the solution is

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[1]J. W. Getzels, "Problem-Finding and the Inventiveness of Solutions," Journal of Creative Behavior 9 (1975): 12-18.

determined by following well-ordered principles to discover the answer. The process of finding right answers falls into the category of application, i.e., applying rules and facts to a new problem. Thus, not all problem solving is creative. Creative problem-solving is employed in situations where there is no known right answer or single solution. Alternative solutions may be sought and tested against specified criteria. The testing is a cognitive form of decision-making or evaluation. The creative person then has facility in all of the processes illustrated in the Cognitive Skills Model.

In addition, a person's affective responses or attitudes play a significant role in creativity. These attitudes may be individual attitudes, such as avid interest in some area of investigation. They may be attitudes that appear to be related to personality clusters, such as the perceiver type in Jung's scheme, who has a preference for deferred judgment, and the intuiter, who perceives in a holistic manner.[1] This latter type suggests right-brain dominance.

The attitudes that are held, then, by an individual, influence the other type of decision-making; i.e., personal value judgments. Lindsay defines decision-making as making a value judgment.[2] Value judgments are made in relation to each voluntary behavior performed. In effect, the person says, "I value this act," by virtue of the fact of its performance. Thus, the person who exhibits creative behavior

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[1]I. B. Myers, Myers-Briggs Type Indicator Manual (Princeton, N.J.: Educational Testing Service, 1962).

[2]Lindsay and Norman, p. 565.

values this creative behavior and probably many of the attitudes that nurture it. The value may derive from either extrinsic or intrinsic satisfactions, which then become stimuli for continuing creative activity.

Given the framework of the process map, it is then possible to understand creative behavior as a series of events which occur as follows: what occurred (perception), what were the associations (cognition), how does it fit with past memories (memory), what does it mean (comprehension), under what circumstances (application), what were all the contributing factors (analysis), how might it be done differently (synthesis), will that work (evaluation) and what will be the impact on the behavior (affective decision-making). If the latter two steps have a positive outcome, implementation behavior should follow. Then a planned or coincidental response to that behavior would serve to reinforce or attenuate or extinguish the behavior, serving as a stimulus for future approach or avoidance of that behavior. Thus, each element of the Human Ecological System Model plays a role in creative behavior.

By using this description of creative behavior, it becomes clear that not all that is labelled creative in popular language is really "creative-behavior." For example, the tendency to call any artistic or even craft endeavor "creative" is misleading--arising out of a failure to distinguish between creativity and techniques and/or skills. The knitting of a sweater by following directions is not being creative. The person who developed the original, unique design was the creator. Dancing a dance choreographed by another (the creator) may well be the

work of a highly skilled technician. If, however, that dancer modifies or adds interpretive qualities, then there is a unique synthesis of the given and the new ideas, and the dancer deserves the label "creative." Cookbooks, to cite another example, are frequently labelled "creative cookery," or something similar. If they have recipes which the cook follows slavishly, then the cook is a technician. A truly creative cookbook would describe principles of food preparation, perhaps give a few examples or rules for creating unique combinations, and leave the rest to the person's own imagination. The point here is that the creator needs to be more than a technician. The technician works at the application level. The creator reaches the synthesis and evaluation levels, to create those unique products that are the results of creative behavior.

In summary, the affective attitudes and general personality traits of a person are as important to creative activity as the cognitive process skills. These attitudes are potentially changeable and the personality traits are at least open to amelioration with appropriate environmental circumstances. With practice and support, a person can increase his tendency to take risks, to trust his own perceptions, and reduce the stresses or improve his response to them. A person's personality type preferences, illustrated in the Myers-Briggs Type Indicator, can be complemented by the development of the the non-preferred type with opportunity, awareness, and encouragement.[1] The moral development proposed by Kohlberg seems to be a developmental

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[1]Myers.

process of moving from outer-directed to inner-directed behavior. To make the transitions he suggests the need for exposure to and cognitive challenge by people in the moral level just above one's own.[1] In other words, although morality is developmental, it may be stunted at any point. A comparable process exists with Rank's levels.[2] Thus, an educational environment can and must attend to providing the appropriate milieu that enhances the possibility of continued personal development of those traits that provide a greater self-actualizing experience.

The conclusion to be drawn from an examination of the variety of explanations of creativity is that it is perhaps the highest form of human intellectual activity, at least at this stage of human evolution. Consequently, it involves human cognitive, affective, and psychomotor elements. The cognitive dimension would include all types of processing known to exist, most particularly focusing on the highest levels of cognitive functioning. The affective dimension contributes significantly. The general belief now is that the greater the level of emotional health, the more creativity that may be expressed. In the psychomotor dimension, diverse skills are needed, depending on the manner in which a person chooses to express his creativity. Some creativity is manipulative, while other expressions emphasize intellectual processes. It is difficult to imagine a creative endeavor that doesn't use some skills in all three areas. They are practically inseparable.

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[1]Robert C. Hawley and Isabel L. Hawley, Human Values in the Classroom: A Handbook for Teachers (New York: Hart, 1975), p. 22.

[2]Rank, pp. 114-120.

The comprehensive description of creative behavior that has been presented challenges the educational system to design and implement an innovative curriculum that will nurture creative behavior. From one point of view, it could be said that schools tend to foster conformism and "right" answers. The role of the schools traditionally has been to transmit the cultural imperative. This responsibility is not contrary to the concept of a curriculum that nurtures creativity. It is the means of transmittal that are in question. The emphasis has been on rigid rules laid down for expected behavior that are not open for debate. This approach is antithetical for the democratic system of citizen participation in decision-making. The difficulty with non-debatable codes is described succinctly by Harris:

> It takes only one generation for a good thing to become a bad thing, for an inference about experience to become dogma. Dogma is the enemy of truth and the enemy of persons. Dogma says, "Do not think! Be less than a person." The ideas enshrined in dogma may include good and wise ideas, but dogma is bad in itself because it is accepted as good without examination.[1]

The subliminal message of unquestioned dogma generates a narrowness that doesn't teach creative behavior nor does it create the diversity that provides the ability of biological systems to thrive. Creative behavior encourages diversity of interests and options. It also stimulates involvement and self-determination. Thus curricula would look very different from the way they usually are designed.

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[1]Thomas A. Harris, I'm OK, You're OK: A Practical Guide to Transactional Analysis (New York: Harper & Row, 1969), p. 226.

Schools also need to see children not as walking storage and retrieval systems. They need to be viewed as problem-solvers and creators of new forms. Glasser developed his curriculum along these lines.[1] The school meetings he held were designed to allow his students to solve their own problems and develop their own social structure. There are payoffs in such an approach. People who experience success in solving problems that concern them have higher self-esteem. Problem-solving enhances the developmental progression of social-emotional behavior, that of moving from dependence through independence to interdependence.[2]

One point that needs to be emphasized is that creativity is not a simple skill that is to be taught to learners, although there are some teachable skills associated with it. The creative potential of learners is there, only to be given permission to be expressed in many,[3] or recognized and reinforced in others. The powers of the mind are extensive and its potential mostly untapped. Some researchers believe that only 5 percent of its potential is used.[4] Also many of the intellectual skills including creative thinking are an inherent part of persons. Lack of use leads to atrophy of the abilities and those abilities that schools permit to atrophy are often the skills

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[1]Glasser.

[2]Everett Shostrom, Freedom to Be: Experiencing and Expressing Your Total Being (Englewood Cliffs, N.J.: Prentice-Hall, 1972), p. 4.

[3]Zinker, p. 3.

[4]Otto.

that are most uniquely human in nature and most beneficial to human existence.

In summary, there are four major reasons for comprehensively infusing creative thinking into a school curriculum. A curriculum that attends to creative activity is more comprehensive, more motivating, more socially relevant, and more realistic. The comprehensive nature of a creative curriculum is demonstrated in its attention to instruction and practice of all of the 128 cells of the cognitive process model. It includes as well the affective elements that contribute to "learning how to learn" and taking responsibility for self-directed learning. The curriculum is broader in scope, and, because process is emphasized, there is greater transfer to areas of content that curriculum does not have time to cover.

A curriculum that emphasizes creative behavior is also motivating to learners. It teaches abilities that learners perceive as useful in their own lives. They are participants in structuring of knowledge rather than recipients of information.

Another benefit of the curriculum that nurtures creativity is that it provides learners with the skills needed to meet societal needs. Today's world of rapid change and new challenges requires continual problem-solving to deal with the surprise consequences of many of the decisions and solutions implemented. The need for many more effective problem-solvers than are presently in existence is practically self-evident.

The last major reason speaks directly to the value of creativity to the school curriculum itself. There has been extensive

literature on the subject of the value of an interdisciplinary approach to curriculum development.[1] The infusion of creative process with its emphasis on synthesis provides a framework for such an approach. Synthesis frequently includes knowledge from diverse sources. Organizing the curriculum around problems, whether ways to save energy or express feelings, gives learners an opportunity to seek background knowledge from a number of disciplines. The acquisition of knowledge, often perceived as irrelevant, now has immediate purpose and thus becomes a more rewarding activity. The application of that knowledge to problem situations allows for the testing of the validity of cultural and scientific theories so that each learner makes the newly acquired understanding his own.

There is much yet to be known about the concept of creativity. The degree to which each of these cognitive and affective elements contribute to creative behavior is yet to be determined. Given the present knowledge of cognitive process, personality theory, and creativity, it seems reasonable to conclude that these elements do influence creative behavior to some extent. Guilford has already done factorial analyses of many of the cells of his SI model.[2] Since these have been retained in cells of the CPM model, although renamed and/or relocated, there is a foundation of evidence for the existence

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[1]R. Thomas Tanner, "The Science Curriculum: Unfinished Business for an Unfinished Country," Phi Delta Kappan 51 (1970): 353-356.

[2]Joy P. Guilford, "Creativity: Retrospect and Prospect," Journal of Creative Behavior 4 (1970): 149-168.

of many of the cognitive skills. In addition, there has been research on many of the attitudinal aspects of creative behavior. The theories presented herein provide the basis for research on the extent of the proposed relationships.

CHAPTER V

CURRICULAR APPLICATIONS OF THE MODELS

There are many educators who now believe that creativity may be nurtured in educational environments. For many years educators have expressed the desire to develop curricula that would enhance creativity. There are critics who claim that many school systems ignore their own stated goals, using them only for cosmetic purposes. More likely, educators want to develop creativity and, because of a misunderstanding or lack of understanding of creativity, either believe they are nurturing creativity or lack the knowledge and skill needed to accomplish the goals they desire.

The purpose of this dissertation is to provide some guidelines for developing curricula that increase the possibility of nurturing creative potential. With the development of the Cognitive Skills Model and the Human Ecological System Model, the next question can be addressed.

Question 6:

In what ways might a curriculum be designed to nurture creativity?

Curriculum for Creativity

The first task is to define the concept curriculum. Taba stated that a curriculum is a way of preparing young people to participate as

productive members of our culture.[1] In addition, she described curricula as having several key elements. These elements are a statement of aims and specific objectives; selection and organization of content, patterns of teaching, and learning; and a program of evaluation of outcomes.

Hass defined curriculum as, "all of the experiences that individual learners have in a program of education whose purpose is to achieve broad goals and related specific objectives, which is planned in terms of a framework of theory and research on past and present professional practice."[2] He specified the elements of the curriculum as the broad goals and specific objectives, the planned learning experiences, and the means to evaluate instructional decisions. These elements are founded on the four bases of curriculum: social forces, human development, the nature of learning, and the nature of knowledge. He further stated that there are two broad areas of concern. The curriculum must be built on goals that relate to society and its values, and goals that relate to the individual learner, his needs, interests, talents, and abilities. Under these are the general goals of citizenship, vocation, self-realization, and critical thinking.

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[1]Hilda Taba, Curriculum Development: Theory and Practice (New York: Harcourt, Brace & World, 1962), p. 10.

[2]Glen Hass, ed. "Introduction," in Curriculum Planning: A New Approach, 2nd ed. (Boston: Allyn & Bacon, 1977), pp. 3-10.

Tyler presented his view of the four elements of curriculum.[1] He felt that educational purposes must be defined, learning experiences designed to help achieve these purposes, the experiences organized effectively, and an evaluation method employed to determine effectiveness.

Eisner and Vallance summarized the variety of approaches to curriculum.[2] They classified these five orientations as (1) the development of cognitive processes, (2) self-actualization, (3) academic rationalism, (4) social reconstruction-relevance, and (5) technology. Each approach, as it is described, tends to neglect the others. Cognitive processes are emphasized to the exclusion of any systematic content. Self-actualization takes precedence over any cognitive activity. Academic rationalism ignores affective education and social concerns. Social reconstruction neglects the basic skills and cognitive processes. Technology often becomes an end in itself, losing sight of its reason for being.

In summary, there is general agreement that a curriculum implies objectives, learning experiences, a planned organization, and evaluation. The actual nature of these is where the wide variance occurs. Secondly, the rationale for the choice of the objectives is a key issue and also a heavily debated topic.

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[1]Ralph W. Tyler, Basic Principles of Curriculum and Instruction (Chicago: University of Chicago Press, 1949), p. 1.

[2]Elliot W. Eisner and Elizabeth Vallance, eds., "Five conceptions of Curriculum: Their Roots and Implications for Curriculum Planning," in Conflicting Conceptions of Curriculum (Berkeley, Calif.: McCutchan, 1974), pp. 1-18.

The position taken in this dissertation is that of John Dewey.[1] There seldom is an "either-or" situation. In a survey of the five conflicting conceptions of curriculum presented by Eisner and Vallance, it is possible to view them each as a necessary component of the whole curriculum.[2] This can be a reality if all of the elements of the Human Ecological System Model and the Cognitive Skills Model are addressed in a curriculum plan. A curriculum that is designed with creative problem-solving in every discipline or cluster of disciplines speaks to all five approaches. This curriculum will be designed to develop the presently understood scope of cognitive processes. It will nurture self-actualization. It can teach critical thinking or academic rationalism. The problem-solving skills can be applied to social problems for social reconstruction. Technology can be an integral part, both as a delivery of instruction and as a technical problem to be approached in order to further the education of society as a whole.

Each of the components of a curriculum have some specific variables that will influence creative behavior. These components are defined as objectives, learning experiences, organization, and evaluation.

Goals and Objectives

The sine qua non of teaching is intentionality. Without intentionality, learning may occur, but it will not be the result

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[1]Dewey, p. 17.

[2]Eisner and Vallance, pp. 1-18.

of teaching or instruction. Thus, a curriculum would have as its keystone a compendium of learning outcomes.[1] These outcomes may be called goals, objectives, evaluation strategies, or other selected terms and may range from very general to very specific, from idealistic to pragmatic to irrelevant. In whatever form and for whatever function they are presented, these learning outcomes are the "blueprints" for the curriculum.

The necessary issue for this dissertation is the nature of the objectives for a curriculum that intends to nurture creativity. There is growing support for the proposition that learner outcomes are descriptions of behaviors learners exhibit which demonstrate that they have learned something, either on their own or with instructional assistance.

Many of the objectives spelled out in present-day curricula tend to be knowledge or memory objectives.[2] Some direct learners to comprehend what they hear or see, restate the knowledge in their own words. In the area of mathematics, problems are presented which provide the learner with an opportunity to apply rules in order to determine the right answer. Some of the innovative science curricula present problems for students to solve. Beyond that, it is probable that there is little emphasis placed on the higher level thinking

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[1]Glen Hass, ed., "Curriculum Criteria," in Curriculum Planning: A New Approach, 2nd ed. (Boston: Allyn & Bacon, 1977), pp. 230-237.

[2]Richard W. Burns and Gary D. Brooks, "Processes, Problem-Solving, and Curriculum Reform," in Conflicting Conceptions of Curriculum, ed. Elliot W. Eisner and Elizabeth Vallance (Berkeley, Calif.: McCutchan, 1974), pp. 37-47.

skills. Dale believed that many schools are little different than fifty years ago.[1] There are numerous innovative delivery systems: auto-tutorial media, modular scheduling, competency-based curricula, open classrooms, and personalized instruction. In that fancy vehicle, however, is carried much of the same old baggage and it is headed down the same road it has traveled for the last fifty or so years, because the engine doesn't have the horsepower to handle today's superhighways and congested city thoroughfares. That is, the same content is being taught and the expected level of cognitive processing by students has changed little. If a curriculum is to nurture creativity, there will need to be some significant changes, not so much in the delivery systems as in the curriculum itself.

One of the major points illustrated by the Cognitive Skills Model is that creativity is primarily a process. Creativity utilizes one or more of the content areas and generates one or more of the products, depending on the nature of the perceived problem or need. Whatever the content and product, however, the same process skills write symphonies, design bridges, develop taxonomies, and change lives.

Since schools traditionally have neglected the higher level process skills, the most important change that can occur is the development of a curriculum that teaches all of the process skills in all of the content areas. This approach is similar to that proposed by educators such as Schwab, who have advocated curricula that addressed

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[1]Edgar Dale, Building a Learning Environment (Bloomington, Ind.: Phi Delta Kappa, 1972), p. 10.

the structure of the disciplines.[1] In this approach, the learner is to work with the content the same way a professional in the field would. The majority of professionals spend the better part of their time problem-solving; i.e., using analysis, synthesis, and evaluation. Thus, the student would learn to apply problem-solving skills in the various content areas.

Burns and Brooks emphasized the importance of the process skills in the curriculum.[2] They defined processes as complex skills which learners use in transforming knowledges and understandings in order to effect solutions to problems.

The importance of process curricula which emphasize the problem-solving skills was underscored by Cole.[3] He stressed the importance of moving beyond the teaching of facts and memory skills to instruction in the more complex cognitive skills. Although he believed that the lower level skills are necessary, they are not sufficient to enhance the possibility of creative activity.

To accomplish the development of comprehensive process skills in a content area, objectives need to be written for all process levels. Since any discipline deals with complex relationships, all product levels also need to be included. Although not every content area is

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[1]Joseph J. Schwab, "The Concept of the Structure of a Discipline," in Conflicting Conceptions of Curriculum, eds. Elliot W. Eisner and Elizabeth Vallance (Berkeley, Calif.: McCutchan, 1974), pp. 162-175.

[2]Burns and Brooks, pp. 37-47.

[3]Cole, "Process Education."

emphasized in a narrowly defined discipline, an interdisciplinary approach would more likely utilize all of them. Perhaps the study of a discipline would be improved by a plan to incorporate all four content areas. As an example, music is a sensory experience. It also is symbolic, using symbols to communicate. Music tends to initiate a bodily reaction, either movement or expression of feelings. Feelings can be translated into words. A study of music can include a comprehensive utilization of all of the cells of the CSM.

An illustration of the learning outcomes that could be written on the basis of the CSM are found in the Appendix. As they are written, they are designed as exemplars of each cell, rather than as curriculum content in a specific academic area.

To illustrate the application of the CSM to a traditional curricular area in the determination of objectives, examples are given in Figure 5.1. These are limited to the analysis, synthesis, and evaluation process levels with a sampling of the content and product dimensions. The code letters are included to assist in classification (see page 123 for codes).

In an innovative environment, where the content tends to be interdisciplinary, the learning experiences expanded beyond classroom walls, and the problem-centered approach geared to the real world, learner objectives can be more comprehensive. The objectives in Figure 5.2 are designed for a curriculum unit on Human Services, an interdisciplinary approach to a social concern.

Using the text and the recommended reading list, analyze the causes of the Civil War. Criteria of acceptability are the development of an hypothesis and appropriate supportive citations from the literature. (A_2 S_3 S)

Using the list of criminal behaviors presented, generate a system of classifying them, giving a rationale for the classification system. (S B C)

Using the group's newly proposed Congressional organization, evaluate its potential effectiveness by comparing the plan to the criteria the class established. (E B S)

Figure 5.1 Social Studies Unit.

Using observation and personnel interviews in the welfare office, analyze the existing system of provision of services. Acceptability of the system design will be determined on the basis of approval by the designated welfare official. (A_2 B S; A_2 S_3 S)

Note: This objective is a multi-cell activity involving the analysis of behavioral and semantic systems.

In a visit to an inner-city and a suburban food supermarket, prepare an analysis of comparison prices between stores and between large and small items. The prices used must be accurate and the unit pricing and calculations correct. The conclusions must accurately reflect the data. (A_2 S_2 R)

Using a budget based on the average income of the inner-city and suburban residents, generate menus and a shopping list to feed a family of five in each instance. (S S_1 S)

Using the generated menus, analyze them as to percent USRDA and use the computer to evaluate your results. (E S_3 S)

Using the data gathered in the food budget study, write a report for a newspaper or other media. Acceptance of the report for publication is the criterion of achievement. (S S_3 S)

Read Alexis d'Tocqueville's Democracy in America. Compare his observations with American society as it exists today. Document your observations and comparisons. (A S_3 R)

Figure 5.2 Human Services Unit.

The objectives presented are just a few examples of the infusion of creative problem solving, the higher level process skills, into both a traditional and an innovative curriculum. The possibilities are endless. The innovative approach also proposes a curriculum that encompasses those five conceptions of curriculum surveyed by Eisner and Vallance.[1] These objectives stress cognitive process. They further promote self-actualization as they both expand the human cognitive potential and serve to establish relevance and meaning for learners. In the study of a classic piece of writing, the curriculum addresses academic rationalism. As they seek to direct understanding of and solutions to social problems, the curriculum is concerned with social reconstruction. The use of technology is addressed in the form of the computer as a realistic teaching and vocational tool.

The assurance that students can apply all of the process skills of the CSM in all content and product areas can go a long way in meeting the demands for more effective education. This will be true, particularly if the goals of individual development and social benefit are kept in mind as guiding principles in the development of the curricular objectives. These objectives that have been discussed, however, are only the cognitive domain. The affective domain has been purported to play a significant role in creative behavior and creative problem-solving. The attitudes and values held by a person will affect choices of cognitive strategies as well as social and emotional behaviors. The literature is extensive on the affective elements of creative behavior. The following checklist of affective behaviors are documented as having

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[1]Eisner and Vallance, pp. 1-18.

impact. An effective curriculum should seek to nurture and reinforce these attitudes. The student will demonstrate:

1. perseverance in an activity of his choice;
2. a willingness to play with ideas, things, and people;
3. a willingness to defer judgment;
4. a willingness to be assertive;
5. a balance between conformity and non-conformity;
6. a preference for applying creative problem-solving in academic and personal situations;
7. a desire for constructive change;
8. a tolerance for ambiguity;
9. openness to new ideas;
10. problem-sensitivity;
11. risk-taking behavior, willingness to fail;
12. flexibility;
13. tolerance for frustration;
14. ability to relax;
15. acceptance of fantasy as desirable and healthy;
16. tendency to integrate rather than polarize; and
17. self-awareness of emotions.

These objectives are not behavioral, but are attitudinal. Behaviors need to be defined for each and a pattern of consistent behaviors observed to determine a student's progress toward these attitudes which foster creative and self-actualizing behavior.[1]

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[1]There is yet to be significant documented research on the identification of attitudes and values by external behavior patterns. At present it is an assumption that such decisions can be made.

Evaluation

The second component of curriculum, which grows out of the goals and objectives, is evaluation. The objectives themselves are statements of the evaluation criteria. Clear, well-stated objectives provide a firm basis for effective evaluation. There are several reasons for the inclusion of evaluation. Students need to know how they are doing and so do the teachers and curriculum designers. Evaluation should serve as data for decision-making and not for labeling students. For one thing, evaluation of students with grades that they have little or no chance of improving, provides a milieu of fear. The fear and the consequences are real and will usually inhibit creativity. When failure can instead be accepted as a legitimate learning experience, which implies an opportunity to correct the mistakes, then students may be more willing to risk and experiment without fear of retribution.

The same philosophy holds for teachers. It can be hypothesized that one of the reasons teachers are afraid to be innovative is that they may fail and then be hurt professionally. In creative activity there will almost assuredly be failures. The teachers need support and caring, and constructive feedback, as long as they are striving to grow and improve. Too frequently the teacher who is rewarded is the one who sticks to the tried and true, which worked for a time but perhaps has become an anachronism. For the evaluation of the cognitive, affective, and psychomotor elements of a curriculum that nurtures creativity, there are many instruments, some better than

others.[1] There has been much controversy in the literature about many of the instruments. One of the major concerns is that frequently one instrument will be touted as a creativity test when, in fact, it measures only on aspect of creativity.[2] An understanding of the Cognitive Skills Model should help clarify which aspect or aspects are being evaluated. The caution is not to assume a child is creative because he can produce an extensive number of remote associations or can list a number of unusual uses for an object. He may be demonstrating only fluency and deferred judgment.

Evaluation of creativity will depend on intelligent uses of existing instruments, or understanding of creativity as a process influenced by attitudes and the environment, and an ongoing awareness of new developments in the field. It is not yet an easy task and may never be. It certainly is a challenge to which creative thinking can be applied.

Learning Experiences

The learning experiences that need to be provided in a creative environment are many. Since the curriculum addresses cognitive,

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[1] Torrance, "Examples and Rationales of Test Tasks for Assessing Creative Abilities"; Sarnoff A. Mednick, "The Remote Associates Test," Journal of Creative Behavior 2 (1968): 213-214; John C. Flanagan, "Ingenuity Tests," Journal of Creative Behavior 2 (1968): 215-216; and Holland and Baird.

[2] Joy P. Guilford, "Some Misconceptions Regarding Measurement of Creative Talents," Journal of Creative Behavior 5 (1971): 77-87.

affective, and psychomotor objectives, the learning experiences must support all three.

Psychomotor objectives suggest a need for many manipulable materials.[1] In science there will be equipment, tools, and machines that can be handled experimentally. Psychomotor behavior implies opportunities to not only verbalize ideas and attitudes but to operationalize them. Experiences such as drama[2] and sociodrama[3] lend themselves to behavioral expression. Games are another psychomotor means of learning, both board and physically active games.[4] This type of learning experience has been limited to elementary grades far too long. The emphasis should also be on cooperative rather than competitive games. The "New Games" movement is a proponent of fun without destructive competition.[5]

Affective learning experiences involve such activities as values clarification,[6] communication skills, assertiveness training,

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[1]Ralph J. Hallman, "Techniques of Creative Teaching," Journal of Creative Behavior 1 (1967): 325-330.

[2]Bob Eberle, "Does Creative Dramatics Really Square With Research Evidence?" Journal of Creative Behavior 8 (1974): 177-182.

[3]E. Paul Torrance, "Sociodrama as a Creative Problem-Solving Approach to Studying the Future," Journal of Creative Behavior 9 (1975): 182-195.

[4]George I. Brown and Donald Gaynor, "Athletic Action as Creativity," Journal of Creative Behavior 1 (1967): 155-162.

[5]Andrew Fluegelman, ed., The New Games Book (Garden City: N.Y.: Headlands Press, 1976), pp. 7-20.

[6]Louis E. Raths et al., Values and Teaching: Working with Values in the Classroom (Columbus, Ohio: Charles E. Merrill, 1966).

self-analysis exercises,[1] and relaxation techniques. They also include the opportunities for self-directed learning,[2] functioning in a truly democratic environment,[3] stress management, and other activities that promote self-esteem.[4] The availability of specific strategies for these learning activities is extensive and would be too unwieldy to survey here. Most, if not all, of these learning experiences have a creative problem-solving component.

In the area of cognitive learning experiences, the first ones that come to mind are the many already known or available to teachers. Memory techniques, such as mnemonics, and ways to teach problem-solving in math are examples. The way to teach many cognitive skills is to model them and then allow for practice and corrective feedback. This technique is useful for teaching anything from sensory awareness to creative problem-solving, as well as the affective and psychomotor skills.

There are several specific strategies, however, that are not usually used in schools. One important one is to reinforce creative behavior, including humor. Another is to refrain from giving the

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[1]Vaughn E. Huff, "Creativity and Transactional Analysis," Journal of Creative Behavior 12 (1978): 202-208.

[2]Hallman, "Techniques of Creative Teaching," pp. 325-330.

[3]Albert R. Wight, "Participative Education and the Inevitable Revolution," Journal of Creative Behavior 4 (1970): 234-282.

[4]Gordon A. MacLeod, "Does Creativity Lead to Happiness and More Enjoyment of Life?" Journal of Creative Behavior 7 (1973): 227-230; and Leonore W. Dickerman, "Self-Image of Students in a Creativity Course," (abstract) Journal of Creative Behavior 14 (1980): 72.

right answers. Use many questions and problems that have no right answers.[1] Provide for cognitive dissonance, and encourage intellectual debate. Provide for individual and group learning experiences.[2] A major need is to reduce strict time guidelines. Creativity does not occur on schedule. Incubation may take from seconds to years. Also, interruption during the encounter phase can be counterproductive.

Success breeds success. Some assistance can be helpful to learners who don't know where to turn next. Perhaps the most important factor is a teacher who models creative process, not just for the daily lesson, but in daily living, and who recognizes it and reinforces it in students.[3]

It will not be possible to include all of the strategies immediately in most school environments. Each one that is added, however, is an investment in creativity that should accrue interest.

Organization

There is not a large body of information available on scope and sequence of the curriculum for creativity. The Williams Total Creativity Project appears to come the closest to having a comprehensive curricular organization.[4] Treffinger and Huber have developed a

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[1]Melissa Strickland, "I Was a Wrong Answer Kid," Journal of Creative Behavior 8 (1974): 153-156.

[2]Brian P. Holleran and Paula R. Holleran, "Creativity Revisited: A New Role for Group Dynamics," Journal of Creative Behavior 10 (1976): 130-137.

[3]Hallman, "Techniques of Creative Teaching," pp. 325-330.

[4]Cole and Parsons.

hierarchy of learner objectives for creative problem-solving.[1] This design is helpful in planning a course, rather than a whole curriculum.

Since creativity appears to be such an individual matter, it does not seem likely that a certain sequence of coursework can be identified. There are several principles to incorporate in planning. Students need the basic skills of communication and computation. They also need a knowledge base but the nature of that base should rest with their interests. The learner who is creatively and passionately consumed by his interest will assimilate a knowledge base more rapidly, probably branching out to other fields more quickly, than the lock-step student who plods through what to him is uninteresting because he sees no purpose to it.

It is important to assure that learners have the lower level process skills before advancing to the high level skills. As Gagné points out, most learners acquire the perception and cognition skills as young children as well as memory skills.[2] There are, however, some who have difficulty with perception and cognition for one reason or another. Teachers need to assure themselves that they are perceiving adequately before expecting advanced processing. It is possible to increase sensory awareness with attention and practice.[3] Memory can

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[1]Treffinger and Huber.

[2]Gagné, p. 67.

[3]Michael F. Andrews, "Pine Cone: Sensory Awareness Module," Journal of Creative Behavior 11 (1977): 229-232.

be improved by learning some strategies. The schools can help to improve what already exists. In fact, that is what nurturing creativity is about. It is bringing to awareness the process and intentionally practicing the skills that are already latent.

The organization of the curriculum that seems to offer the most promise is the organization of resources in a way that encourages and assists students to use them effectively. As for the sequence of learning objectives, all understanding is built on prior learning. The teacher can designate a logical sequence of objectives in courses such as math, where sequence is significant, but the student should be assisted in developing self-direction as readily as is possible. That means deciding whether or not they need prior knowledge and, if so, when to seek it.

The Diffusion of an Innovation

The development of an effective curriculum will not assure its success, however. There are frequently factors that work to inhibit the implementation of change. To address this challenge, the final question is posed.

Question 7:

What can be done to facilitate the transformation of a curriculum to one which nurtures creativity?

The two major elements involved in the transformation of a curriculum are the knowledge of how to accomplish it and the plan to "sell" the innovation. The first element is the major concern of pre-service and in-service education. The second element is of prime interest to the persons wishing to promote adoption.

In-Service Education

The one most important principle that must be kept uppermost in a discussion of in-service in process skills is that the teachers must first experience learning what they are going to teach and then have an opportunity to practice teaching it.[1] Since most teachers have come through the school systems that neglected process skills, they often lack the very skills they wish to teach their students. Process skills are not readily learned by talking about them. Process implies doing. Until teachers "do," they probably will not understand well enough to teach.

Since creativity is often defined as creative problem-solving, the core of an in-service program to teach creative process skills, could well be the creative problem-solving model. Assuming the teachers have come because they have expressed an interest in changing their curriculum to nurture creativity, they have identified a problem. During the first phase, while teachers are continuing to gather more knowledge about the nature of creativity, they will be practicing the creative problem-solving process. The problem they will work on could be stated: In what ways might I nurture creativity in my students? Or, one of the many subproblems growing out of that statement. The results at the end of that time would be enough information and experience to go home and work individually.

The second phase of the workshop would occur at a later date, allowing for some incubation time as well as individual opportunity to

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[1]Cyril O. Houle, Continuing Learning in the Professions, (San Francisco: Jossey-Bass, 1980), p. 225.

think through the problem and develop some independent ideas. At the second workshop, there would be a renewed effort to develop more extensive and creative solutions, in addition to opportunities to practice teaching the process to others. At the end of phase two, teachers should have enough information to go back and teach the process to students and be ready to implement some curricular revisions.

A third phase is designed for follow-up. This is an opportunity for teachers to bring back their successes, failures, and resulting new problems, and to learn additional strategies for nurturing creativity.

A final recommendation would be for the teachers to consider attendance at the Creative Problem-Solving Institute.[1] The Institute provides an intensive week-long laboratory of experiences and resources of both the material and human kind. There are opportunities to learn to facilitate creative process and many educators with whom ideas and resources can be exchanged. It is almost impossible to duplicate the scope of the opportunities in any other context.

Pre-Service Education

Perhaps the most effective means of transforming the schools into nurturing environments is to impact teacher education. People tend to do better at any process skill the more practice they have. Instead of one, two, or three workshops, a whole teacher education curriculum infused with creative process and attitudes would surely be more effective in bringing creativity to school classrooms.

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[1]Sidney J. Parnes, "CPSI--A Program for Balanced Growth," Journal of Creative Behavior 9 (1975): 23-29.

One course in creativity is better than nothing,[1] but will be viewed as a course rather than as an integral part of all learning. One course may serve to enlighten a few, but the assimilation of creative thinking as a natural part of human functioning is doubtful. If the K-12 curriculum can be infused with strategies for creative behavior, using the CSM and HES models as guidelines, it would seem appropriate to propose that the same process could be used for development of the teacher preparation program. In fact, the question really is: Why not?

Diffusion Process

For change agents who are not limited to one school district, and who wish to identify the places with the best potential in which to invest their efforts, a diffusion process is relevant. On the basis of a summary by Rogers of what is known about the diffusion process, there are a number of steps that can be taken.[2] These steps maximize the probability of one or more educators being willing to transform their curricula into process curricula. The suggestions are not all-inclusive, however, and are based on generalizations, not principles.

In seeking early adopters of the proposed curriculum revision, one guideline is to look for evidence of willingness to change and try

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[1] Mohan.

[2] Everett M. Rogers, Diffusion of Innovations (New York: The Free Press, 1962), pp. 311-314.

new ideas, rather than for evidence of maintenance of tradition. Traditional persons tend to be less innovative. Look at the community, its politics, social and cultural propensities, and laws. Look for indications of adherence to archaic laws, traditional social and cultural events and ultraconservative politics. The social system in which a teacher functions exerts a strong influence.

Once within a system, it is most effective to seek out early adopters. These early adopters are generally the younger ones with higher mental ability and who are viewed and view themselves as nonconformist. Social status and financial status have a positive effect also. Seek the willing persons. The later persons tend to adopt, the more likely they also will discontinue the innovation.

Have patience! The spans between awareness, trial and trial-adoption take time, even for the willing. Also, early adopters like to try innovations on a small scale. Innovations that can be segmented and pieces tried are more likely to be tested as well.

Every effort should be made to make the innovation appear as simple as possible. Innovations that are hard to understand are frequently ignored.

An innovator also needs to see a reason for adopting the innovation. It has to appear to be an improvement over existing programs. The innovation must also interface easily with the remaining programs.

A last point that is worth consideration is that of promotion. Persons need impersonal sources of information early in the process.

Later they need personal attention and assistance. General promotional efforts by change agents are also beneficial.

Community Support

The installation of an innovation is rarely effective without the support of administrators, school boards, and citizens. Although these people will not be directly involved in development, they need to be knowledgable about what is being developed.

Administrators and school boards should be involved in the decision to test and adopt revised curricula. The ultimate accountability is theirs. They also can defend what teachers are doing to questioning parents and citizens, when they are informed and supportive.

Citizens like to feel they have a part in their schools. They are frequently annoyed by what they perceive is happening in the schools, often because they are not knowledgeable about what is going on and why. Change agents who wish to smooth the way for an innovation, particularly one such as creativity that is quite misunderstood, must be cognizant of the needs of people to know and understand what affects them.

Summary

Thus, there are two major questions addressed in this chapter. On one hand, the development of a curriculum that nurtures creativity is discussed. On the other, the procedures that tend to expedite a transformation of the curriculum are examined.

The curriculum was viewed as a set of objectives, learning experiences, organization, and evaluation plans. The Cognitive Skills Model (CSM) and the Human Ecological System Model (HES) were used to illustrate the elements that were a basis for decisions about the four components.

The nature of in-service and pre-service education programs were discussed as they related to the infusion of creativity into curricula. Generalizations about the diffusion process were used to develop plans for influencing educators to consider creating a curriculum that infused creative process throughout.

CHAPTER VI

SUMMARY

Major Findings

The models and exemplars of objectives developed in this presentation are a germinal attempt to provide tools for the infusion of creative thinking in every aspect of educational curricula. They also provide the inspiration for research on numerous questions that they raise.

In a search of literature, it was determined that creativity can be defined adequately for educational purposes. The investigators and scholars generally proposed definitions that related to their own interest areas. Cognitive psychologists, represented by Guilford and Gagné, defined creativity in terms of the cognitive processing that occurs during creative thinking.[1] Humanistic psychologists, including May and Maslow, emphasized the personality and its development.[2] Philosophers, such as Koestler and Huxley, often took a societal perspective.[3] Physiological psychologists, for example, Gazzaniga

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[1]Guilford, Way Beyond the IQ; and Gagné, Conditions of Learning.

[2]May, The Courage to Create; and Maslow, The Farther Reaches of Human Nature.

[3]Koestler; and Aldous Huxley, "Education on the Non-Verbal Level," Daedalus 91 (1962): 279-293.

and Bogen, have studied hemispheric brain activity.[1] Other psychologists with interests in altered states of consciousness, such as Gowan and Krippner, have yet another perspective on creative thinking and behavior.[2]

Essentially, these diverse theorists do not disagree on the important attributes of creativity. Although the dispute over social consequences and value as necessary has not been settled, the process involved seems to be definable with significant support from the scientific community. Since it is relatively well accepted that creative thinking is possible to some degree in almost all persons, and can be encouraged and facilitated by example, practice, and supportive environmental factors, educational implications are obvious. The educational community can develop a curriculum that includes appropriate examples, practice, and environmental factors; that is, schools can nurture creativity.

A second major finding is that creative thinking can be defined not only in words, but described in a model. This model illustrates all of the presently proposed cognitive processing skills as they relate to the various types of stimuli (content) and cognitive organization of information (product). The primary difficulty in this task involved the use of different labels for the same or quite similar concepts, or the subdivision of the concepts of some theorists into smaller units by others.

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[1]Gassaniga; and Joseph E. Bogen, "Some Educational Implications of Hemispheric Specialization," in The Human Brain, ed. M. C. Wittrock (Englewood Cliffs, N.J.: Prentice-Hall, 1977), pp. 133-152.

[2]Gowan, "Some New Thoughts"; and Krippner.

The model is comprehensive in that it includes the spectrum of cognitive skills. The cognitive skills or processes that contribute directly to creativity are the highest level skills, while the effective use of this high level cognitive processing is contingent upon the lower level processes. Creative behaviors may involve any one of the content areas or a synthesis of them. Creativity also may include any one of the product levels.

There is some ambiguity in the consideration of a unit as a product of creative thinking, since creativity is a synthesis of two or more units. The ambiguity that results is based on the question of the definition of a unit. As it is used by Guilford, it appears that a unit may have once been a system that resulted from the synthesis of previous units. Thus, a unit could be the result of creative thinking. An example would be that a letter is a unit, but it is a synthesis of curves and lines; a word is a unit, but a synthesis of letters; and a sentence is a unit, but also a synthesis of words. Whether or not this perspective is correct does not seem to be critical to the purposes of this proposal.

The next major finding is that behavior can be presented descriptively in a model that demonstrates the relationship of cognitive, affective, and psychomotor skills and their action on and reaction to the environment. The model does not purport to be an exhaustive explanation of the numerous dynamics that transpire in creative functioning. This would, first, be highly presumptuous, as much is yet to be understood in regard to the mind's highly sophisticated activities. Second, what is known is also complex enough that a

detailed model likely would confuse more than elucidate. What is presented is a simplified model of human behavior that is adequate to explain the elements of creativity: creative thinking, creative attitude, creative behavior, and creative milieu.

The consequence of these descriptive models is the transformation of the many elements of creative thinking and behavior into a set of objective statements. These statements attempt to describe the external expression of the cognitive processing, as well as the creative attitudes most contributory to creativity. Such statements provide a core of process skills that transcend the various disciplines in the educational environment. These skills are relevant, not only in creative thinking, but in all aspects of cognitive activity. By attending to a systematic teaching of these process skills, eduators should increase the likelihood of creative development in all students.

Implications

The value of the inclusion of all of the known cognitive skills in a curriculum derives from the needs of students to use much more of their mental capabilities than they do. Increased ability to deal with complex problems that have no ready solution is more important today than ever before. Within a society that suffers a greater anxiety from more nebulous causes than perhaps ever before, there is a need for creative ways to see things differently and express them differently, for both self-understanding and societal awareness. Certainly the creation of more self-actualizing people has been seen in recent years as a desirable social goal. Such people are more capable of resisting

pressure of the crowd psychology and the tendency toward conformity that authoritarian leadership often counts on to secure blind adherence to their own political goals.

One of the real values of creative behavior is that it is also highly motivating. When a student creates something he has not just stored pre-digested material, but has reorganized it in a way that has meaning for him. It is well known that the best way to commit something to long-term memory is to link it to previously stored material that has some meaning to the student. To be creative a student must do this. Then the creative outcomes will reinforce his valuing of creativity because they are his own and have meaning for him.

Even more motivating is the learner's self-determination of problems, needs, challenges of most concern to him.[1] When students are challenged by self-determined issues, their response often promotes more creative thinking.

Specified as objectives, statements of the cognitive skills can help a student evaluate his own creativity and determine areas in which he needs practice. For example, a student can discover that he is not very high on the perceptive scale so, assisted by a teacher, he could select sensory awareness activities that increase perceptual abilities. If, on the other hand, he has trouble with memory, he could select activities that develop memory skills. The same is true in all of the areas. In many cases, perhaps all that is needed is practice, with corrective feedback. The abilities may be there, but

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[1]Ron Barnes, Learning Systems for the Future (Bloomington, Ind.: Phi Delta Kappa, 1972), p. 14.

they are dormant from lack of attention. Often a conscious awareness of various types of cognitive activities allows a person to choose those skills for the appropriate situations. Otherwise, as with Jung's personality variables, we tend to choose the familiar, well-practiced approaches to human mental processing.

Teachers also benefit from an increased awareness of creativity. Employing creative activities in the classroom can be just as motivating for the teacher as it is for the students. It is far more exciting to involve students in seeking answers, rather than being the "authority" figure with all of the answers. Being a human encyclopedia is a heavy burden for almost anyone.

The analysis of the cognitive skills and affective components provides guidelines for the teacher, also, in assessing student competence and attitudes. Such information also permits careful planning of activities and materials designed to promote growth of creativity.

Perhaps the most challenging and stimulating implication is that teachers who choose to develop their own creative abilities, in order to instruct and serve as models, will find that using these abilities in their own teaching will make their profession more exciting. Teacher stress and "burnout" are common today. Often boredom is one of the major contributory factors as are frustration and depression. Boredom derives from the day-in, day-out, repetition of instructional plans. Frustration and, subsequently, depression occur when there seems to be no way out, i.e., no solutions to the multitude of problems both curricular and extracurricular, frequently ending in drug abuse.

The professional education literature identifies many problems crying for solutions, mostly creative ones. Educators gain satisfaction from meeting those problems head-on with confidence that solutions are possible. Finally, there is a social value in promoting creativity in schools. When students and teachers discover the intrinsic satisfaction which comes from creative activity, they will have little patience with restrictive environments that do not allow expression of their propensities.

Local educational agencies that promote curricula for creativity will undoubtedly have both supporters and detractors. Early supporters will be those parents who value creativity and the arts, who want the schools to expand their arts program. When the full impact of creativity surfaces, there are often political consequences. Creativity correlates with non-conformity, risk, freedom, and these are frequently feared by the socially motivated patrons. The schools will need to be prepared for this eventuality. Parent education and involvement from the early stages of curricular planning may reduce the misunderstandings and fear that may surface when the curriculum begins to impact on students. There will be less despair in the sciences because parents generally have less personal investment in science outcomes. The development of creative scientific thinkers, however, will promote comparable independence in students, to which many parents will react uncomfortably.

Most assuredly, schools will need to provide in-service for their staff in this area. Pre-service education for teachers is,

with a few significant exceptions, devoid of any preparation in creativity. The best laboratory for teachers is in both their own classrooms and in staff meetings. Modeled creative behavior is best begun at the "top." The key, however, to wider dissemination of creativity as a valid curricular concern is in teacher education. Post-secondary institutions have the researchers who can pursue investigations of the concept of creativity, instructional implications, and societal and institutional impact. There are effective courses and programs in creativity, including the pioneering graduate Creative Studies program at Buffalo State.[1] Many of the gifted education professionals are already including creativity in their curricular plans, but there appear to be only a few organized curricular guidelines to help teachers do so.[2]

The early inclusion of cognitive skills in a teacher preparation curriculum, rather than peripheral elective courses, convey the message that process is central, not just "nice to know." The maxim that process is as important as, if not more so than, content has been bandied about for a long while.[3] Dewey also had something to say in that regard.[4] Few course titles, however, address themselves to

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[1]Sidney J. Parnes and Ruth B. Noller, "Applied Creativity: The Creative Studies Project: Part IV. Personality Findings and Conclusions," Journal of Creative Behavior 7 (1973): 15-36.

[2]Renzulli and Smith.

[3]Cole, "Process Education."

[4]Dewey, p. 84.

process. They appear to be content-oriented. If process is incorporated it is probably seen as secondary to math, art, psychology, etc. It appears to be long overdue that process becomes a significant part of the curriculum.

Implementation

Any attempts at incorporating innovations in schools are fraught with difficuties. It is generally well recognized, after the attempts at institutional revolution in the seventies, that effective change usually occurs in small increments and in stages with only a few willing to be the pioneers.

To accomplish an effective inclusion of these objectives in the educational setting, several factors need to be considered. Any implementation will need to be both an infusion into existing curricula and able to be incorporated into an autonomous classroom. Otherwise, even successful models of these skills in innovative educational settings will be rejected as not relevant.

The implementation of these cognitive skills addressed in the Cognitive Skills Model (CSM) can be effected by taking present curricular objectives and adding the higher level cognitive skills. The model encourages attention to all of the defined categories. These objectives may be in art, math, geography, foreign language, and any other course existing in the curriculum. Creative problem-solving and expression require a synthesis of many skills and will involve the student more fully. Rigid schedules and plans will interfere with effective implementation. Students need to be free enough to

contemplate, experiment, interact, and seek out information as they need it.

An open classroom setting would lend itself more readily to creativity because of the lack of rigid structures and the emphasis on learner interests. That does not mean creativity cannot be taught in the traditional classroom. Nor does it mean creativity will blossom in an open classroom. Other elements come into play, such as modeling, instruction, reinforcement, relevance, and resources.

The main objection that likely will be heard is, there is not enough time to learn all of the basic skills and information needed to survive. High level skills, however, utilize the lower level skills and both are retained more effectively than when the lower level skills are learned in isolation. Higher level thinking is more motivating to the learner. In addition, the time has come when knowledge for its own sake is less important than learning how to obtain knowledge and solve problems--process. Process cannot exist without content, but the nature of the content acquires less significance. Student-generated content interest is also more motivating and is prerequisite to effective creative behavior. The absorption necessary in the encounter phase enhances creative endeavor.

The greatest incentive to transform our schools to creative educational institutions, however, is eloquently expressed in a poem by Cole, based on his own personal experience as a teacher.[1] The

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[1]Henry P. Cole, "Tell Me, Teacher," Journal of Creative Behavior 6 (1972): 204-208.

experience opened his eyes to the tendency of schools to nurture dependency and submissiveness. His poem follows:

Tell Me Teacher

Teacher, teacher, tell me true
Tell me what I ought to do!

Teacher, teacher, where's my book?
Tell me where I ought to look!

Tell me what to feel and how to think!
When to eat and what to drink.

Tell me what is good and what is bad
When I'm happy and when I'm sad.

Tell me, tell me, what to do,
Tell me, tell me, what is true.

Make me learn and make me know.
Watch me closely as I come and go.

For I am small and I am weak,
Without your permission I cannot speak.

I cannot learn except by your decree,
Please, I beg you, give knowledge to me.

I am stupid and you are bright.
I am wrong and you are right.

I am bad and you are good.
I must do what you say I should.

Oh, teacher, teacher, look what you have done!
I don't believe I'm anyone.

Oh, teacher, teacher, can't you see!
Look at what you've done to me!

Recommendations

As Sarnoff and Cole stated, with any problem solution there are almost always a new set of problems generated.[1] So it is with this dissertation. The models presented were created to enable educators to plan and develop curricula that nurture creativity. These "solutions," in turn, generated a number of problems that now need to be addressed.

The first major challenge is to validate the cells of the Cognitive Skills Model (CSM). Guilford performed factorial analyses of his cells of the Structure-of-Intellect (SI) and some of those validations will transfer to the CSM.[2] For example, the MVR (Memory of Visual Relations) of the SI is equivalent to the MSU (Memory of Sensory Relations) of the CSM. Other cells have changed significantly. These cells do need validation.

The translation of the CSM cells into curricular objectives needs to be done in content areas, similar to the examples given in the text and in the appendix. Then some means by which sets of objectives can be organized, perhaps as a spiral curriculum, may be considered.

When the translation of the cells to objectives is accomplised, a test of whether or not educators can take the models and objectives and develop a curriculum plan, using them as guidelines, will be necessary. With the curriculum plan accomplished, the next question will be

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[1]Sarnoff and Cole.

[2]Guilford, Way Beyond the IQ, p. 11.

whether or not it can be operationalized effectively and what consequences are obtained. Studies also will need to be done concerning attitudes of the many persons involved: teachers, students, administrators, and parents.

Upon successful implementation, there will need to be studies done on changes in learner creativity, using a number of validated instruments that measure elements of creativity.

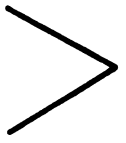
The purpose of this dissertation was to build a usable framework that has the potential of assisting educators in understanding and nurturing creativity. The proposed "solutions" have been examined on the basis of the data of previous investigators and an analysis of that data. The next step, or last step, in the creative process, implementation and testing, is ahead. The possibilities provide challenges for a long time to come.

APPENDIX

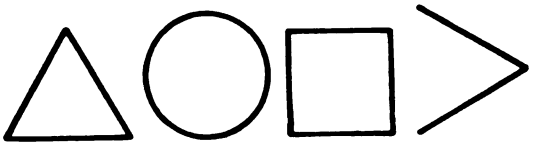
PERCEPTION OF SENSORY UNITS (PS_1U): Given a geometric figure, select the identical figure from a group of figures.

Test Item

Given:



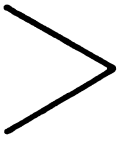
Instruction: Select the identical figure.



COGNITION OF SENSORY UNITS (C_1S_1U): Given a geometric figure and its name and then shown only the figure, name the figure.

Test Item

Given:



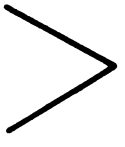
Question: What is this figure?

This is an acute angle, that is less than 90°.

MEMORY OF SENSORY UNITS (MS_1U): Given a previously studied geometric figure, name the figure.

Test Item

Given:

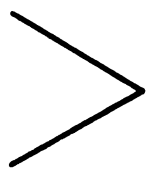


Instruction: Name this figure.

COMPREHENSION OF SENSORY UNITS (C_2S_1U): Given a geometric figure, identify from a selection of figures, the figure of the same name but not identical characteristics (e.g., size, orientation).

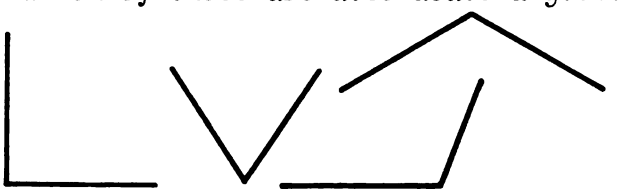
Test Item

Given:



Acute Angle

Question: Which of these are also acute angles?



APPLICATION OF SENSORY UNITS (A_1S_1U): Given a geometric figure, identify an example of its use in design.

Test Item

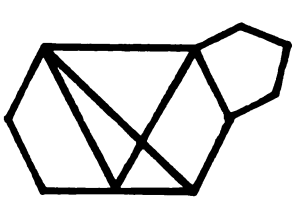
Question: Draw five closed geometric figures that each have at least one acute angle (following directions).

ANALYSIS OF SENSORY UNITS (A_2S_1U): In a given design find the examples of its incorporation into the design.

Test Item

Given:

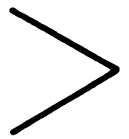
Question: How many acute angles can you find?



SYNTHESIS OF SENSORY UNITS (SS_1U): Design a drawing or structure that incorporates a given geometric figure.

Test Item

Given:



Instruction: *Add lines to make (1) arrow, (2) bird, (3) triangle, (4) science fiction character.*

EVALUATION OF SENSORY UNITS (ES_1U): Given a self-selected geometric figure or figures and selected criteria, evaluate the figure(s) in terms of their meeting the criteria.

Test Item

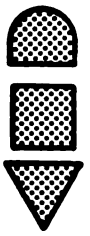
Instruction: *Using the selection of drawings from the synthesis activity, select the best one on the basis of realism, simplicity, and good design criteria.*

SENSORY CLASSES

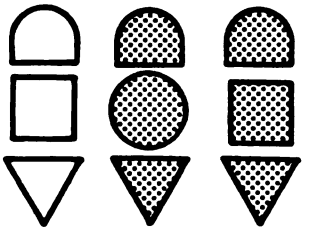
PERCEPTION OF SENSORY CLASSES (PS_1C): Given a set of three figures, select the set of identical figures from several sets.

Test Item

Given:



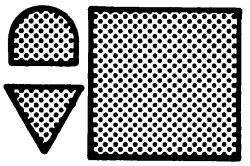
Instruction: Select the identical set of figures.



COGNITION OF SENSORY CLASSES (C_1S_1C): Given a set of figures and a description of their common attributes, restate their common attributes.

Test Item

Given:



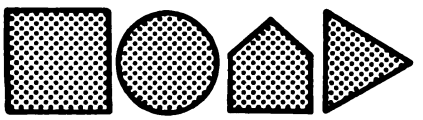
Question: What do they have in common?

These are all shaded figures.

MEMORY OF SENSORY CLASSES (MS_1C): Given a set of previously studied figures, describe the common attribute(s).

Test Item

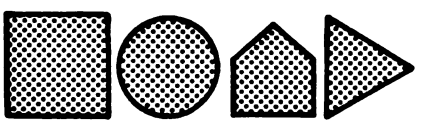
Given: *Question: What do they have in common?*



COMPREHENSION OF SENSORY CLASSES (C_2S_1C): Given a set of previously studied figures and another group of varied figures, select from the second group those that belong in the first set.

Test Item

Given: *Match:* *1.* 



2. 

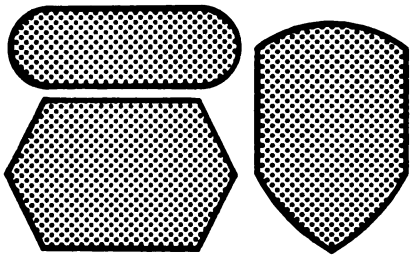
3.

4. 

APPLICATION OF SENSORY CLASSES (A_1S_1C): Given a set of figures, draw several other figures that belong to that set.

Test Item

Given:

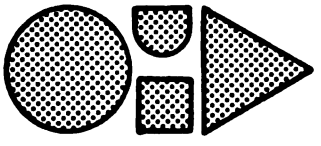


Instruction: Complete it to make it match.

ANALYSIS OF SENSORY CLASSES (A_2S_1C): Given a set of novel figures not previously studied, analyze them for their common attributes.

Test Item

Given:



Match:

1. 

2. 

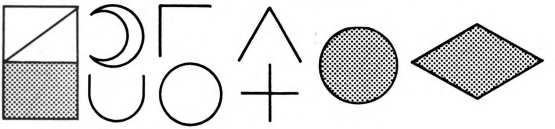
3. 

4. 

SYNTHESIS OF SENSORY CLASSES (SS_1C): Given a selection of figures develop a classification system to include all.

Test Item

Given: *Instruction: Classify, developing your own system.*



(Possible responses: Curved lines, intersecting lines, straight lines only, shaded, unshaded, internally divided, open and closed, etc.)

EVALUATION OF SENSORY CLASSES (ES_1C): Given a self-generated system of classification and selected criteria, evaluate the sets in terms of their meeting the criteria.

Test Item

Instruction: Given the figures in the classification exercise, all figures must be included in one and only one group.

Example:

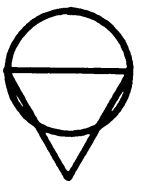
Acceptable response:	*Unacceptable response:*
Open figures	*Open figures*
Unshaded figures	*Curved figures*
Shaded figures	*Straight lines only*
Internally divided figures	

SENSORY RELATIONS

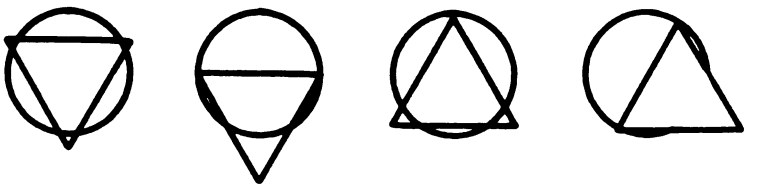
PERCEPTION OF SENSORY RELATIONS (PS_1R): Given a pair of related figures, select, from several pairs, the same pair.

Test Item

Given:



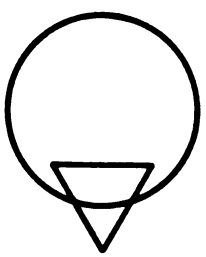
Instruction: Select the identical figure.



COGNITION OF SENSORY RELATIONS (C_1S_1R): Given a pair of related figures and a description of their relationship, and then shown the figure only, describe the relationship.

Test Item

Given:



Instruction: Describe the relationship between these two figures.

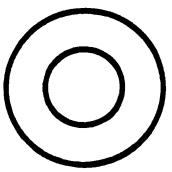
This is a circle of 1" diameter with an equilateral triangle extending through the circle, one angle external and two internal to the circumference. The circle bisects two sides, which are ½" in length.

MEMORY OF SENSORY RELATIONS (MS_1R): Given a pair of previously studied related figures, describe the relationship.

Test Item

Given:

Instruction: Describe the relationship between these two figures.

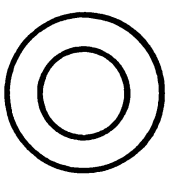


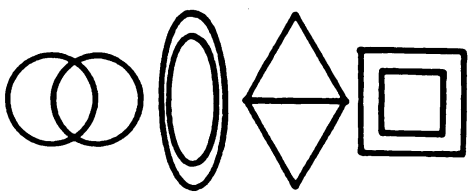
COMPREHENSION OF SENSORY RELATIONS (C_2S_1R): Given a pair of related figures and several other pairs, select the pair that has the same relationship.

Test Item

Given:

Question: Which has the same relationship?



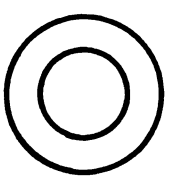


APPLICATION OF SENSORY RELATIONS (A_1S_1R): Given a pair of previously studied related figures, describe a real world relationship that is comparable.

Test Item

Given:

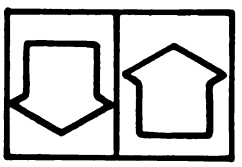
Question: What relationship might this represent.

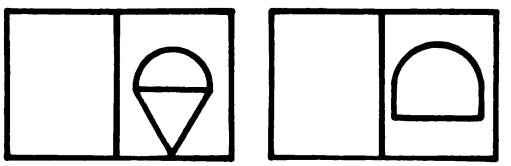


ANALYSIS OF SENSORY RELATIONS (A_2S_1R): Given a pair of not previously studied related figures, analyze the relationship.

Test Item

Given: *Complete:*





SYNTHESIS OF SENSORY RELATIONS (SS_1R): Design several pairs of figures that are related in some way.

Test Item

Instruction: *Combine a rectangle and a triangle in a geometric design that demonstrates these relationships:*

1. *Internal/external*
2. *Higher/lower*
3. *Equality*

EVALUATION OF SENSORY RELATIONS (ES_1R): Given alternative responses and selected criteria, identify the preferred response based on the criteria.

Test Item

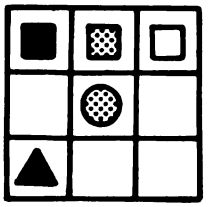
Instruction: *In the synthesis exercise, describe your way of representing each of the dimensions (e.g., equality = equal area).*

SENSORY SYSTEMS

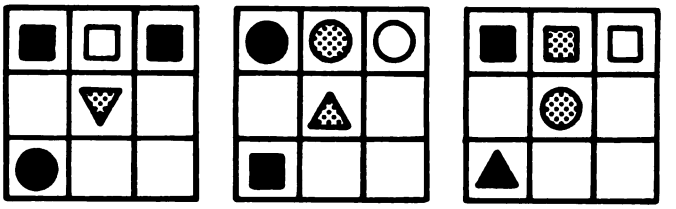
PERCEPTION OF SENSORY SYSTEMS (PS_1S): Given a group of three or more interrelated figures, select from several groups of figures, the identical group.

Test Item

Given:



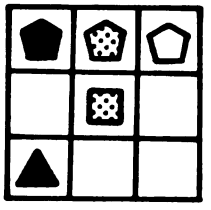
Instruction: Select the identical figures.



COGNITION OF SENSORY SYSTEMS (C_1S_1S): Given a group of three or more interrelated figures, and a description of their relationships, and then shown only the group of figures, describe the relationships.

Test Item

Given:



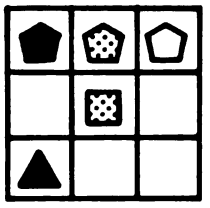
Instruction: Describe the relationships between each of the columns and rows.

1. *The first row contains five-sided figures,*
2. *The second row squares, and*
3. *The third row triangles.*
4. *The first column contains solid figures,*
5. *The second column shaded, and*
6. *The third column clear.*

MEMORY OF SENSORY SYSTEMS (MS_1S): Given a group of previously studied, interrelated figures, describe the relationship.

Test Item

Given:

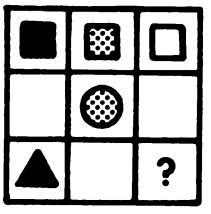


Instruction: Describe the relationship between each of the columns and rows.

COMPREHENSION OF SENSORY SYSTEMS (C_2S_1S): Given a group of interrelated figures and several other groups, select the group that illustrates the same relationships.

Test Item

Given:

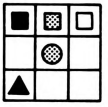


Question: What figure replaces "?"?

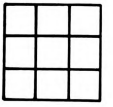
APPLICATION OF SENSORY SYSTEMS ($A_1S_1S_1$): Given a group of interrelated figures, design some different way of illustrating the same relationships.

Test Item

Given:



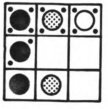
Instruction: Design a figure with the same interrelationship using different figures.



ANALYSIS OF SENSORY SYSTEMS (A_2S_1S): Given a novel group of interrelated figures not previously studied, analyze the relationships.

Test Item

Given:

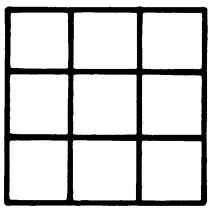


Instruction: Analyze the relationships between the columns and rows and complete the figures.

SYNTHESIS OF SENSORY SYSTEMS (SS_1S): Given a selection of figures, generate a system of relationships among them.

Test Item

Given:



Instruction: *Design a figure using several interrelationships.*

EVALUATION OF SENSORY SYSTEM (ES_1S): Given alternative responses at any of the previous levels, identify the preferred response and state the internal/external criteria used to make that selection.

Test Item

Instructions: *Using several designed figures, compare your criteria with each and choose the one that best meets the criteria.*

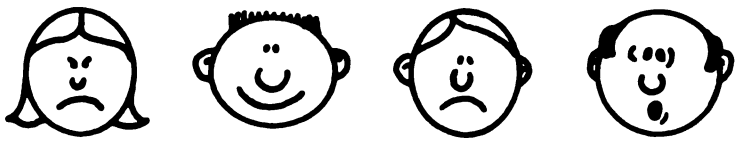
BEHAVIORAL UNITS

PERCEPTION OF BEHAVIORAL UNITS (PBU): Given a picture of a facial expression, select the identical picture from a group of pictures.

Test Item

Given:

Question: Which expression is identical?



COGNITION OF BEHAVIORAL UNITS (C_1BU): Given a picture of a facial expression and a description of the state of mind to examine and then given only the identical picture, recall the state of mind.

Test Item

Given:

Instruction: Describe what this person is doing and feeling.

The person is frowning and upset.

MEMORY OF BEHAVIORAL UNITS (MBU): Given a previously studied picture of a state of mind, describe the state of mind.

Test Item

Given:

Instruction: Describe what this person is doing and feeling.

COMPREHENSION OF BEHAVIORAL UNITS (C_2BU): Given a picture of a facial expression, identify, from a selection of pictures, the one that represents the same state of mind.

Test Item

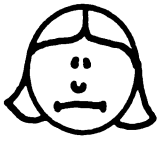
Given:

Question: Which person feels the same way?

APPLICATION OF BEHAVIORAL UNITS (A_1BU): Given a behavioral expression, describe a probable situation which might stimulate that response.

Test Item

Given:



Question: *What would be most likely to have caused this reaction?*

a. Fell off a bike

b. Got a raise

c. Got an F on a history paper

ANALYSIS OF BEHAVIORAL UNITS (A_2BU): Given a behavioral expression, analyze the thoughts and feelings behind the expression.

Test Item

Given:

Question: *What is this person feeling and why do you think so?*

SYNTHESIS OF BEHAVIORAL UNITS (SBU): Given a behavioral expression, generate a sentence or sentences the person might speak simultaneously.

Test Item

Instruction: *Role play a way to demonstrate anxiety with several different behaviors.*

EVALUATION OF BEHAVIORAL UNITS (EBU): Given alternative responses at any of the previous levels, identify the preferred response and state the internal/external criteria used to make that selection.

Test Item

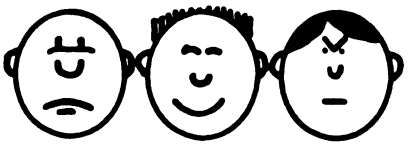
Instruction: Compare the role plays with selected criteria to determine if it was effective in communicating anxiety.

BEHAVIORAL CLASSES

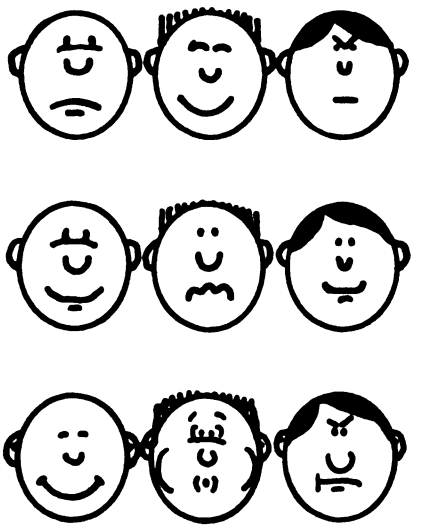
PERCEPTION OF BEHAVIORAL CLASSES (PBC): Given 3 pictures of facial expressions, select the set of pictures, from several sets, that is identical.

Test Item

Given:



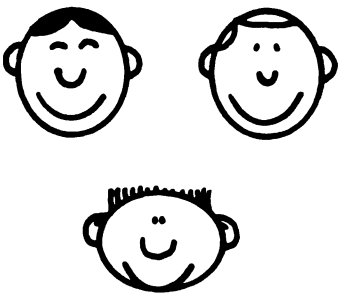
Instruction: Select the identical set.



COGNITION OF BEHAVIORAL CLASSES (C_1BC): Given 3 pictures of facial expressions and a description of the state of mind they all represent and then given the identical set, recall the state of mind.

Test Item

Given:



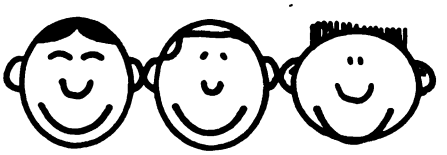
Question: What common feelings do their faces express?

These faces all express happiness.

MEMORY OF BEHAVIORAL CLASSES (MBC): Given a group of previously studied pictures, describe the state of mind they share.

Test Item

Given:



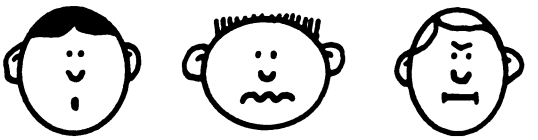
Question: What common feelings do these faces express?

COMPREHENSION OF BEHAVIORAL CLASSES (C_2BC): Given a set of pictures exemplifying a state of mind and several pictures to choose from, select the one which belongs to the set of three.

Test Item

Given:

Question: Which of these faces is also expressing a similar feeling?



APPLICATION OF BEHAVIORAL CLASSES (A_1BC): Given a group of pictures that exemplify a state of mind, describe a probable situation that might stimulate those responses.

Test Item

Given:

Question: These people would be watching:

a. a losing basketball team?

b. a circus?

c. a flood?

ANALYSIS OF BEHAVIORAL CLASSES (A_2BC): Given a group of pictures that exemplify a state of mind, analyze the thoughts and feelings that are common attributes.

Test Item

Given:

Question: What might these women be feeling and thinking?

SYNTHESIS OF BEHAVIORAL CLASSES (SBC): Given a verbal description of an experience of feelings, pantomime the feelings using several different parts of the body.

Test Item

Given:

You have just learned that you won $100,000 in the sweepstakes.

Instruction: Pantomime your reaction.

EVALUATION OF BEHAVIORAL CLASSES (EBC): Given alternative responses at any one of the previous levels, identify the preferred response and state the internal/external criteria used to make that selection.

Test Item

Given:

Your non-verbal role plays of winning the sweepstakes.

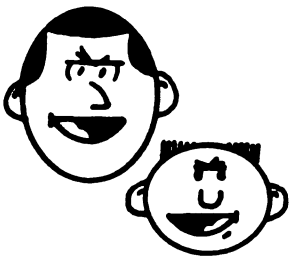
Question: Which one seems to best express the feelings of amazement and disbelief.

BEHAVIORAL RELATIONS

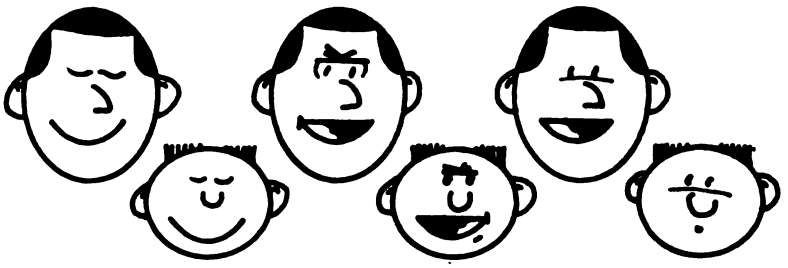
PERCEPTION OF BEHAVIORAL RELATIONS (PBR): Given two pictures of related expressions, select the pair of pictures, from several pairs, that is identical.

Test Item

Given:



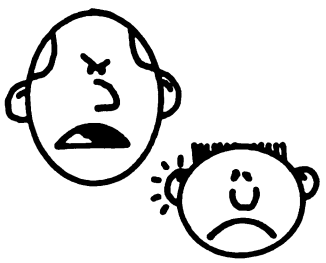
Question: Which is identical to the first pair?



COGNITION OF BEHAVIORAL RELATIONS (C_1BR): Given two persons with related expressions and a description of their emotional relationships, and then the identical pair, recall (state) their emotional relationship.

Test Item

Given:



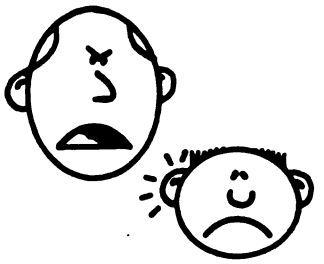
This father is angry at his child. The child is feeling physical and mental pain.

Question: What is the emotional relationship between these two persons?

MEMORY OF BEHAVIORAL RELATIONS (MBR): Given two previously studied pictures of related expressions, recall their emotional relationship.

Test Item

Given:

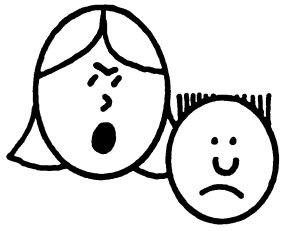


Question: What is the emotional relationship between these two persons?

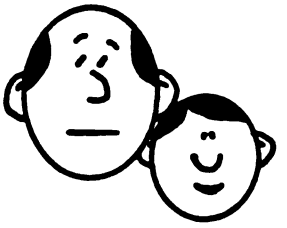
COMPREHENSION OF BEHAVIORAL RELATIONS (C_2BR): Given two pictures of related expressions, select from several pairs, the pair that represents the same relationship.

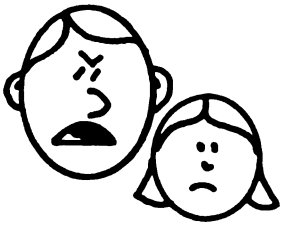
Test Item

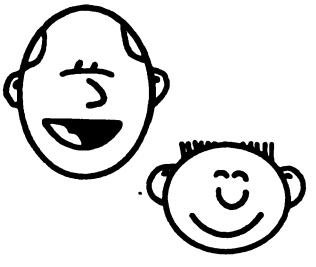
Given:



Question: In which of these pairs is the relationship similar?



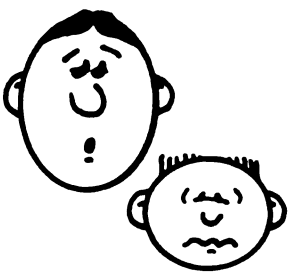




APPLICATION OF BEHAVIORAL RELATIONS (A_1BR): Given two pictures of related expressions, select the statement that best describes the probable situation.

Test Item

Given:



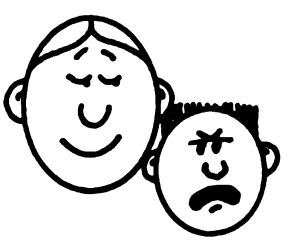
Question: Which situation most likely exists here?

1. *One person is responding to another's needs.*
2. *One person is admonishing another for wrongdoing.*
3. *One person is irritated at being bothered.*

ANALYSIS OF BEHAVIORAL RELATIONS (A_2BR): Given two pictures of related expressions not previously analyzed, analyze the relationship.

Test Item

Given:



Instruction: Describe the relationship and the behavioral cues that suggest the relationship.

SYNTHESIS OF BEHAVIORAL RELATIONS (SBR): Given a paragraph, descriptive of a behavioral interaction, role play non-verbally the interaction.

Test Item

Given:	*Instruction:*
Two people are embroiled in an argument over who is responsible for a poor decision.	*Role play, non-verbally, the relationship between the two people.*

EVALUATION OF BEHAVIORAL RELATIONS (EBR): Given alternative responses at any of the previous levels, identify the preferred response and state the internal/external criteria used to make the selection.

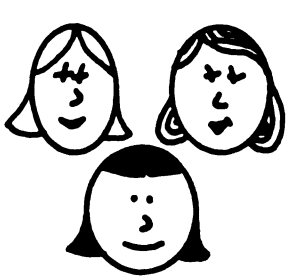
Test Item

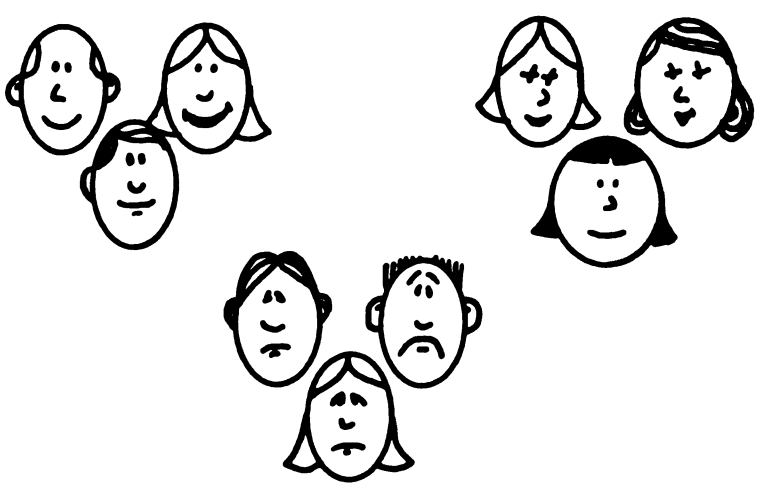
Given:	*Instruction:*
Several people who role-played the previous situation in different ways.	*Select the role-play that best demonstrates domination on the part of one and timidity on the part of the other.*

PERCEPTION OF BEHAVIORAL SYSTEMS (PBS): Given a series of related pictures of behavioral expression, select from several series, the identical series.

Test Item

Given: *Question: Which set is identical to the first?*





COGNITION OF BEHAVIORAL SYSTEMS (C_1BS): Given a series of related pictures of behavioral expressions and a description of the relationships and then given the identical series, describe the relationships.

Test Item

Given:

The men are listening to one of their colleagues as he presents them with some information.

Question: How are these men relating to one another?

MEMORY OF BEHAVIORAL SYSTEMS (MBS): Given the previously studied series of related pictures of behavioral expressions, describe the relationships.

Test Item

Given:

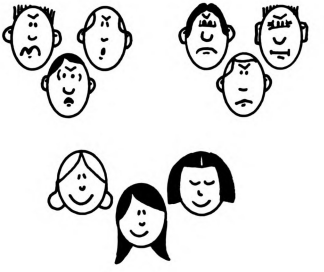
Question: How are these men relating to one another?

COMPREHENSION OF BEHAVIORAL SYSTEMS (C_2BS): Given a series of related pictures of behavioral expressions, select from several series the one that exemplifies the same relationship.

Test Item

Given:

Question: Which group of people is relating to each other the same way as in the first?



APPLICATION OF BEHAVIORAL SYSTEMS (A_1BS): Given a series of related pictures of behavioral expression, select the situation in which they would most likely occur.

Test Item

Given:

Question: Under what circumstances would this most likely occur?

1. *At a funeral.*
2. *At a business meeting.*
3. *At the boss's house.*

ANALYSIS OF BEHAVIORAL SYSTEMS (A_2BS): Given a series of related pictures of behavioral expressions, not previously analyzed, analyze the relationship.

Test Item

Given:

Instruction:

Analyze the relationship between each of these people and the present state of their interaction.

SYNTHESIS OF BEHAVIORAL SYSTEMS (SBS): Given a series of related pictures of behavioral expressions, generate a role play that would predict the outcome.

Test Item

Given:

Instruction:

Role play the possible outcome of these relationships.

EVALUATION OF BEHAVIORAL SYSTEMS (EBS): Given alternative responses at any of the previous levels, identify the preferred response and state the internal/external criteria used to make the selection.

Test Item

Given:	*Instruction:*
Several possible role-played outcomes to the previous situation.	*Select the one that has the highest probability of occurring on the basis of what you know about human nature.*

SYMBOLIC UNITS

PERCEPTION OF SYMBOLIC UNITS (PS_2U): Given a symbol, select the identical symbol from a group of symbols.

Test Item

Given: *Instruction: Select the identical symbol.*

3x *3y* *4x* *xy* *3x*

COGNITION OF SYMBOLIC UNITS (C_1S_2U): Given a symbol and its name and then given only the symbol, state the name.

Test Item

Given: *Question: What does this symbol mean?*

3x

This symbol means that there are 3x's and each x stands for any designated variable.

MEMORY OF SYMBOLIC UNITS (MS_2U): Given a symbol previously studied, state its name.

Test Item

Given:

3x

Question: What does this symbol mean?

COMPREHENSION OF SYMBOLIC UNITS (C_2S_2U): Given a symbol, select from a list of statements its meaning.

Test Item

Given:

3x

Question: What is its value if:

x = 4?

x = 2?

x = 6?

APPLICATION OF SYMBOLIC UNITS (A_1S_2U): Given a symbol, describe a situation in which it would be used.

Test Item

Given:

3x + 4 =

x = 2

Instruction: Find the correct answer.

ANALYSIS OF SYMBOLIC UNITS (A_2S_2U): Given a novel symbol in context, describe what it means.

Test Item

Given:	*Instruction:*
$3x + 5 + 4x - 7 = 12$	*Find the value of* x.

SYNTHESIS OF SYMBOLIC UNITS (SS_2U): Generate a novel symbol to represent a communication.

Test Item

Instruction: *Write an equation that will demonstrate that* $3x = 6$.

EVALUATION OF SYMBOLIC UNITS (ES_2U): Given several alternative symbolizations, select the preferred one on the basis of external/internal criteria.

Test Item

Given:	*Instruction:*
Several alternative equations.	*Check the correctness of the equation by substitution.*

SYMBOLIC CLASSES

PERCEPTION OF SYMBOLIC CLASSES (PS_2C): Given a set of symbols with common attributes, from several sets, select the identical set.

Test Item

Given:

4a 3y 6t

Question: Which set is identical?

1. 4y 3t 6a

2. 4a 3t 6y

3. 4a 3y 6t

COGNITION OF SYMBOLIC CLASSES (C_1S_2C): Given a set of symbols with common attributes and a description of those attributes, then shown only the symbols, describe the attributes.

Test Item

Given:

4a 3y 6t

Question: What do these have in common?

These three symbols are made up of one constant and one variable factor.

MEMORY OF SYMBOLIC CLASSES (MS_2C): Given a set of previously studied symbols with common attributes, describe the attributes.

Test Item

Given:

4a 3y 6t

Question: What do these symbols have in common?

COMPREHENSION OF SYMBOLIC CLASSES (C_2S_2C): Given a set of symbols with common attributes and several other novel symbols, identify those that belong in the set.

Test Item

Given:

$4a \quad 3y \quad 6t$

Question: Which of these symbols belongs with the others?

$\frac{7}{t} \quad xy \quad 2-z \quad 8a^2 \quad 10m$

APPLICATION OF SYMBOLIC CLASSES (A_1S_2C): Given a set of symbols, describe a situation in which they might be used as a set.

Test Item

Given:

A car drives four times as fast as a Moped, goes three times as far using 6 times as much gas.

Instruction:

Write symbols for these unknowns.

ANALYSIS OF SYMBOLIC CLASSES (A_2S_2C): Given a set of symbols not previously studied, analyze and describe their common characteristics.

Test Item

Given:

$2x + y \quad T+3W \quad 7a + 6$

Instruction:

Analyze these symbols for common attributes.

SYNTHESIS OF SYMBOLIC CLASSES (SS_2C): Get a selection of symbols, develop a classification system for them.

Test Item

Given:

$3+x \quad 8-y \quad 7+6$

$7T \quad 6/m \quad c-y$

$6+2y \quad 12 \div Z \quad n^2$

Instruction:

Cluster these equations into sets of your choice.

EVALUATION OF SYMBOLIC CLASSES (ES_2C): Given alternative responses at any of the previous levels, identify the preferred response and state the internal/external criteria used to make that selection.

Test Item

Given:

The alternative responses in the synthesis exercise.

Instruction:

Define the criteria you used for deciding which sets were preferable in the synthesis exercise.

PERCEPTION OF SYMBOLIC RELATIONS (PS_2R): Given a pair of related symbols, select an identical pair from several pairs.

Test Item

Given:

$4x - 2y = 10$

Instruction: *Select the identical statement.*

$4y - 2x = 10$

$2x - 4y = 10$

$4x + 2y = 10$

$4x - 2y = 10$

COGNITION OF SYMBOLIC RELATIONS (C_1S_2R): Given a pair of related symbols and a description of their relationship and then shown only the pair of symbols, describe their relationship.

Test Item

Given:

$4x - 2y = 10$

This means 4 x's minus 2 y's are equal to 10.

Question: What does the formula mean?

MEMORY OF SYMBOLIC RELATIONS (MS_2R): Given a previously studied pair of related symbols, describe their relationship.

Test Item

Given:

$4x = 2y = 10.$

Question: What does this formula mean?

COMPREHENSION OF SYMBOLIC RELATIONS (C_2S_2R): Given a pair of related symbols and several other novel related pairs, identify the pair that has the same relationship as the first pair.

Test Item

Given:

$4x - 2y = 10$

$x = 36.$

Question: What does y = ?

APPLICATION OF SYMBOLIC RELATIONS (A_1S_2R): Given a pair of related symbols, describe a situation in which they might be used as a related pair.

Test Item

Given:

A rectangular field is four times the length of the barn (x) and two times the width (y). The difference in the length and width is 10 yards. The barn is 36 yards long.

Question: What is the width of the barn?

ANALYSIS OF SYMBOLIC RELATIONS (A_2S_2R): Given a pair of related symbols not previously studied, in context, analyze the relationship.

Test Item

Given:

$4x - 2y = 10$

Instruction:

Transform the equation to demonstrate x - and y = .

SYNTHESIS OF SYMBOLIC RELATIONS (SS_2R): Design a pair of novel symbols to illustrate a relationship.

Test Item

Given:

$4x - 2y = 10$

Instruction:

Write a description (story problem) of a situation that this statement might represent.

EVALUATION OF SYMBOLIC RELATIONS (ES_2R): Given alternative responses at any one of the previous levels, identify the preferred response and state the internal/external criteria used to make that selection.

Test Item

Question: *Given the story problems developed in the synthesis exercise, determine selection criteria and choose the preferred problem on that basis.*

PERCEPTION OF SYMBOLIC SYSTEMS (PS_2S): Given a group of three or more interrelated symbols, select, from several groups, the identical group.

Test Item

Given:

$4a^2 + 3ab - b^2 = 25$

Instruction:

Select the identical statement.

1. $4a^2 - 3ab - b^2 = 25$
2. $4a + 3ab - b = 25$
3. $4a^2 + 3ab^2 - b^2 = 25$
4. $4a^2 + 3ab - b^2 = 25$

COGNITION OF SYMBOLIC SYSTEMS (C_1S_2S): Given a group of three or more interrelated symbols, and a description of the relationships and then shown only the group of symbols, describe the relationships.

Test Item

Given:

$$\frac{4a^2 + 3ab}{C} = 25$$

This is an equation with three unknowns that, when the correct numbers are substituted for a, b, and C, will equal 25.

Instruction:

Describe the equation.
Explain the relationship.

MEMORY OF SYMBOLIC SYSTEMS (MS_2S): Given a group of previously studied interrelated symbols, describe the relationships.

Test Item

Given:

$$\frac{4a + 3b}{C} = 25$$

Instruction:

Explain the equation.

COMPREHENSION OF SYMBOLIC SYSTEMS (C_2S_2S): Given a group of interrelated symbols and several other novel groups, select the group that illustrates the same relationship.

Test Item

Given:

$$\frac{4a + 3b}{C} = 25$$

$a = 15$
$b = 30$

Question: What does C = ?

APPLICATION OF SYMBOLIC SYSTEMS (A_1S_2C): Given a group of interrelated symbols, demonstrate the use of the group.

Test Item

Given:

A back yard is four times the area of the garden plot and three times the area of the garage. The garden is 15 sq. ft. The garage is 30 sq. ft. The family has enough children to divide up the mowing into 25 sq. ft. sections.

Question: *How many children are there in this family?*

ANALYSIS OF SYMBOLIC SYSTEMS (A_2S_2S): Given a novel group of interrelated symbols, analyze the relationships.

Test Item

Given:

$\frac{4a + 3b}{C} = 25$

Instruction: *Find the values of* $a =$; $b =$; *and* $C =$.

SYNTHESIS OF SYMBOLIC SYSTEMS (SS_2S): Given a variety of symbols, develop a novel system of the symbols.

Test Item

Given:

$\frac{4a + 3b}{C} = 25$

Instruction:

Generate a description (story problem) that this statement might represent.

EVALUATION OF SYMBOLIC SYSTEMS (ES_2S): Given alternative responses at any of the previous levels, identify the preferred response and state the internal/external criteria used to make the selection.

Test Item

Instruction: Insert the values designated for the variables in the formula and calculate to determine correctness of problem.

SEMANTIC UNITS

PERCEPTION OF SEMANTIC UNITS (PS_3U): Given a word, select the identical word from a group of words.

Test Item

Given:

there

Instruction: Select the identical word.

1. *where*
2. *then*
3. *there*
4. *their*

COGNITION OF SEMANTIC UNITS (C_1S_3U): Given a word and its meaning, then given only the word, restate its meaning.

Test Item

Given:

there

Over in that place

Instruction:

Repeat the meaning of the word.

MEMORY OF SEMANTIC UNITS (MS_3U): Given a previously studied word, restate its meaning.

Test Item

Given: *there*

Instruction: *State the meaning of the word.*

COMPREHENSION OF SEMANTIC UNITS (C_2S_3U): Given a word, state its meaning in your own words.

Test Item

Given: *there*

Instruction: *State the meaning in your own words or act it out.*

APPLICATION OF SEMANTIC UNITS (A_1S_3U): Given a word and three sentences, select the sentence in which it belongs.

Test Item

Given: *there*

Instruction: *Identify the sentence in which the word belongs.*

1. _____ *going to a party.*
2. *He went to a party* _____.
3. *He went to* _____ *party.*

ANALYSIS OF SEMANTIC UNITS (A_2S_3U): Given a novel word in context, analyze its meaning.

Test Item

Given:

With his fists up and a scowl on his face he looked very pugilistic.

Instruction:

Write a definition of the underlined word.

SYNTHESIS OF SEMANTIC UNITS (SS_3U): Given an incomplete sentence, select a word that effectively completes the sentence.

Test Item

Given:

The sisters felt _____ as a result of the hurt they caused each other.

Instruction:

Select a word to complete the sentence.

EVALUATION OF SEMANTIC UNITS (ES_3U): Given several alternative words, select the preferred word on the basis of internal/external criteria.

Test Item

Given:

Four or five words possible in stated sentence.

Question: Which is the preferred word and why?

PERCEPTION OF SEMANTIC CLASSES (PS_3C): Given a set of words, select the identical set from several alternatives.

Test Item

Given:

knew

new

gnu

Instruction: *Select the identical set.*

1. *know now grow*
2. *knew new gnu*
3. *knee nee gun*

COGNITION OF SEMANTIC CLASSES (C_1S_3C): Given a set of words and their common attributes, then shown only the set, restate the common attributes.

Test Item

Given:

knew

new

gnu

These words are all pronounced nū.

Instruction:

Restate what these words have in common.

MEMORY OF SEMANTIC CLASSES (MS_3C): Given a set of previously studied words, relate their common attributes.

Test Item

Given:

knew

new

gnu

Instruction:

State what these words have in common.

COMPREHENSION OF SEMANTIC CLASSES (C_2S_3C): Given a set of words, and several other words, select those that belong in the set.

Test Item

Given:

hen

duck

goose

Instruction:

Select which of the following words belong to the group.

1. cat 2. cow 3. turkey

EVALUATION OF SEMANTIC CLASSES (ES_3C): Given a set of words you have classified, state the criteria by which you determined the set.

Test Item

Given:

Set of words from a synthesis exercise.

Instruction:

State the criteria by which you developed the sets.

SEMANTIC RELATIONS

PERCEPTION OF SEMANTIC RELATIONS (PS_3R): Given two related words, select the identical pair from several pairs.

Test Item

Given:

justice

discrimination

Instruction:

Select the identical words.

1. justice discrimination

2. judicial domination

3. judiciary determination

COGNITION OF SEMANTIC RELATIONS (C_1S_3R): Given two related words and a description of the relationship between them, and then shown only the words, restate the relationship.

Test Item

Given:	*Instruction:*
justice-discrimination *These words have opposite meanings.*	*Restate the relationship.*

APPLICATION OF SEMANTIC CLASSES (P_1S_3C): Given a situation involving a class of words, describe the words that would be included in that set.

Test Item

Given:	*Instruction:*
A disease has struck the barnyard that affects only birds.	*Name the barnyard animals that might get sick with that disease.*

ANALYSIS OF SEMANTIC CLASSES (A_2S_3C): Given a set of words not previously studied, analyze their common attributes.

Test Item

Given:	*Instruction:*
delta *tributary* *rapids* *falls*	*Describe the common attributes.*

SYNTHESIS OF SEMANTIC CLASSES (SS_3C): Develop lists of words with common attributes that can be used interchangeably.

Test Item

Given:

A selection of words

Instruction:

Organize these words into sets with common attributes.

MEMORY OF SEMANTIC RELATIONS (MS_3R): Given two previously studied related words, restate the relationship between them.

Test Item

Given:

justice-discrimination

Instruction:

State the relationship.

COMPREHENSION OF SEMANTIC RELATIONS (C_2S_3R): Given two related words, select another pair of related words, symbols, or behaviors, which illustrate the same relationship.

Test Item

Given:

justice-discrimination

Question: Which pair are most similar?

1. *honesty-fairness*
2. *happy-sad*
3. *race-sex*

APPLICATION OF SEMANTIC RELATIONS (A_1S_3R): Given a sentence which includes two related words, use them appropriately in the sentence.

Test Item

Given:	*Instruction: Fill in the blanks.*
justice-discrimination	*In a country where the emphasis is on _____ for all, there is still a significant amount of _____.*

ANALYSIS OF SEMANTIC RELATIONS (A_2S_3R): Given two words with a relationship not previously studied, analyze the relationship.

Test Item

Given:	*Instruction:*
cognitive-affective	*Define the relationship.*

SYNTHESIS OF SEMANTIC RELATIONS (SS_3R): Generate a list of novel word relationships.

Test Item

Given:	*Instruction:*
star	*List many possible ways in which the two words could be related (forced associations).*
wastebasket	

EVALUATION OF SEMANTIC RELATIONS (ES_3R): Given a list of word relationships, select the best one by the criteria chosen.

Test Item

Given:

The list of brainstormed ideas.

Instruction:

Select the best relationship (association) on the basis of its marketability.

SEMANTIC SYSTEMS

PERCEPTION OF SEMANTIC SYSTEMS (PS_3S): Given three or more interrelated words, select, from several groups, the identical group of words.

Test Item

Given:

The cow jumped over the moon.

Instruction: Select the identical sentence.

1. *The car journeyed over the map.*
2. *The cow jumped over the moon.*
3. *The moon jumped over the cow.*

COGNITION OF SEMANTIC SYSTEMS (C_1S_3S): Given three or more interrelated words and a description of their relationship, restate the description.

Test Item

Given:

The cow jumped over the moon.

Demonstrated with toy figures.

Instruction:

Using the toy cow and the ball as a moon, show what happened.

MEMORY OF SEMANTIC SYSTEMS (MS_3S): Given three or more previously studied words, restate the relationships (diagram).

Test Item

Given:	*Instruction:*
The cow jumped over the moon.	*Explain or diagram.*

COMPREHENSION OF SEMANTIC SYSTEMS (C_1S_3S): Given three or more interrelated words, state their relationships in your own words.

Test Item

Given:	*Instruction:*
The cow jumped over the moon.	*Restate in your own words.*

APPLICATION OF SEMANTIC SYSTEMS (A_1S_3S): Given a selection of interrelated words with several incorrectly placed, reorganize the sentence according to the rules.

Test Item

Given:	*Instruction:*
The moon the cow jumped over.	*Reorganize correctly.*

ANALYSIS OF SEMANTIC SYSTEMS (A_2S_3S): Given a novel group of interrelated words, analyze their relationships.

Test Item

Given:	*Instruction:*
On the basis of that decision, the teacher chose to find another job.	*Diagram the sentence.*

SYNTHESIS OF SEMANTIC SYSTEMS (SS_3S): Write a story, paragraph, or poem.

Test Item

Instruction: Write a poem on any topic.

EVALUATION OF SEMANTIC SYSTEMS (ES_3S): Given a story, poem or other creative writing task, evaluate it on the basis of stated criteria.

Test Item

Instruction: Describe the criteria you used to determine how you would write your poem, i.e., meter, style, etc.

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