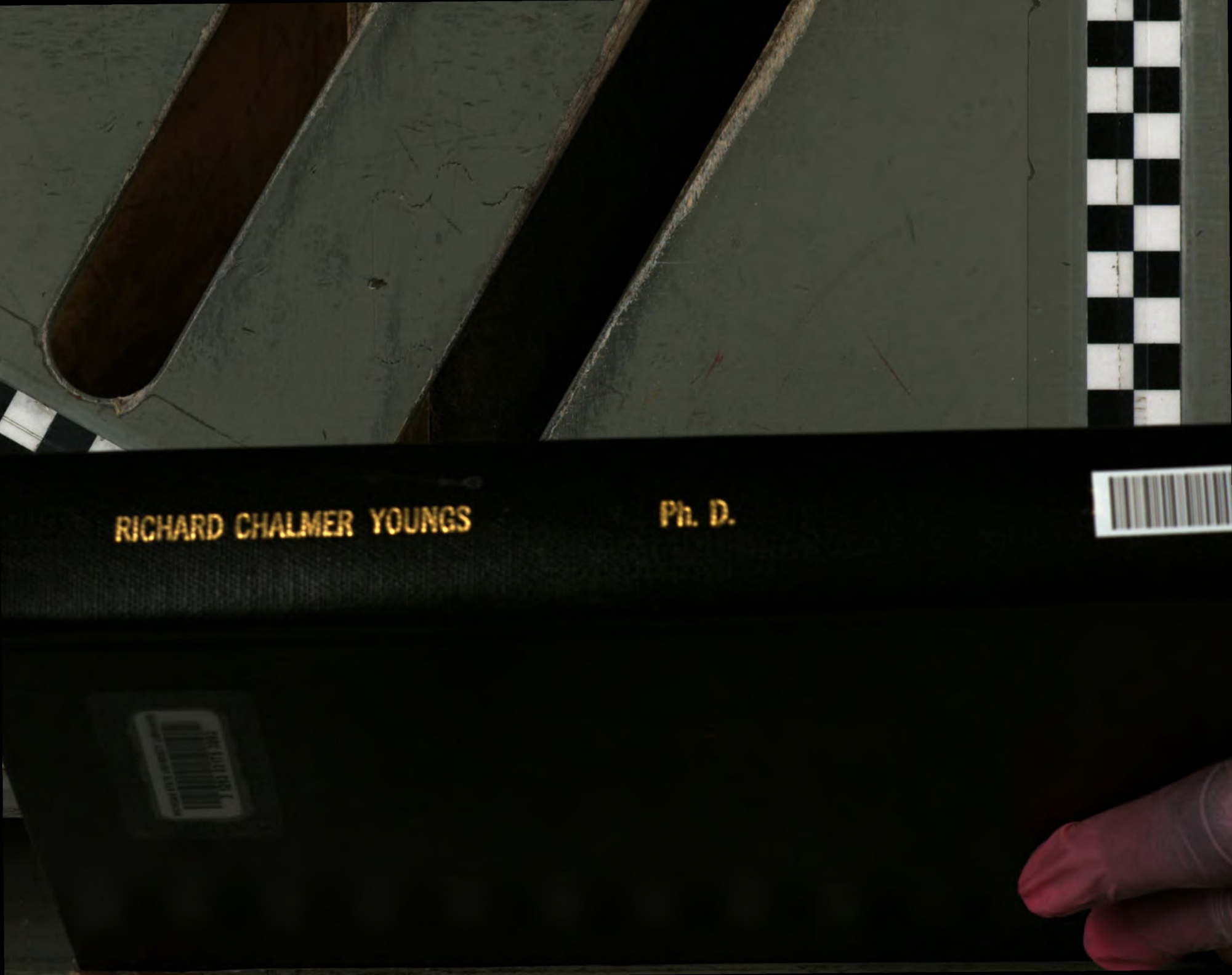
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Ph. D.

CREATIVITY MATERIALS FOR THE MIDDLE GRADES: THEIR DEVELOPMENT AND EFFICACY

Thesis for the Degree of Ph. D.

MICHIGAN STATE UNIVERSITY
RICHARD CHALMER YOUNGS

1970

This is to certify that the

thesis entitled

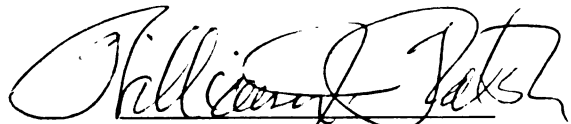
Creativity Materials for
the Middle Grades:
Their Development and Efficacy

presented by

Richard Chalmer Youngs

has been accepted towards fulfillment
of the requirements for

Doctor's degree in Philosophy



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ABSTRACT

CREATIVITY MATERIALS FOR THE MIDDLE GRADES:
THEIR DEVELOPMENT AND EFFICACY

By

Richard Chalmer Youngs

Purpose

The purpose of the study was to test the efficacy of a set of learning materials developed from a base of educational theory and research, specifically designed to stimulate creative thinking in middle grade children.

Procedures

An analysis of the literature relating to creative thinking suggested that the divergent thinking section of Guilford's structure-of-intellect model was appropriate as a matrix for developing seventy creative thinking activities for children in grades four through six. The activities were uniformly divided among the twenty-four cells of the matrix and were developed as self-instructional kits.

The creative thinking kits were tested with a group of twenty-four sixth grade laboratory school children for thirty class periods over a period of four months.

Treatment and control groups were identified and the treatment group used the creativity materials while the control group worked with science activities. Both groups occupied the same classroom during the treatment period and were supervised and taught by the researcher.

Seven hypotheses relating to improvement of verbal fluency, flexibility, originality; and figural fluency, flexibility, originality and elaboration were stated. Data were gathered through the use of the Torrance Tests of Creative Thinking and gains were compared through an analysis of covariance.

Findings

1. No significant differences were found between the treatment and control groups following treatment for the measures of verbal fluency, flexibility, originality; and figural fluency, flexibility, originality, and elaboration.
2. The gains of the treatment group exceeded the gains of the control group by a nonsignificant margin for six of the seven measures of creative thinking. The treatment group exhibited no gains relative to the control group for measures of figural elaboration.

Conclusions

The seven hypotheses which declared that the treatment group would score significantly higher on measures of verbal fluency, flexibility, originality; and figural fluency, flexibility, originality, and elaboration were rejected. It was concluded that significant differences between the treatment and control groups were not demonstrated for any of the seven measures.

Possible reasons for the lack of significance between the groups included inadequacy of the materials, short duration of the treatment period, contamination of the control group, insufficient sample size, and inadequacy of the creative thinking test.

CREATIVITY MATERIALS FOR THE MIDDLE GRADES: THEIR DEVELOPMENT AND EFFICACY

By

Richard Chalmer Youngs

A THESIS

Submitted to

Michigan State University

in partial fulfillment of the requirements

for the degree of

DOCTOR OF PHILOSOPHY

College of Education

1970

PREFACE

The disparity between research and practice is known to be a critical issue in the educational process.

This study was undertaken for the express purpose of applying accepted research knowledge to classroom practice. Specifically, theory and research relating to cognitive processes, intellect, motivation, and classroom milieu were integrated into a framework which provided a basis for the development of materials designed to stimulate creative thinking. The study was concerned with the development and efficacy of a set of creative thinking materials.

The researcher is deeply indebted to Dr. William J. Walsh, Chairman of the Guidance Committee, whose encouragement, knowledge, and assistance guided this study to completion. The researcher also wishes to acknowledge the contributions made by Dr. Charles A. Blackman, Dr. William K. Durr, and Dr. Richard J. McLeod who were members of the Guidance Committee and gave generously of their time and talents in guiding the study.

The wife of the researcher deserves grateful recognition for her assistance in developing the creativity materials, reading and commenting on the early drafts of

the thesis, and supporting and encouraging the endeavor.

The thesis is dedicated to the researcher's children and their contemporaries for it is they who will need to generate the creative solutions to the problems confronting their generation.

Finally, where regulations permitted, this thesis was bound in a colorful cover. The color of the cover was chosen to emphasize the viable nature of the topic, and to attract the attention of inquiring and innovative educators.

R. C. Y.

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INTRODUCTION

> In this period of revolutionary ferment and continued technological development, we seek the new Renaissance man who is willing to ride the wild horse of change and tame it to his own uses. (Gallagher, 1966)

NEED FOR THE STUDY

"Is America Neglecting Her Creative Talents?" inquired Arnold Toynbee in a recent publication.[1] He answered his question with a resounding "Yes," pointing out that America is losing that quality of a democracy which means "giving an equal opportunity to individuals to develop their unequal capacities."[2] Toynbee observed that America's lack of understanding of the implications of educational quality has stifled the creative mind. He condemned conservatism as being in part responsible for America's neglect of her creative talents, stating, "Creation is a disturbing force in society because

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[1]Arnold Toynbee, "On the Role of Creativity in History," and "Is America Neglecting Her Creative Talents?" Creativity Across Education (Salt Lake City: University of Utah Press, 1967), p. 23.

[2]Toynbee, p. 24.

it is a constructive one."[3] He summarized his position by stating "Egalitarianism and conservatism work together against creativity, and in combination, they mount up to a formidable repressive force."[4]

Cultural Change

In regard to the question concerning the neglect of creative talent, a concern has been raised about the future of a culture which neglects its creative individuals. Cultures have been improved and enhanced only through change. Changes or improvements of the social order have originated as thoughts and ideas from within the mind of man and societies which have not produced and sustained individuals capable of innovative and creative thought have been destined to a future of repetition and stagnation.

Torrance takes the position that "social importance" is a reason for educators to be concerned with developing creativity. He pointed out, "It takes little imagination to recognize that the future of our civilization--our very survival--depends on the quality of the creative imagination of our next generation."[5] As one means of encouraging a positive approach to the situation this study was dedicated

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[3]Toynbee, p. 27. [4]Toynbee, p. 28.

[5]E. Paul Torrance, Guiding Creative Talent (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1962), p. 6.

to the development and evaluation of materials specifically designed to stimulate creative thinking in school-aged children.

Individual Development

One can identify several reasons why educators should be concerned with the development of an individual's creativity per se. Four paramount reasons were an individual's mental health, fully developed functions, educational achievement, and vocational success.[6] Torrance observed that stifling creativity ultimately creates an overwhelming tension with a deleterious effect on the individual's ability to function adequately. He noted, "There is also little doubt that one's creativity is his most valuable resource in coping with life's daily stresses."[7]

The demands of our culture have been ever increasing because of its complexity. Individuals who have not been "fully functioning" persons have come to be a liability with which our culture must reckon. Torrance declared, "Certainly we cannot say that one is fully functioning mentally, if the abilities involved in creative thinking remain underdeveloped or paralyzed."[8]

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[6]Torrance, Creative Talent, pp. 2-7.

[7]Torrance, Creative Talent, p. 2.

[8]Torrance, Creative Talent, p. 3.

The concept of a "fully functioning" person was extended to include the student and his interaction with the school environment. Research done by Torrance, Getzels, and Jackson has demonstrated that creative thinking abilities contribute importantly to acquisition of information and other educational skills.[9]

An additional reason why educators should be concerned with developing creative thinking, said Torrance, is that it contributes to vocational success.[10] He noted that creativity is a prominent characteristic of outstanding individuals in almost every field. Most educators feel that high intelligence, special talent, and technical skills alone are not enough for outstanding success. J. P. Guilford summarized most aptly the need for developing higher levels of creative performance when he stated, ". . . nothing could contribute more to the general welfare of the nation and to the satisfaction and mental health of its people than a rising of the general level of creative

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[9]Torrance, Creative Talent, p. 4, citing E. P. Torrance, "Eight Partial Replications of the Getzels-Jackson Study," Research Memo BER-60-18 (Minneapolis, Minnesota: Bureau of Educational Research, 1960); see also Torrance, Creative Talent, p. 4, citing J. W. Getzels and P. W. Jackson, "The Meaning of 'Giftedness'--an Examination of an Expanding Concept," Phi Delta Kappan, 40 (1958), 75-77.

[10]Torrance, Creative Talent, p. 5.

performance."[11]

The Gap Between Research and Practice

Considerable research has been available to educators who are concerned with nurturing creativity. Unfortunately, only a small portion of this literature has found its way into the hands of teachers; even less of those findings reach the stage of classroom implementation.

Obviously there has been a critical need to translate theoretical research into practical teaching methods and materials. Parnes acknowledged the hiatus when he stated, "In spite of this increasing concern, our present educational system, to a large extent, still overlooks the intentional enhancement of creative ability in students."[12] Taylor and others asserted, "There is scanty assurance that the many basic research findings with potential relevance to education will quickly--or ever--be applied in determining what happens in the classroom."[13]

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[11]J. P. Guilford, "A Psychometric Approach to Creativity," Creativity in Childhood and Adolescence, ed. Harold H. Anderson (Palo Alto, California: Science and Behavior Books, Inc., 1965), p. 1.

[12]Merrill B. Parnes, "Imagination: Developed and Disciplined," Instructional Media and Creativity, ed. C. W. Taylor (Salt Lake City: University of Utah Press, 1967), p. 230.

[13]Calvin W. Taylor, Brewster Ghiselin, and John A. Wolfer, "Bridging the Gap Between Basic Research and Educational Practice," The NEA Journal (January, 1962), 23.

Benjamin Bloom, in assessing the progress of educational research during the past 25 years, observed a "lack of clear evidence about the instructional approaches which are effective in bringing about significant changes in higher mental processes."[14] Guilford, however, observed that these mental processes or "thinking skills" should be an important educational goal.[15] Supporting Guilford in a recent study David Denny identified teacher-classroom variables which facilitated pupil creative growth:

> Investigations of the development of creativity might be criticized as premature in light of the limited stage of research defining creativity, . . . it is the opinion of many in education that the factors measured by the test developed to date are important in themselves whether labeled creativity or simply ideational fluency, originality, et cetera.[16]

Priestman summarized the urgency for the development of instructional programs which stimulate the higher thought processes in general and creativity in particular when she stated, ". . . for man is a thinking animal and we do

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[14]Benjamin S. Bloom, "Twenty-five Years of Educational Research," American Educational Research Journal, III, 3 (May, 1966), 217.

[15]J. P. Guilford, "Progress in the Discovery of Intellectual Factors," Instructional Media and Creativity, ed. C. W. Taylor (Salt Lake City: University of Utah Press, 1967), p. 77.

[16]David A. Denny, "A Preliminary Analysis of an Observation Schedule Designed to Identify the Teacher-Classroom Variables which Facilitate Pupil Creative Growth," (ERIC, ED 010194, 1967), p. 11.

children grievous wrong when we train them in school to listen and accept, instead of to experience and understand."[17]

PURPOSE OF THE STUDY

As stated in an earlier section, the purpose of this study was to test the efficacy of materials specifically designed to stimulate creative thinking. The researcher developed materials from a base of educational research and theory. Similarly, classroom implementation of the materials was founded upon current educational literature. A broad research goal was to bridge the gap between basic research and common educational practice; more specifically, the body of knowledge and the research of creativity were directed toward development of materials which stimulate creative thinking in sixth grade children.

BACKGROUND OF THE STUDY

Parnes and Burnelle reported that the number of titles relating to creativity were appearing in professional literature with increasing frequency. For example the quantity of research published during the eighteen-month period of January, 1965, to June, 1966, equaled the quantity

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[17]Barbara Priestman, Froebel Education Today (London: University of London Press, 1952), p. 19.

reported in the preceding five years. A similar number of titles were developed during the previous ten years. A one hundred year period between 1850 and 1950 was required to produce the quantity of research equal to the amount published between January, 1965, and June, 1966.[18]

Early Investigations

Early investigations of creativity attempted to determine the hereditary factors linked to creativity.[19] Studies carried out near the turn of the century examined intellectual and personality components of intelligence and their relation to creativity.[20] By 1950 studies had been conducted relating to psychological aspects of creativity with specific attention to the personalities, interests, and aversions of creative individuals. Many of these studies were restricted to special groups and

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[18]Sidney J. Parnes and Eugene A. Brunelle, "The Literature of Creativity (Part I)," The Journal of Creative Behavior, I, 1 (Winter, 1967), 52.

[19]F. Galton, Hereditary Genius: An Inquiry into its Laws and Consequences (New York: Macmillan and Co., 1892), p. 12.

[20]G. V. Dearborn, "A Study of Imaginations," American Journal of Psychology, 9 (January, 1898), 183-190; see also L. M. Terman, "Genius and Stupidity: A Study of Some of the Intellectual Processes of Seven 'Bright' and Seven 'Stupid' Boys," Pedigogical Seminar, 13 (1906), 307-373.

occupations.[21] In addition to the psychological aspects of creativity, the steps of the creative process were delineated by the early 1950's.

A Turning Point

Guilford regarded 1950 as a turning point with respect to interest in creativity.[22] He suggested that this turning point resulted from a number of causes including the pressures brought on society by World War II, the cold war, the space age, and the concomitant demands these conditions made on creative imagination.

Early Programs

Early in the 1950's the Creative Education Foundation was formed through the efforts of Alex F. Osborn. At that time attention was turned to improvement of adult creative production through special courses or programs.[23]

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[21]Brewster A. Ghiselin (ed.), The Creative Process: A Symposium (Berkeley: University of California Press, 1952), pp. 1-53; see also Jacques S. Hadamard, An Essay on the Psychology of Invention in the Mathematical Field (Princeton, New Jersey: Princeton University Press, 1945), pp. 100-115; see also J. Rossman, The Psychology of the Inventor (Washington, D.C.: Inventors' Publishing Company, 1931), pp. 35-53.

[22]J. P. Guilford, "Creativity: Yesterday, Today, and Tomorrow," Journal of Creative Behavior, I, 1 (Winter, 1967), 6.

[23]Alex Osborn, Applied Imagination: Principles and Procedures of Creative Problem Solving (New York: Charles Scribner's Sons, 1961), pp. ix-xxii.

A list of these programs and courses is provided for the purpose of identifying institutions, and more importantly, individuals who were pioneers in the field of creativity.

By 1959, six noteworthy centers had been established which were devoted primarily to the study of creative thinking abilities and to the development of instruments for measuring those abilities.[24] These centers were located at the University of Southern California under the leadership of J. P. Guilford; the University of Utah, under the leadership of C. W. Taylor and B. A. Ghiselin; The Institute of Personality Assessment and Research at the University of California at Berkeley, under the leadership of D. W. MacKinnon and F. Barron; Pennsylvania State University, under the leadership of V. Lowenfeld; the University of Chicago with J. W. Getzels, P. Jackson and M. I. Stein providing leadership; and the University of Buffalo with the program of the Creative Education Foundation, directed by S. Parnes and A. Osborn. A significant portion of the relevant research about creative individuals has been conducted at these six centers.

More recently, researchers have belatedly turned their attentions toward the development of methods and

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[24] E. P. Torrance, "Current Research on the Nature of Creative Talent," Journal of Counseling and Psychology, 6 (1959), 309-310.

materials which stimulate creative performance.[25] Even with these concentrated efforts, materials specifically designed to be used with children are scarce.

THEORY FOR THE STUDY

J. P. Guilford has suggested that intellect or intelligence consists of 120 different factors. These factors have been formed by Guilford into a cubical model representing a "structure-of-intellect."[26] One of the five groups of intellectual operations predicted by the model was an individual's capacity to generate numerous plausible answers or solutions for a given problem. This operation was called "divergent thinking." Several authors have suggested that unusual intellectual potency in the area of divergent thinking is a factor which gives rise to creativity.[27] In this study, the 24 cells of the divergent

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[25]Sidney J. Parnes and Eugene A. Brunelle, "The Literature of Creativity (Part I)," The Journal of Creative Behavior, I, 1 (Winter, 1967), 54.

[26]J. P. Guilford, "Three Faces of Intellect," American Psychologist, XIV, 8 (August, 1959), 469-479.

[27]James J. Gallagher, Teaching the Gifted Child (Boston: Allyn Bacon, Inc., 1964), p. 206; see also John Gowan, "What Makes a Gifted Child Creative?--Four Theories," Gifted Child Quarterly, IX (Spring, 1965), 3-6; see also J. P. Guilford, "Potentiality for Creative Behavior," Gifted Child Quarterly, VI (Autumn, 1962), 98-90; see also George F. Kneller, The Art and Science of Creativity (New York: Holt, Rinehart & Winston, Inc., 1965), p. 39.

thinking section of Guilford's model were used as a matrix for the preparation of specialized materials.

Individualized Instruction

In addition, development of these materials took cognizance of a growing concern in education for the importance of individualized instruction.[28] Considering that children have different needs and aspirations, learning materials and instructional methods need to be designed for pursuit of learning, at rates and in areas suited to the learner's needs. The creativity activities designed for this study were constructed with this desideratum in mind.

Motivational Theory

The steps of the creative process indicated that creativity could not be programmed because insight, a vital aspect of the creative process, did not occur at predictable moments. The activities and materials designed for this study compensated for this difficulty by presenting problem situations at regular intervals, with little or no external pressure upon the learner to arrive at a solution to the problem within a specified period of time.

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[28]Calhoun C. Collier, et al., Teaching in the Modern Elementary School (New York: The Macmillan Company, 1967), p. 149.

Intrinsic motivation, however, encouraged the learner to progress at a rate which best suited his needs and abilities.

For this approach there was support from a number of authors who have observed that motivation for creativity is intrinsic. It may be in the form of curiosity, self-realization, or the need to arrive at closure.[29] The materials were designed to incorporate these theoretical constructs.

Classroom Milieu

Studies have conclusively shown that classroom environment has considerable influence on creativity. Torrance has used these studies to develop five principles for teaching behavior which are important in stimulating creative thinking.

1. Be respectful of unusual questions.
2. Be respectful of unusual ideas of children.
3. Show children that their ideas have value.
4. Provide opportunities for self-initiated learning and give credit for it.

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[29] Carl R. Rogers, "Toward a Theory of Creativity," Creativity and Its Cultivation, ed. Harold H. Anderson (New York: Harper and Brothers, 1959), p. 72; see also George F. Kneller, The Art and Science of Creativity (New York: Holt, Rinehart, & Winston, Inc., 1965), p. 27.

5. Provide for periods of non-evaluated practice or learning.[30]

Hypotheses

The problem, stated in general terms, was: Could self-instructional materials be developed for middle school aged children which would measurably improve their ability to be creative? The critical portion of the question was whether or not materials could measurably improve creative performance.

In approaching this question, four hypotheses were developed for testing which concerned components of creative thinking. One hypothesis relating to figural productivity alone was examined:

1. The treatment group would score significantly higher on measures of elaboration than would the control group.

Three hypotheses were related to both verbal and figural productivity. They were:

2. The treatment group would score significantly higher on measures of fluency than would the control group.
3. The treatment group would score significantly higher on measures of flexibility than would

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[30] E. Paul Torrance, "Give the Devil His Dues," Gifted Child Quarterly, 5 (Winter, 1961), 117-118.

the control group.

4. The treatment group would score significantly higher on measures of originality than would the control group.

DESIGN OF THE STUDY

The study was concerned with testing materials developed by the researcher to determine their efficacy in stimulating creative thinking. The experimental design involved a comparison of pretest and posttest scores for treatment and control groups. The pretests consisted of Torrance Tests of Creative Thinking, Figural Test Booklet A, and Verbal Test Booklet A. The posttests included Figural Test Booklet B and Verbal Test Booklet B of Torrance Tests of Creative Thinking.[31]

Population

The population for this study was a 1969-70 sixth grade class of the Metcalf Laboratory School at Illinois State University, Normal, Illinois. A major portion of the children in the class was children of college faculty or professional people, and a large number of the children had attended Metcalf School since entering kindergarten.

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[31] E. Paul Torrance, Torrance Tests of Creative Thinking (Princeton, New Jersey: Personnel Press, Inc., 1966).

Many parents were teachers and had been prepared in techniques for teaching and motivating children.

A stratified random sample technique was employed to insure that the children were randomly assigned to two groups, a treatment group and a control group. Both groups were taught by the researcher and received the same instruction during the semester except that the treatment group used the creativity materials for thirty class periods during the spring semester of 1970. During the time the treatment group worked with the creativity materials the control group received science instruction. The control group was permitted to work on science projects of their own choice. The self-instructional nature of the creativity materials permitted the researcher to supervise both the science projects and the creativity activities simultaneously. A permissive classroom milieu was maintained for both groups. The instruction offered to the groups for the rest of the school day was essentially the same.

From the administration of the Torrance Tests of Creative Thinking measures were obtained on verbal fluency, flexibility, originality, and figural fluency, flexibility, originality and elaboration. The data were subjected to an analysis of covariance and differences which developed between the groups during the treatment period were observed and recorded.

Data Gathering

Figural and verbal pretests and posttests were administered. The figural tests required one fifty-minute setting and the verbal tests required one fifty-minute setting and one twenty-minute setting. The posttests were administered on the same days of the week and at the same times within the day as were the pretests. The pretests and posttests were separated by a four-month interval. The tests were scored by two individuals familiar with test scoring procedures and cognizant of the philosophy underlying the test instrument. The verbal pretests and posttests were scored by one scorer and the figural pretests and posttests were scored by a second scorer. All tests were scored in the same order.

Randomizing Groups

Randomization of the treatment and control groups was obtained by permitting each child to select a number between 1 and 99. Their numbers were then compared with a table of random numbers. The numbers of the first six boys and first six girls to appear in the table comprised one group; the remaining seven boys and five girls constituted a second group. This stratified random sampling procedure was employed to insure balance of girls and boys in the two groups. Once two groups were identified a toss of a coin determined the treatment group. The

children participated in the selection procedure so that they could better understand the experimental process and be assured that their selection for either group was based purely on chance and not on "hidden" criteria. Their numbers were later used in place of names on all tests to insure anonymity.

Class Meetings

The class met for forty minutes, three days a week for seventeen weeks. During thirty of the class periods the creative thinking kits were available for use by the treatment group. Most of the treatment group worked on the kits during all the time which was made available for that purpose. The control group received science instruction during these class periods. The remaining class periods were used to provide science instruction to the total class and administer the pretest and posttests. Four of the class periods, used for science instruction, were shortened to fifteen minutes to accommodate special faculty meetings.

The materials were designed so that they were self-instructional. They were not sequential in nature; instead they provided a milieu designed to stimulate creative thinking. The children progressed at various rates and pursued the activities in varying depths. A more detailed description, analysis, and evaluation of the materials is given in chapters three and four.

Observing Gains

Measuring the efficacy of instructional materials depended on the purpose of the materials. These materials were designed to stimulate creative thinking and their success was determined by this purpose. More specifically the materials were designed to stimulate heightened levels of performance on tasks which required verbal fluency, flexibility, originality, and figural fluency, flexibility, originality, and elaboration.

Pretest and posttest scores on these seven measures were compared through an analysis of covariance. Significant differences between the experimental and control groups were conceded for measures which exceeded the .05 level of confidence.

Other types of anecdotal data were gathered, summarized, and reported. No attempt was made to systematically analyze the anecdotal data or to draw conclusions from those data; they were reported only when they related to or supported conclusions extracted from the statistical analysis.

DEFINITIONS FOR THE STUDY

Creativity

A variety of definitions have been offered for creativity. For the purpose of this thesis, creativity was defined as the production of ideas resulting in behaviors

or products which are new, original and worthwhile to the person creating them.

Some definitions of creativity have required that the idea be unique to the culture or that it be judged worthwhile by critics. This reservation to the definition of creativity was not applied in this study.

Divergent Thinking

The term divergent thinking included operations and content factors of creativity related to fluency, flexibility, originality, and elaboration. The operations were further defined:

> Fluency was the ability to generate many responses to a problem or stimulus. The quantity of output was important even when the quality was disregarded, although the response to the stimulus or problem must have been appropriate.
>
> Flexibility was the capacity to bring about change in meaning, interpretation or use, the ability to change a strategy, or a way of doing a task; it implied the ability to develop a new interpretation of a goal, through understanding or a change in direction of thinking.
>
> Originality was the productivity of unusual, far-fetched, remote, or clever responses; it included the ability to develop novel ideas, particularly

those new to the individual concerned.

Elaboration was the ability to improve, to enhance, and to develop from a bare outline a finished product, and to develop from a simple plan or description an improved and completed product or idea.

In addition, divergent thinking content factors were defined:

Figural factors meant concrete material perceived through the senses, not representing anything except itself, such as visual materials having properties of size, form, color, location or texture.

Symbolic factors were composed of letters, digits, and other conventional signs, often organized in general systems such as the alphabet or the number system.

Semantic factors comprised verbal meanings or ideas, thoughts communicated through written or spoken language.

Behavioral factors included actions, conduct, mannerisms and a person's responses to observable stimuli. This factor is sometimes called social intelligence or social awareness.

Verbal factors consist of the same factors as do semantic factors.

ASSUMPTIONS AND LIMITATIONS OF THE STUDY

Assumptions concerning this study related to the children as a group, the materials as purveyors of change, and the test instrument as a satisfactory estimate of change.

It was assumed that the children selected for this study were representative of average or above socioeconomic level middle school aged children found in many schools across the country, and that their reactions to the materials were similar to those of children of similar social, economic and intellectual levels.

Further, it was assumed that the materials caused the change in student performance revealed by the tests, and that the materials, in their present form or with some modification, were appropriate for children of the middle school grade levels.

The assumption was made that the test instrument effectively measured creativity as reported by test scores. Finally, it was assumed that the variables not controlled in this experiment had a random effect on the results and did not produce erroneous conclusions.

The limitations of the study were similarly concerned with the children, the materials, and the test instrument. Statements about the effectiveness of these materials need to be limited to the types of children for

which they were developed. One cannot assume similar results from children differing in age ranges, intellect, social or economic levels.

The materials were developed from a theoretical base which predicted twenty-four different types of divergent thinking operations. The Torrance Tests of Creative Thinking were effective in measuring only a portion of these intellectual operations. No claim can be made about the thinking operations other than those which are measured by the test instrument.

Assumptions Listed

Stated explicitly this study was predicated on the following assumptions:

1. The nurturing of creativity was a desirable educational goal.
2. Improving the skills of fluency, flexibility, elaboration, and originality would result in heightened levels of creativity.
3. Stimulating creative thinking in individuals as children would result in creative behavior as adults.
4. The learning activities were properly generated from the theoretical model.
5. The changes in performance were a result of the treatment.

6. Test instruments effectively measured fluency, flexibility, elaboration and originality.
7. The setting and population in which the experiment was conducted was not so unusual that the outcomes within limitation could not be generalized to other similar populations.
8. Variables not controlled in this experiment had a random effect on the results and did not produce erroneous conclusions.

Limitations Listed

1. The test instrument sampled only a portion of the twenty-four types of thinking operations. The remainder of the operations remained untested and therefore statements could not be made about them.
2. The efficacy of the materials was limited to the appropriate use of the materials.
3. The generalization of the experimental results was limited to populations which were similar to the treatment group.

ORGANIZATION OF THE THESIS

The thesis is composed of five chapters: an introduction, a review of the related literature, the implementation of the study, an analysis of results, a summary and conclusions.

Need for the Study

The introductory chapter identifies the need for the study and focuses on bridging the gap between research and practice. The background, purpose, and theory of the study are discussed. In the last part of the chapter, general hypotheses are listed along with the discussion of the experimental design. The chapter closes with a listing of definitions, assumptions, and limitations of the study.

The Literature

The second chapter of the thesis contains a review of the related literature. The literature is organized into five categories. The initial category is concerned with the act of creation, followed by a category in which attitudes and aptitudes of creative individuals are considered. An examination of the conditions which affect creativity comprises the third category, and in the fourth category ways of teaching for creative production are identified. In the last category, Guilford's model of the structure-of-intellect is considered in more detail, and studies using this model to develop methods and materials are discussed.

Implementation

In chapter three, the implementation of the study, the development of the materials is described along with a discussion of the experimental design. The experimental design includes an examination of the hypotheses tested, the population, the analysis of covariance model, and an assessment of the evaluation instrument.

The Data

Chapter four contains an analysis of results including summaries of field notes, questionnaires, pretest and posttest data. This chapter also includes a list of the hypotheses tested and statements of the significance of the findings.

Summary and Conclusions

The last chapter of the thesis, chapter five, includes a summary of the thesis, a discussion of the conclusions and recommendations. The results are also discussed and implications for further development of the creativity materials examined. Suggestions are made for improving the creativity materials and questions for further investigation are considered.

Chapter 2

REVIEW OF THE RELATED LITERATURE

> Fools act on imagination without knowledge; pedants act on knowledge without imagination. The task of a university is to weld together imagination and experience. (Whitehead, 1929)

INTRODUCTION

In this chapter, literature relating to creativity is examined. It is a long chapter because of the quantity of theory and research germane to development of educational materials for creative thinking.

The review of the literature has been organized into five categories and was limited to studies and opinions relating directly to development of instructional methods and materials for elementary school children. In the initial category, the act of creation is considered. Included in this section are theories of creativity, the creative process and levels of creative performance. The next category contains an examination of the attitudes and aptitudes an individual brings to the creative endeavor. It includes consideration of characteristics of creative persons, levels of creativity in individuals and the relationship between creativity and intelligence. The

third category provides for consideration of the conditions which affect creativity. In this section, a theory for instruction is examined along with the relationship between thinking and creativity, environmental conditions which affect creativity, and motivational factors of creativity.

In the fourth category, teaching for creative production is reviewed. In this section, techniques for stimulating creative thinking are considered along with the role of the teacher in the process. Selected programs for stimulating creativity are noted. The last category in the chapter provides for a review of Guilford's structure-of-intellect model, and consideration of ways of using the model to develop instructional methods or materials.

THEORIES OF CREATIVITY

Four types of theories explaining creative behavior were concerned with (1) creativity as a function of a unique relationship, association or ability, (2) creativity as a function of mental health, (3) creativity as self-fulfillment, and (4) creativity as factors of intellect.

Unique Relationships, Associations and Abilities

Early theories of creativity implied divine inspiration. Carlyle wrote "... the artist ... must speak of

inspiration and . . . call his work the gift of divinity."[1] In the late 1800's, Galton postulated a genetic base for variations in creative performance.[2] Kneller summarizes the theory, Creativity as Intuitive Genius, as;

> . . . a wholesome, highly developed form of intuition . . . [which] . . . cannot be generally educated because it is unpredictable, non-rational, and limited to a few unusual people.[3]

Whitehead considered creativity a cosmic force, rhythmic, or cyclical in nature, wherein entities are born, develop, and die. He postulated that these rhythmic cycles consist of the stages of romance (the first encounter), precision (order is introduced), and generalization (mastery and application).[4]

A Function of Mental Health

Older theories of creativity stated that high levels of creative performance are a result of "madness" or

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[1]Thomas Carlyle, quoted in John M. Fletcher, Psychology in Education with Emphasis on Creative Thinking (New York: Doubleday, 1934), pp. 364-365.

[2]Francis Galton, Hereditary Genius: An Inquiry Into its Laws and Consequences (New York: Macmillan and Co., 1892), p. 1.

[3]George F. Kneller, The Art and Science of Creativity (New York: Holt, Rinehart, & Winston, Inc., 1965), p. 21.

[4]Alfred North Whitehead, The Aims of Education (New York: The American Library, 1949), pp. 26-33.

neuroses.[5] These theories asserted that creativity results from neurosis or mental instability, and were still popular at the turn of the century.[6] May reported a conversation with Alfred Adler in which Adler discussed his compensatory theory of creativity. The theory, in brief, stated ". . . human beings produce art, science, and other aspects of culture to compensate for their own inadequacies."[7]

Later theories, however, suggested that creativity is the product of a healthy mind and helps to maintain mental health.[8] In these theories, it is the creative person who can adjust to changes and problems presented by the environment. The creative production of solutions and changes made it possible for him to adapt to his

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[5]Kneller, p. 20.

[6]C. Lombroso, The Man of Genius (New York: Charles Scribner's Sons, 1895); see also J. F. Nisbet, The Insanity of Genius (London: De La Nore Press, 1895).

[7]Rollo May, "The Nature of Creativity," Creativity and Its Cultivation, ed. H. H. Anderson (New York: Harper and Brothers, 1959), p. 56.

[8]Kneller, p. 28; see also Kneller, p. 33; see also John C. Gowan, "What Makes a Gifted Child Creative?--Four Theories," The Gifted Child Quarterly, 9 (Spring, 1965), 3-6; see also E. Paul Torrance, Guiding Creative Talent (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1962), p. 3.

environment and hence maintain his mental health.[9]

A Life Force or Self-fulfillment

Several theories described in this section related to those previously considered. They differed in their extension beyond the concept of adequate adjustment and mental health.

This group of theories posited resolution of individual problems as a requisite to personal fulfillment. They suggested that individuals have a basic drive to become fully actualized, creative, or to achieve self-realization. In this group, creative thinking was explicated primarily as a reconstruction of patterns such that the patterns become complete. Thus, the need for completeness motivated the creative act.[10]

Maslow spoke of creativity as a result of a "self-actualizing individual" who can free himself from the psychological constraints inhibiting creativity.[11] Rogers proposed a similar view and defined creativity as the urge

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[9]Gowan, "Four Theories," p. 4.

[10]Kneller, p. 27.

[11]A. H. Maslow, "Creativity in Self-Actualizing People," Creativity and Its Cultivation, ed., H. H. Anderson (New York: Harper and Brothers, 1959), pp. 83-95.

to fulfill oneself.[12] Wilson noted two conditions which maximize the likelihood of the emergence of creativity, "psychological safety" and "psychological freedom," or the feeling of emotional security and lack of undue emotional constraints.[13]

Finally, Gutman argued that creativity had its roots in the biological needs of man to reproduce and to create.[14] This was a particularly cogent postulate in light of the increasingly imminent population problem.

A Factor of Intelligence

In suggesting that creativity results from a particular type of mental functioning the following were not in conflict with theories described previously. They dealt primarily with intellectual processes and did not involve aspects of personality, environment, and heredity. Older theories in this group held that creative acts were limited to a small and highly intelligent portion of the population, while more recent theories contended that

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[12]Carl R. Rogers, "Toward a Theory of Creativity," Creativity and Its Cultivation, ed., Anderson, p. 72.

[13]R. C. Wilson, "Creativity," Education for the Gifted, ed., N. B. Henry (Yearbook for the National Society for the Study of Education, 1958), LVII, 2, p. 117.

[14]Herbert Gutman, "The Biological Roots of Creativity," Genetic Psychological Monograph, 1966, pp. 419-458.

"abilities involved in being creative are universal," and that the ability to be creative is possessed in some degree by all individuals.[15]

One of the better known theories of this group was Guilford's structure-of-intellect theory.[16] This theory expanded the concept of intelligence beyond notions that intelligence consisted of one, two, six, or eight dimensions.[17] These notions were rejected in favor of a multidimensional model consisting of 120 different intellectual factors.[18] Over sixty of these factors have been empirically verified.

Of the 120 factors, twenty-four were in a category designated as "divergent thinking." The theory implied that creativity is more apparent in individuals who have an unusual facility in the divergent thinking intellectual

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[15]Kneller, p. 21; see also Wilson, p. 109.

[16]J. P. Guilford, "Three Faces of Intellect," American Psychologist, XIV, 8 (August, 1959), 469-479.

[17]Thelma G. Thurstone, "Primary Mental Abilities of Children," Educational and Psychological Measurements, I, 12 (1941), 105-116.

[18]J. P. Guilford, "Progress in the Discovery of Intellectual Factors," Widening Horizons in Creativity, ed., C. W. Taylor (New York: John Wiley and Son, 1964), pp. 261-264.

factors.[19]

PROCESS OF CREATING

Traditionally the creative process has been described as a series of stages or steps. Although descriptions of stages varied among theoreticians the four-stage analysis advanced by Wallas was more prevalent.[20] These stages consisted of periods of preparation and incubation, followed by culminating stages of illumination and verification.

The Stages

Patrick continued the work of Wallas in identifying, describing, and delineating the stages of the creative process.[21] She also conducted experiments to determine the order and relation of these events to the creative process.

The works of Wallas, Patrick and others who have attempted to specify the steps of the creative process were

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[19]Gowan, "Four Theories," p. 3; see also J. P. Guilford, "Traits of Creativity," Creativity and Its Cultivation, ed. H. H. Anderson (New York: Harper and Brothers, 1959), p. 152; see also E. Paul Torrance, Rewarding Creative Behavior (Englewood Cliffs, New Jersey: Prentice-Hall, 1965), p. 5.

[20]G. Wallas, The Art of Thought (New York: Harcourt, Brace & Co., 1926), p. 52.

[21]Katherine Patrick, What Is Creative Thinking? (New York: Philosophical Library, 1955), pp. 3-47.

summarized by Wilson, Marksberry, and Kneller.[22] They describe the period of preparation as characterized by such activities as "defining the problem, gathering data and material, and choosing a plan of action."[23] The second stage, the period of incubation, was a period of "unconscious activity, during which time there is a ripening or germinating of the solution" within the mind.[24] This period was often characterized by frustration, restlessness, and feelings of inferiority. The third stage was the stage of illumination. During this stage the process of creation comes to a climax and, "suddenly, the creator grasps the solution to his problem. . . ."[25] The final stage was the period of verification, during which the plan or solution was tested and an evaluation of the solution was made.

The four stages were generally called the stages of the creative process. The stages may not all occur in any particular creation: they may be telescoped, occur in rapid succession, extend over a long period of time, or the cycle repeated several times during a particular creation.

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[22]Wilson, p. 111; see also Mary Lee Marksberry, Foundations of Creativity (New York: Harper and Row, 1963), p. 17; see also Kneller, p. 47.

[23]Wilson, p. 112.

[24]Marksberry, p. 18.

[25]Kneller, p. 53.

Many authors held that the creative process consisted of a set of interrelated intellectual operations rather than a sequence of discrete events.

Levels of Creativity

Durr and Torrance described Taylor's five levels of creative performance.[26]

1. Expressive creativity. (Independent expression where skills, originality, and the quality of the product were unimportant. Spontaneous drawings of children exemplified this level.)
2. Productive creativity. (Artistic or scientific products which displayed heightened realism, objectivity, and completion.)
3. Inventive creativity. (Ingenuity in the use of methods, materials, and techniques. It involved new applications of basic ideas.)
4. Innovative creativity. (Improvement through significant modification of basic skills.)
5. Emergentive creativity. (The development of entirely new principles or assumptions.)

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[26]William K. Durr, The Gifted Student (New York: Oxford University Press, 1964), p. 175, citing Irving A. Taylor, "The Nature of the Creative Process," Creativity: An Examination of the Creative Process, A report on the Third Communications Conference of the Art Directors Club of New York, ed. Paul Smith (New York: Hastings House, 1959), pp. 54-61; see also Torrance, Creative Behavior, p. 5, citing Taylor, "The Nature of the Creative Process."

The five levels represent a hierarchy of creative performance. The first and second levels were commonly observed among school children while the higher levels were rare even among adults.

TRAITS OF CREATIVE INDIVIDUALS

Many interesting studies have been conducted which were concerned with traits of creative individuals. Summarized here are works particularly relevant to this study.

Creative Artists

Roe examined artists and their works by conducting clinical studies of twenty living American painters. She found that some of the general characteristics of the group were an above average intelligence, a tendency toward abstract thinking, and a sensitive nonagressive personality.[27]

In another study, personality, thinking, and perceptual differences between artists and non-artists were compared by Eiduson and it was found that artists "look for ways of thinking that are original and unusual."[28] The

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[27]Anne Roe, "Artists and Their Work," Journal of Personality, XV (1946), 3-4.

[28]Bernice T. Eiduson, "Artists and Non-artists: A Comparative Study," Journal of Personality, XXVI (1958), 25.

artists also showed a tolerance for ambiguity, a desire for personal recognition, and self-expression.

Creative Scientists

Roe studied the differences in personality and life history patterns between research scientists. An implication of this study was that the process of investigation was motivated by curiosity, and negated by authoritarianism. The author concluded the study with the observation that "Freedom breeds freedom. Nothing else does."[29] The quotation implies that inquiry develops only in an environment which is free and unrestricted.

Barron attempted to determine which factors generated originality.[30] He found that:

1. Original persons preferred complexity and some degree of apparent imbalance in phenomenon.
2. Original persons were more independent in their judgments.
3. Original persons rejected suppression as a mechanism for the control of impulse.

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[29]Anne Roe, The Making of a Scientist (New York: Dodd, Mead, 1952), p. 244.

[30]F. Barron, "The Disposition Towards Originality," The 1955 University of Utah Research Conference on the Identification of Creative Scientific Talent, ed. C. W. Taylor (Salt Lake City: University of Utah Press, 1956), p. 159.

Stein conducted a study to determine levels of creativity in scientists. He administered psychological tasks and biographical questionnaires to a group of industrial scientists and found that:[31]

1. The less creative scientists were more submissive to authority and more acceptant of tradition.
2. The more creative scientists saw themselves as more different from their work groups and from the general population than did the less creative scientists.

Characteristics Compared

MacKinnon has conducted several studies which were concerned with characteristics of creative persons. He included samplings from the fields of creative writing, architecture, mathematics, industrial research, physical science, and engineering.[32] Artistic creativity was represented by studies of the work of poets, novelists, and essayists.

Artistic creativity reveals itself as an expression of the creator's needs, perceptions, and motivations.

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[31]Morris I. Stein, "A Transactional Approach to Creativity," in Barron, Utah Conference, pp. 226-227.

[32]Donald W. MacKinnon, "The Nature and Nurture of Creative Talent," American Psychologist, 17 (1962), 484-495; see also Donald W. MacKinnon, "Characteristics of the Creative Person: Implications for the Teaching-Learning Process," Current Issues in Higher Education, 7 (1961), 89-92.

Through his products the artist externalized something of himself into the public field. In scientific creativity, on the other hand, the creator worked largely as a mediator between externally defined needs and goals. He simply operated on some aspect of his environment so as to produce a novel or appropriate product.

MacKinnon also examined architects because they represented both artist creativity and scientific creativity. He found that creative architects more often viewed themselves as being more inventive, independent, enthusiastic, determined, and industrious than did the less creative members of their profession.[33]

MacKinnon summarized the characteristics of the more creative individuals from all these groups. He found they were intelligent, more fluent, more independent in thought and action, relatively free from conventional restraints and inhibitions, and inclined to recognize and admit unusual and unconventional self-views.[34]

Hughes assembled a similar list by surveying mature creative scientists.[35] He observed that they were

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[33]MacKinnon, "Nurture of Creative Talent," p. 487

[34]MacKinnon, "Implications for the Teaching," p. 90.

[35]Harold Hughes, "The Enhancement of Creativity," Journal of Creative Behavior, III, 2 (Spring, 1969), 82.

distinguished from their less creative peers by their selective memory, openness to new experience, ability to think divergently, attraction to resolve disorder, insistence on free time, and their need for a supportive climate.

Summaries of Traits of Creative Persons

Several summaries of traits of creative persons have been assembled.[36] Several traits which reoccur in the summaries seem pertinent to the educational process. They indicate that the creative person:

1. Was less repressed, less inhibited, less formal, less conventional and showed low authoritarian values;
2. Was independent and autonomous;
3. Was more intuitive and perceptive;
4. Was highly motivated to achieve in situations where independence of thought and action were required;

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[36] James J. Gallagher, Research Summary on Gifted Child Education (Springfield, Illinois: Superintendent of Public Instruction, 1966), p. 46; see also Donald W. MacKinnon, "Personality Correlates of Creativity," Productive Thinking in Education, ed. Mary Jane Aschner and Charles E. Bish (Washington: The National Education Association, 1965), p. 161; see also Torrance, Creative Behavior, p. 7.

5. Produced novel and unconventional solutions to problems;
6. Showed tolerance for ambiguity.

CREATIVITY AND INTELLIGENCE

Questions regarding the relationship between intelligence and creativity have been raised by a number of psychologists over the years. Terman, as early as 1906, came to the conclusion that creativity (invention) and intelligence were separate intellectual operations.[37] Cropley concurred and argued that logical ways of thinking, as measured by IQ tests, differed from creative ways of thinking, as measured by creativity tests.[38]

A study was done by Getzels and Jackson comparing academic performance of highly creative and highly intelligent high school students. They found that highly creative and bright students were able to compete academically with very bright but less creative students.[39] Torrance reported

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[37]Louis M. Terman, "Genius and Stupidity: A Study of Some of the Intellectual Processes of Seven 'Bright' and Seven 'Stupid' Boys," Pedagogic Seminary, XIII (1906), 372.

[38]A. J. Cropley, Creativity (Education Today Series. New York: Humanities Press, 1968), pp. 1-2.

[39]J. W. Getzels and P. W. Jackson, Creativity and Intelligence (New York: John Wiley, 1962), pp. 22-33.

on eight replications of the Getzels and Jackson study using elementary, high school, and college students.[40] The results of these studies confirmed the former findings; bright students who scored high on creativity tests did as well scholastically as less creative students who scored very high on IQ tests. Torrance did find, however, that when the IQ scores of "high creative" students dropped below 120 they encountered more difficulty in competing.

Other researchers have confirmed Torrance's finding that creativity correlated with intelligence when the full range of intelligence was considered. When only the upper range of intelligence scores were compared with creativity scores, a correlation was not observed.[41]

In Guilford's model of the structure-of-intellect, one section was designated as divergent thinking. Intersecting with divergent thinking was a second set of intellectual abilities called transformation. This group of abilities included the intellectual functions of fluency, flexibility, originality and elaboration. Although these processes appeared to be part of intelligence, Guilford

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[40] E. Paul Torrance, Guiding Creative Talent (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1962), p. 5.

[41] MacKinnon, "Implications for Teaching," p. 89; see also MacKinnon, "Personality Correlates," p. 161; see also Gallagher, Research Summary, p. 50.

argued that they were not measured by conventional IQ tests.

CREATIVE POTENTIAL OF ALL PERSONS

A study, conducted by Bowers, investigated the hypothesis that many people have a potential for higher creative performance which is blocked from expression by defensiveness. She found that individuals had ideas but were reluctant to express them or even consider them unless they were provided with an environment that gave them a mental set different from their habitual set.[42]

Another study, by Wallach and Kogan, compared subjects with varying levels of creativity. They found some subjects reluctant or fearful of being original, rather than unable to be original.[43]

Guilford concluded, ". . . creativity is not a gift of the select few. It is instead a property shared by all humanity, to a greater or smaller degree."[44]

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[42] P. G. Bowers, "Effects of Hypnosis and Suggestions of Reduced Defensiveness on Creativity Test Performance" (unpublished Doctor's dissertation, University of Illinois, Urbana, 1965), p. 46.

[43] N. A. Wallach and N. Kogan, Modes of Thinking in Young Children (New York: Holt, Rinehart & Winston, Inc., 1965), pp. 286-303.

[44] J. P. Guilford, "A Psychometric Approach to Creativity," Creativity in Childhood and Adolescence, ed., H. H. Anderson (Palo Alto, California: Science and Behavior Books, Inc., 1965), p. 8.

INSTRUCTIONAL THEORIES OF CREATIVITY

In this section, instructional theory relating to creative development was examined. The term instructional theory was meant to represent a set of statements based on sound research enabling one to predict the effect of particular changes in the educational environment on pupil learning.[45]

It was recognized that the theory and techniques for nurturing creativity were not as highly evolved as those for developing cognitive processes. Authorities, however, held that instructional theories needed to be explicated and instructional methods and materials could be developed to stimulate creative thinking.

> Although it is true that both theory and research in learning support the notion that creative, novel, insightful behavior cannot be rigidly controlled or predicted at this time, . . . present evidence suggests rather strongly that insight is more likely to result when certain appropriate responses have been previously acquired and that the development of such responses may be taught directly.[46]

Bloom also supported this position by his statement:

> In contrast to the evidence about the great variety of instructional approaches which are

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[45]Association for Supervision and Curriculum Development, Criteria for Theories of Instruction (Washington: NEA, 1968), p. 3.

[46]N. L. Gage (ed.), Handbook of Research on Teaching (Chicago: Rand McNally, Co., 1963), p. 489.

> relevant to the learning of information, is the lack of clear evidence about the instructional approaches which are effective in bringing about significant changes in the higher mental processes.[47]

Origin of Instructional Theory

Curricula which directly or indirectly provide opportunities for the development of creative talents probably had their beginnings in the works of such theoreticians as John Dewey, Harold Rugg, and William James. In a doctoral thesis concerned with a critical analysis of the concept of creativity in current educational theory, Lynch identified William James and John Dewey as chief contributors to the tenets of self-cultivation, unfolding, creative expression, and fullest utterance of self.[48]

Bellack, in reviewing the history of curriculum thought and practice, cited the work of Seguel who examined the developing curriculum problems in the early 1900's. He too identified several influential men in curriculum development at that time, including John Dewey and Harold

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[47]Benjamin S. Bloom, "Twenty-Five Years of Educational Research," American Educational Research Journal, III, 2 (May, 1966), 217.

[48]J. E. Lynch, "A Critical Analysis of the Concept of Creativity in Current Educational Theory" (unpublished Doctor's dissertation, The Catholic University of America, Washington, D.C., 1963), pp. 72-77.

Rugg. Seguel concluded that this period was characterized by four persistent interests on the part of curriculum specialists. These interests were:

> (1) the nature of knowledge, (2) the nature of the learning process, (3) the professional status of the new specialty of curriculum making, and (4) procedures for introducing new curriculum insights into educational practice on a broad scale.[49]

More recently the national committee on the Project on Instruction identified five essential objectives for school programs. They are:

> (1) learning how to learn, how to attack new problems, and acquire new knowledge; (2) using rational process and developing an abiding interest in learning; (3) exploring values in new experiences; (4) understanding concepts and generalizations; and (5) competence in basic skills.[50]

In this list of essential objectives, the first three were particularly relevant to the design of learning experiences intended to stimulate creative production.

In an attempt to develop a theory of education from psychological and other basic research findings, Taylor and others identified five perspectives for viewing educational

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[49]Mary Louise Seguel, The Curriculum Field, Its Formative Years (New York: Teacher's College Press, 1966), cited by Arno A. Bellack, "A History of Curriculum Thought and Practice," Review of Educational Research, XXXIX, 3 (June, 1969), 283.

[50]National Education Association, Deciding What to Teach (Washington: NEA, 1963), p. 92.

programs.[51] One perspective was examined because it related most directly to creative productivity.

Frequently cited by Taylor was the work of Kubie, who stressed the importance of educational processes involving the learner in the solution of the problems of his environment. His view concluded that the great cultural processes have three functions: (1) to enable human nature to change, (2) to enable each generation to transmit to the next whatever wisdom gained about living, and (3) to free the creative potential latent in everyone.[52] Certainly the first and third of these had implications for the development of materials designed to stimulate creativity.

Newer Theoretical Implications

Gowan focused attention on Guilford's structure-of-intellect model and stated that the model was "particularly amenable to interpretations which suggest implications for creative learning."[53] He pointed out that the section of factor abilities labelled "divergent production" reflected

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[51]Calvin Taylor, et al., Development of a Theory of Education from Psychological and Other Basic Research Findings (Salt Lake City: University of Utah, 1964), p. 8.

[52]Taylor, Theory of Education, p. 25.

[53]John C. Gowan, "Some Newer Theoretical Implications for Creative Learning," Creativity: Its Educational Implications, eds. J. C. Gowan, G. D. Demos, E. P. Torrance (New York: John Wiley & Sons, Inc., 1967), p. 79.

a constellation of factors capable of stimulation through classroom experiences. He cited as examples such abilities as: "ideational fluency," "spontaneous flexibility," "associational fluency," "expressional fluency," and "originality."[54]

Gowan envisioned a hierarchy of cognitive abilities. He noted the tendency of teachers to teach the simpler skills of the hierarchy while neglecting the higher-level cognitive abilities. He expressed the concern that divergent thinking is often neglected in the educational process.[55] Meeker invested considerable effort in explicating Guilford's model. She showed how the model could be used to diagnose learning deficiencies and to develop and prescribe learning activities.[56]

Torrance listed five principles which he believed to be important in developing creative thinking.[57] He suggested that teachers and parents who follow these principles would assist in the development of creative potential

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[54]Gowan, "Creative Learning," p. 79.

[55]Gowan, "Creative Learning," p. 80.

[56]Mary Nacol Meeker, The Structure of Intellect: Its Interpretation and Uses (Columbus, Ohio: Charles E. Merrill Publishing Co., 1969), pp. 105-108.

[57]E. Paul Torrance, "Give the Devil His Dues," Gifted Child Quarterly, 5 (Winter, 1961), 117-8.

in their children. The principles were:

1. Be respectful of unusual questions.
2. Be respectful of unusual ideas of children.
3. Show children that their ideas have value.
4. Provide opportunities for self-initiated learning and give credit for it.
5. Provide for periods of non-evaluated practice or learning.

A subsequent study conducted by Enochs examined the efficacy of Torrance's five principles and found creative thinking can be fostered by applying these principles.[58]

CREATIVE THINKING AND LEARNING

The following paragraphs were a partial summary of the first chapter of a recent book titled Teaching for Thinking: Theory and Application.[59] The authors took issue with school programs which maintained that students must learn the facts first, and then be asked to think about them later. They held that students should compare and contrast different thoughts, events, and examples as they learn the facts. The authors proposed that thinking is a

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[58]Paul Enochs, "An Experimental Study of a Method for Developing Creative Thinking in Fifth-Grade Children," (unpublished Doctor's dissertation, University of Missouri, Columbia, 1964), p. 85.

[59]Lewis E. Raths, et al., Teaching for Thinking: Theory and Application (Columbus, Ohio: Charles E. Merrill Publishing Co., 1967), pp. 1-30.

way of learning and a way of acquiring relevant factual information.

In an attempt to more clearly delineate the act of thinking, they described a number of cognitive operations. A summary of the operations was listed below because of their relation to the creative process.

1. Comparing was to examine two or more objects, ideas or processes with the idea of seeing what relationships one has to another.
2. Summarizing was to state in brief or condensed form the substance of what has been presented.
3. Observing was to concentrate on details, substance or procedures.
4. Classifying was to put into groups according to some principle.
5. Interpreting was to explain the meaning an object or event has to the observer.
6. Criticizing was to analyze and to make evaluations and judgments.
7. Identifying assumptions was to note statements which were taken for granted.
8. Imagining was to perceive in the mind what had not been wholly experienced.
9. Gathering and organizing data was to collect and collate findings.

10. Hypothesizing was to propose a possible solution to a problem.
11. Application of knowledge was to apply facts and principles in new situations.
12. Decision making was to apply knowledge for the purpose of determining an outcome.
13. Designing projects or investigations was to develop a plan or experiment.

The authors also listed aspects of human behavior reflecting inadequate experiences with thinking. They noted several behaviors which tended to curtail effective thinking and suggested that these behaviors could be altered as a result of a program which emphasized thinking. The behaviors that had a negative influence on thinking were listed as:

1. Impulsiveness (reaction on the spur of the moment);
2. Overdependence on the teacher;
3. Inability to concentrate;
4. Missing the meaning (failure to comprehend the central theme or idea);
5. Dogmatism (declarations in absolute terms and insensitivity to newness of expression and shades of meaning);
6. Rigidity (inflexibility to changes in routine, behavior or thinking);

7. Extreme lack of confidence in one's own thinking;
8. Unwillingness to think (dependence on others for structure and direction).

The authors (Raths, et al.) emphasized that this list was not all-inclusive. They held, however, that higher mental processes could not be developed without involving children and students in these types of thinking operations. They also maintained that effective thinking could not take place in the presence of a sizeable quantity of negative influences.

Suchman compared creative thinking and conceptual growth.[60] He pointed out that creative thinking had two definitive characteristics. First, the activity was autonomous and self-directed and secondly, the activity was directed toward the production of some new form. Conceptual growth was the expansion, elaboration, or other modifications of a conceptual framework. In addition, "teaching methods which permit the learner to operate autonomously in the search for new understandings utilize creative thinking to promote concept development."[61] He pointed out that creative thinking can be promoted as an aid to

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[60]J. Richard Suchman, "Creative Thinking and Conceptual Growth," Gifted Child Quarterly, 6 (Autumn, 1962), 95-99.

[61]Suchman, p. 98.

conceptual growth by making the teacher's role less directive and more responsive. This would encourage the teacher to help the learner focus on a problem, allowing him to gather data freely with the help but not the direction of the teacher.

CONDITIONS WHICH AFFECT CREATIVITY

A number of studies have been reported concerning environmental effects on creativity. Those discussed below were particularly concerned with children, adolescents, or the educational process.

Parental Influence

A study conducted by Ellinger examined the home environment and the creative thinking ability of children. She found that parents' interests and activities directly influence the interests and activities of highly creative children and that "Families of highly creative children involved their children in family activities to a greater extent than did families of less creative children."[62] Highly creative children were read to more often and were plentifully supplied with magazines, books, and reference

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[62]Bernice Dees Ellinger, "The Home Environment and the Creative Thinking Ability of Children" (unpublished Doctor's dissertation, Ohio State University, Columbus, 1964), p. 168.

materials. She noted that coersive discipline was negatively correlated with creative thinking and that girls seemed to be more directly influenced by home environment than were boys.

Sears also examined the influence of parents on the development of creativity in their children. She found that children who displayed heightened levels of divergent thinking came from homes where the parents expressed support and satisfaction with self and with child; there was a low degree of punishment, a low pressure for conformity, and a lack of intrusiveness.[63]

Risk-taking and Anxiety

Pankove noted the relationship between creativity and risk-taking in fifth grade children. She found that creativity bore a more powerful relationship to risk-taking than it did to intelligence.[64]

Two interesting studies have been conducted comparing creativity with anxiety and stress. Hadley found significant differences in creative performance depending

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[63]Pauline S. Sears, "The Study of Development of Creativity: Research Problems in Parental Annecedonts" (ERIC ED021279), p. 1.

[64]Ethel Pankove, "The Relationship Between Creativity and Risk Taking in Fifth-Grade Children" (ERIC ED010249), p. 110.

on the level of anxiety. He observed the highest level of creativity displayed with modest levels of anxiety. High and low levels of anxiety produced lower levels of creativity.[65] A similar study by Suedfeld and Vernon compared stress and verbal originality. They also observed a curvilinear relationship between verbal originality and stress.[66]

Maturation

Several fascinating longitudinal studies have been conducted by Torrance and his associates examining the relationship between creative performance and maturation.[67] Torrance found that from 45 to 61 per cent of his subjects showed significant slumps at the fourth grade level. Torrance identified several cultural influences supposedly responsible for the fourth grade slump in creativity.[68]

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[65] D. J. Hadley, "Experimental Relationships Between Creativity and Anxiety" (unpublished Doctor's dissertation, University of Michigan, Ann Arbor, 1965), p. 109.

[66] P. Suedfeld and J. Vernon, "Stress and Verbal Originality in Sensory Deprivation," Psychological Record, XV, 4 (1965), 567-570.

[67] J. C. Gowan and E. P. Torrance, "An Inter-Cultural Study of Non-Verbal Ideational Fluency," Gifted Child Quarterly, 9 (Spring, 1965), 29; see also E. Paul Torrance, "A Longitudinal Examination of the Fourth-Grade Slump in Creativity," Gifted Child Quarterly, 11 (Winter, 1968), 195-199.

[68] E. Paul Torrance, "Nurture of Creative Talents," Explorations in Creativity, eds. Ross L. Mooney and Tatter A. Razir (New York: Harper and Row Publishers, 1967), pp. 185-195.

Adverse cultural influences affecting creative development might have been success orientation, peer orientation, sanctions against questioning and exploration, misplaced emphasis on sex roles and divergency equated with abnormality.

Relevant Factors

In summarizing the literature regarding environmental conditions which affect creativity, Parnes stated, "There are many variables; almost everything is relevant."[69] In reviewing the research, Parnes found that an environment which asks for creative behavior and rewards it, promotes its development. He also observed that idea-seeking teachers generate an environment which is significantly more conducive to growth in student creative behavior.

Motivation

A key issue in any learning endeavor is motivation. Part of the research in this area is contradictory. Savoca observed the effect of rewards on the divergent thinking of very young children. He found that immediate material reinforcement had an overall enhancing effect on the

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[69]Sidney J. Parnes, "The Literature of Creativity Part II," Journal of Creative Behavior, I, 2 (Spring, 1967), 192.

divergent thinking of very young children.[70] Williams, however, came to the opposite conclusion in observing the reinforcement factors in creative performance of sixth grade students. He noted that an extended training program with reinforcement by the experimenter did not have the slightest effect on the development of the trait of originality.[71]

Torrance reported a positive relationship between competition and flexibility of responses on a product improvement task. He stated, "There was a fairly consistent tendency for children under competitive conditions to excel those under other conditions."[72] Adams offers an opposing view as a result of his study comparing the relative effects of various testing atmospheres on spontaneous flexibility. He found "competition tends to hamper spontaneous flexibility."[73]

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[70]A. F. Savoca, "The Effects of Rewards, Race, IQ and Socio-Economic Status on Creative Production of Preschool Children," (unpublished Doctor's dissertation, Louisiana State University, New Orleans, 1965), p. 34.

[71]Frank E. Williams, "Practice and Reinforcement as Training Factors in Creative Performance" (unpublished Doctor's dissertation, University of Utah, Salt Lake City, 1965), p. 124.

[72]Torrance, Creative Behavior, p. 147.

[73]John C. Adams, "The Relative Effects of Various Testing Atmospheres on Spontaneous Flexibility, A Factor of Divergent Thinking," The Journal of Creative Behavior, II, 3 (Summer, 1968), 193.

In his article, "Creative Thinking and Conceptual Growth," Suchman described briefly his inquiry training method. He stated that the key elements of this approach were the responsive environment, and the freedom given the children to operate within it. He considered the responsive environment, coupled with a child's native curiosity, to be the motivating factors in his program. He further defined "responsive environment" as an environment which gives the learner freedom to operate in his own way, at his own pace, without extrinsic rewards and pressures.[74]

In discussing the motivation for creativity, Carl Rogers emphasized that the mainspring for creativity is "man's tendency to actualize himself, to become his potentialities."[75] Rogers held that man has an innate drive to express and activate all his capacities. He believed that man lives in a hostile society and as a result needs to build psychological defenses to protect himself from the hostilities. Some of these defenses have the effect of destroying his native creative ability.

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[74]Suchman, "Creative Thinking," pp. 96-97.

[75]Carl R. Rogers, "Toward a Theory of Creativity," A Sourcebook for Creative Thinking, eds. Sidney J. Parnes and Harold F. Harding (New York: Charles Scribner and Son, 1962), p. 66.

A general achievement motive is reported by Alpert.[76] The author reviewed the works of other researchers and suggested that achievement motivation in children is related to (1) the amount of contact between parent and child, (2) the intensity and stability of the effective bond between parent and child, (3) the extent of the use by parents of psychological techniques of reward and punishment, and (4) the degree and age of independence training.

Alpert went on to observe, "It appears that those people who are not successful in terms of tangible achievement products are not lacking in motivation; they lack nonthreatening opportunities to express the motive."[77] He articulated concern that routes to achievement of success in the school are dwindling and that the educational process is increasingly limiting its rewards to the lower levels of cognitive functioning.

Groups Versus Individuals

The research on the question of group versus individual settings for creative productivity also failed to

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[76]Richard Alpert, "Motivation to Achieve," Productive Thinking in Education, eds. M. J. Aschner and C. Bish (Washington: The National Education Association, 1965), p. 109.

[77]Alpert, "Motivation," p. 111.

find consensus regarding the suitable milieu.

A study conducted by Dunnette and others compared individual and group effectiveness in "brainstorming." (Brainstorming is a group creative process.) The author found "individuals produced . . . more ideas than groups . . . without sacrificing quality."[78] Another study by Cohen and others compared brainstorming by groups and pairs. They found brainstorming by pairs to be more effective.[79]

A third study conducted by Taylor and others on the same topic observed a significant difference in favor of the groups.[80] In addition the fourth study in this series, conducted by Zagona and others, examined group effectiveness in creative problem-solving tasks. They concluded, "In experiments that compared individuals to groups in creative problem-solving ability, the evidence tipped the

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[78]M. D. Dunnette, J. Campbell, and K. Jaastad, "The Effect of Group Participation on Brainstorming Effectiveness for Two Industrial Samples," Journal of Applied Psychology, XLVII, 1 (1963), 36.

[79]D. Cohen, I. W. Whitmyer, and W. H. Funk, "Effective Group Cohesiveness and Training Upon Creative Thinking," Journal of Applied Psychology, XLIV (1960), 322.

[80]D. W. Taylor, P. C. Berry, and C. H. Block, "Does Group Participation While Using Brainstorming Facilitate or Inhibit Creative Thinking?" Technical Report No. 1 (prepared under contract No. 609-2-NR150-166 for Office of Naval Research, New Haven, Connecticut: Yale University, 1957).

scales in favor of the groups, though not on man-hour measures."[81]

Apparently, in some unidentified circumstances, individuals working by themselves produce the greatest number of creative ideas and products. Conversely, under other circumstances a group effort appeared to be the most productive.

Deferred Judgment

Parnes summarized fourteen studies which were concerned with the principle of deferred judgment. He observed that twelve of the fourteen studies demonstrated that more ideas and more high quality ideas were produced when subjects deferred evaluation of the ideas temporarily. It seemed, "Deferred judgment frees the adult from anxieties about his ideas, and thereby results in greater release of creative potential."[82]

Parnes also cited the work by Cartledge and Krauser which examined the principle of deferred judgment with

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[81]S. V. Zagona, J. E. Willis, W. J. MacKinnon, "Group Effectiveness in Creative Problem Solving Task: An Examination of Relevant Variables," Journal of Psychology, LXII, 1 (1966), 134.

[82]Parnes, "Creative Literature Part II," p. 198.

children.[83] These researchers found no difference between deferred judgment and conventional thinking. Parnes concluded, ". . . young children will produce original ideas whether encouraged to or not. They have not yet learned to fear their ideas as adults do." Parnes also noted, "In the relatively uninhibited child, the release [of ideas] is evidently more natural. The internal governor has not yet fully been established."[84] Such a comment was implicitly a serious indictment of our culture and the educational process.

TEACHING FOR CREATIVE THINKING

Many studies have been conducted which examine various techniques for stimulating creative thinking. Summarized below are a portion of these studies especially exphasizing programs designed for elementary children.

A study by Cartledge and Krauser examined first grade children who had scored low on a screening test of creativity and were given experiences designed to stimulate creativity. Posttest scores revealed significant differences

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[83] C. J. Cartledge and E. Krauser, "Training First Grade Children in Creative Thinking Under Quantitative and Qualitative Motivation," Journal of Educational Psychology, LIV, 6 (1963), 295-299.

[84] Parnes, "Creative Literature Part II," p. 198.

when compared with the control group.[85]

Hutchinson researched creative and divergent thinking in the classroom.[86] His objective was to determine which thinking and learning processes would be elicited in students by certain modifications of teaching models. Guilford's model of the structure-of-intellect was used to generate a system for classifying different teaching methods. The four teachers who participated in the study each taught one experimental and one control group.

The findings and conclusions of this study indicated gains on measures of creativity for the treatment groups were significantly greater than for the control groups on four of ten measures. Further, students who scored high in creativity did not have an opportunity to use their creative potential in control classrooms.

Programmed Lessons

Olton examined development of productive thinking skills in fifth and sixth grade children through self-instructional programmed lessons. He observed significant

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[85]C. J. Cartledge and E. Krauser, "Training First Grade Children," pp. 295-299.

[86]William L. Hutchinson, "Creative and Productive Thinking in the Classroom," Journal of Creative Behavior, I, 4 (Fall, 1967), 419-427.

gains in creative thinking and problem solving.[87] Similar results were obtained by Krauser who also experimented with programmed instruction.[88]

Parnes experimented with ways of programming creative behavior. His study concerned audio instructional materials designed to develop creative behavior. He concluded that experimental students "made better gains than did the control students."[89]

Another study which concerned the development of creative problem solving abilities through programmed instruction was conducted by Treffinger and Ripple. They examined the effects of Crutchfield's Productive Thinking Program in bringing about changes in verbal creative thinking abilities and creative problem solving.[90] The

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[87]Robert M. Olton et al., "The Development of Productive Thinking Skills in Fifth-Grade Children" (ERIC ED021312), p. 3.

[88]Arthur W. Krauser, "An Investigation of the Development of Abstract Thinking in Children Through Programmed Instruction (unpublished Doctor's dissertation, University of Rochester, Rochester, 1964), p. vi.

[89]J. S. Parnes, Programming Creative Behavior (Abstract of research supported by a grant from the U. S. Department of Health, Education and Welfare, U. S. Office of Education: Title 7, Project No. 5-0716).

[90]Donald Treffinger and Richard E. Ripple, "Developing Creative Problem Solving Abilities and Related Abilities Through Programmed Instruction," Journal of Creative Behavior, III, 3 (Spring, 1969), 105-110.

conclusion was that:

> . . . the results of this study offer no support for the effectiveness of the instructional materials with respect to the development of pupils' verbal creative thinking abilities at any of the four grade levels reported.[91]

The authors pointed out that these results were consistent with previous studies, not reported above, which used an abbreviated form of the experimental materials with eighth grade pupils. In that study, no significant differences between the instructed and control pupils on creative thinking measures were observed.[92]

Crutchfield reported on two other major studies which have been conducted concerning the effectiveness of programmed materials for stimulating creative thinking.[93] His findings do not support the conclusions reported above. He stated that the findings were clear; "the trained children showed a marked superiority in performance over the control children."[94] He went on to say, "It is manifest then that the audio instructional program does succeed in improving proficiency in creative problem solving, [and] the divergent thinking task adapted from

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[91]Treffinger, p. 109. [92]Treffinger, p. 110.

[93]Richard S. Crutchfield, "Instructing the Individual in Creative Thinking," The New Approach to Individualizing Instruction (Princeton, New Jersey: Educational Testing Service, 1965), p. 22.

[94]Crutchfield, "Thinking," p. 22.

Torrance shows similar positive results."[95] He concluded, "There is wide-spread generalization of the effects of the training lessons to the enhancement of imaginative and inventive processes in the individual."[96]

Guilford's Model as a Theoretical Framework

A criticism of the Productive Thinking Program was that it was ". . . not derived from any particular theoretical position."[97] Several authors have suggested that Guilford's model of the structure-of-intellect might be used to generate instructional methods and materials.

Parnes and Brunelle reviewed the literature of creativity and concluded,

> The need also appears great for designing and carrying out a full-scale evaluative experiment that would use and integrate all the known approaches to the development of creative intellectual behavior. Guilford's structure-of-the intellect might provide the theoretical framework for such an experiment.[98]

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[95] Crutchfield, "Thinking," p. 22.

[96] Crutchfield, "Thinking," p. 23.

[97] Treffinger, "Problem Solving," p. 105.

[98] Sidney J. Parnes and Eugene Brunelle, "The Literature on Creativity (Part I)," Journal of Creative Behavior, I, 1 (Winter, 1967), 57.

Meeker has recently published an extensive explication of Guilford's model. She stated that the structure-of-intellect model can be used in planning curriculum and for assessing educational needs. Chapter seven of her book is devoted to the section of Guilford's model which deals with divergent production. The chapter contains many suggestions for developing learning materials designed to stimulate creative thinking.[99] Although the creative thinking kits developed for this study were conceived prior to publication of this book they very closely parallel the activities proposed by Meeker.

Guilford himself proposed that the structure-of-intellect model might well be used to develop materials designed to stimulate intellectual growth.

> The structure-of-intellect offers a broad and systematic taxonomy of behavior and novel behavior may touch upon almost any aspect of it. Thus, I cannot help urging that a plan for creativity training should be sufficiently broad to take into account all potentially useful intellectual contributions.[100]

Aschner and Bish gave additional support to this position in their statement:

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[99]Mary Nacol Meeker, The Structure of Intellect: Its Interpretation and Uses (Columbus, Ohio: Charles E. Merrill, 1969), pp. 86-99.

[100]J. P. Guilford, "Basic Problems for Teaching Creativity," Instructional Media and Creativity, ed., C. W. Taylor (Salt Lake City: University of Utah Press, 1967), p. 76.

> It is our belief that the classroom teacher, once equipped with the kind of conceptual framework that Guilford's structure-of-intellect model affords, can move ahead on his own in developing new ways of bringing thinking into the service of learning.[101]

A more extensive examination of Guilford's structure-of-intellect model and its relation to teaching was given later in this chapter.

Recommendations for Stimulating Creative Thinking

In commenting about the implications of his research for the teaching-learning process, MacKinnon suggested that activities which stressed the use of analogies, similes, metaphors, symbolic equivalents of experience in a variety of sensory experiences, would promote development of divergent thinking.[102]

Hallman stated, "Research literature supports the position that creativity indeed can be taught, but cannot

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[101] Mary Jane Aschner and Charles E. Bish, "Implications for Teaching," eds., Aschner and Bish, Productive Thinking, p. 42.

[102] MacKinnon, "Implications for Teaching," p. 92; see also MacKinnon, "Nature of Creative Talent," p. 494.

be taught by traditional authoritarian methods."[103] He suggested that creative teaching was the best way, and perhaps the only way, to promote creative behavior in pupils. He listed twelve ways in which teachers could help nurture creativity in their classroom:[104]

1. Provide for self-initiated learning on the part of the pupils;
2. Develop nonauthoritarian learning environments;
3. Encourage pupils to over-learn; to saturate themselves with information, imagery, and meanings;
4. Encourage creative thought processes (To seek new connections among data, to associate, imagine, think up hypotheses, make wild guesses and to build on the ideas of others.);
5. Defer judgment of students' efforts;
6. Promote intellectual flexibility among the students;
7. Encourage students to evaluate their progress;
8. Encourage students to become more sensitive persons;

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[103]Ralph J. Hallman, "Techniques of Creative Thinking," Journal of Creative Behavior, I, 3 (September, 1967), 327.

[104]Hallman, "Creative Teaching," pp. 327-330.

9. Make effective use of questions;
10. Provide opportunities for students to manipulate materials, ideas, concepts, tools and structures;
11. Assist the students in coping with frustration and failure;
12. Urge pupils to consider problems as wholes.

Finally, Gallagher summarized an extensive discussion on teaching creativity by stating:

> First of all, it is not useful to talk about teaching for productive thinking or creative thinking. The terms are too broad and too inclusive to allow the teacher or educator to develop anything very specific in the way of curriculum. On the other hand, it does seem feasible for the teacher to develop certain kinds of specific intellectual skills which cover a narrow range of activities. To do this the teacher must have some model or structure of intellectual process at hand.[105]

Teacher Characteristics

An interesting study was conducted by James, who examined the relationship of teacher characteristics and pupil creativity. In this study, James administered a number of tests to twenty seventh grade teachers and their students. These tests included a personal-social motivation inventory, a creative attitude scale, an art scale,

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[105]James J. Gallagher, Teaching the Gifted Child (Boston: Allyn Bacon, 1964), p. 206.

a psychological inventory, and creative thinking tests.

The researcher found that boys in classes of the highly creative teachers differed significantly from those in classes of less creative teachers on elaboration, originality, fluency, nonverbal, and total creativity scores. Girls in classes of the highly creative teacher differed significantly from those in classes of less creative teachers on curiosity, verbal tasks, fluency, elaboration and nonverbal tasks. She also compared highly creative teachers with less creative teachers on a number of personality and psychological variables. She found that the less creative teacher was significantly more dominant than the high creative teacher.[106]

Another study by Otte concerned reactions of elementary school teachers and principals to various factors that promote and hamper creativity in teaching. He identified thirteen factors which foster creativity in teaching and nine factors which hamper creativity in teaching.[107]

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[106] G. R. James, "The Relationship of Teacher Characteristics and Pupil Creativity," (unpublished Doctor's dissertation, University of North Carolina, Chapel Hill, 1962), p. 115.

[107] R. W. Otte, "The Reactions of Elementary School Teachers and Principals in Indiana Public Schools Study Council System to Various Factors that Foster and Hamper Creative Teaching" (unpublished Doctor's dissertation, University of Colorado, Boulder, 1964), pp. 182-188.

He concluded that principals should develop skill in releasing creative potential from teachers, and decrease the pressure for conformity and rigid daily schedules. In addition, Otte observed that school principals should develop a helpful attitude toward creativity, eliminate restrictive administrative policies, depart from routine procedures, and experiment with novel teaching methods. He also noted a need for teachers to be free from traditional textbook coverage expectations, to accept suggestions that encourage teacher initiative, to develop empathy and rapport with the principal, and to work to eliminate negative attitudes by other teachers towards creative thinking.[108]

Finally, a study conducted by Wodtke and Wallen, reported in 1965, examined the relationship between classroom control, pupil creativity, and pupil classroom behavior. These researchers concluded:

> Until further research has been completed, judgments as to the comparative effectiveness of permissive versus direct teaching for accomplishing such objectives as the development of pupil achievement, creativity, problem solving, etc., must be regarded in most cases as pure conjecture, and at best as judgments based on tentative findings.[109]

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[108] Otte, p. 194.

[109] K. H. Wodtke and N. E. Wallen, "Teacher-Classroom Control, Pupil Creativity, and Pupil-Classroom Behavior," Journal of Experimental Education, XXXIV, 1 (1965), 63.

Programs for Developing Creativity

In his review of the literature of creativity for the first volume of the Journal of Creative Behavior, Parnes examined over forty studies which evaluated programs for teaching students to improve their sensitivity, fluency, flexibility, originality, elaboration, and other related areas. He found that these investigations concerned students ranging in ability from retarded to gifted and from first grade through college. He reported that the evaluations of these teaching attempts indicated fairly consistent success. A few studies were reported which required considerable transfer or unusual training methods; these attempts proved to be less successful.[110]

A recent publication by Parnes listed twenty-seven representative programs or techniques which were designed to stimulate creative behavior.[111] The list included:

1. Awareness Development, a program to increase the individual's sensitivity to what is going on within himself and how he relates to the here and now.

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[110]Parnes, "Literature on Creativity, Part I," p. 54.

[111]Sidney J. Parnes, Creative Behavior Guidebook (New York: Charles Scribner's Sons, 1967), pp. 300-302.

2. Biographical Film Program, an educational film program which provided contact with exemplary personalities and opportunity to draw from the student's own inner resources to express himself.
3. Brainstorming, a technique which developed ideas through group discussion and deferrment of judgment.
4. Creative Analysis, a program of exercises designed to increase the college student's facility in discovering relationships within the knowledge he possesses.
5. Creative Thinking Workbook, a program for adults and college students in which exercises are designed to remove internal governors and to provide practice in stretching the imagination in problem finding and problem solving.
6. General Semantics, an approach which helped individuals to discover multiple meanings or relationships in words or expressions.
7. Problem Solving Training, a program on problem solving skills for bright first graders which consisted of games presented by the teacher for individual instruction.
8. Productive Divergent Thinking Model, an approach designed to help elementary teachers

integrate factors of fluency, flexibility, and originality in the teaching of subject matter.

9. Productive Thinking Program, a self-instructional program for upper elementary grades which attempted to increase the number of elements considered in problem solving.
10. Self-instructional course in applied imagination, a programmed set of twenty-nine self-instructional booklets for improving creative behavior.
11. Torrance's Programmed Experiences, exercise books, recorded activities and biographical recordings about creative people designed to provide examples, stimulus and opportunities for making fresh, imaginative associations, developed for elementary school children.
12. The Young Thinker, a series of more than fifty projects and exercises designed for children five to ten which can be used by individuals or by groups.

GUILFORD'S STRUCTURE-OF-INTELLECT MODEL

A number of authors have suggested that the structure-of-intellect model could appropriately be used for a variety of educational purposes. Guilford declared, "The structure-of-intellect offers a broad and systematic

taxonomy of behavior. . . ."[112] Aschner and Bish stated that the model could assist teachers in ". . . developing new ways of bringing thinking into the service of learning."[113]

Gowan examined the structure-of-intellect model and observed that creative individuals were probably individuals who had an unusual facility in the divergent thinking aspects of intelligence. He noted that intelligence appeared to be multi-dimensional and partly affected by environment. He suggested the role of experience is important and that the stimulation of factors of intellect is worthwhile.[114]

In discussing intellectual characteristics appearing to have a relationship with creative performance, Taylor noted that divergent production factors, including fluencies and flexibilities, seemed to be most important.[115] Torrance noted, however, that ". . . creative thinking cannot be equated with divergent thinking."[116]

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[112]J. P. Guilford, "Basic Problems in Teaching for Creativity," Instructional Media, ed. Taylor, p. 76.

[113]Aschner and Bish, Productive Thinking, p. 42.

[114]Gowan, "Four Theories," p. 4.

[115]C. W. Taylor, Creativity: Progress and Potential (New York: McGraw-Hill Book Co., 1964), p. 179.

[116]Torrance, Creative Behavior, p. 5.

He said that creativity involves a redefinition of ability and sensitivity to problems. He observed that the redefinition ability involves transformations of thought, reinterpretations, and freedom from fixedness. These intellectual operations appear to be outside the category of divergent thinking.

Gallagher denied the utility of talk about teaching for productive thinking or creativity. He noted that the terms are too broad and too inclusive to allow the teacher to develop anything specific in the way of curriculum.[117] He did suggest, however, that Guilford's model could be used to develop certain kinds of specific intellectual skills which cover a narrow range of activities.

The Model

Guilford's work provided a substantial base for the development of the materials for this study. His work is reported on more extensively here because of its importance to the study.

For over two decades, J. P. Guilford has conducted a project concerned with cognitive abilities. This project, The Aptitudes Project, developed a model which attempted to predict the various factors of intellect. The model organized the known intellectual abilities into a system;

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[117]Gallagher, Teaching Gifted, p. 206.

the structure-of-intellect.[118] Guilford stated that factors of human intelligence can be classified in three different ways. One taxonomy is related to the kind of process or operations performed. This type of classification generated five groups of intellectual abilities; cognition (discovery or recognition), memory, convergent thinking, divergent thinking, and evaluation.

A second taxonomy of intellectual factors referred to the kind of materials or contents involved. These factors were titled figural (figures, diagrams, etcetera), symbolic (symbols), or semantic (language) and behavioral (actions, mannerisms, etcetera).

A third way of classifying the factors of intellect related to the kinds of products involved. The six kinds of products were: units, classes, relations, systems, transformations, and implications.

The four content designations, the five operation designations, and the six product designations can be inscribed on the three perpendicular planes of a cube. The intersection of any three of these dimensions describes one type of intellectual operation.

For example, figural (content), memory (operation), and unit (product) intersect to form one type of intellectual

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[118] J. P. Guilford, "Three Faces of Intellect," American Psychologist, XIV, 8 (August, 1959), 469-479.

operation. (See Figure 1.)

The intersections (four contents, five operations, six products) generated 120 different types of intellectual operations. Guilford's model, therefore, predicted 120 different types of intellectual operations which comprise "intelligence."

Our interest in Guilford's model was concerned with the section labeled divergent thinking. The twenty-four cells of the divergent thinking section were examined more closely in chapter three which dealt with the development of the materials.

Using Guilford's Model

Williams described an attempt to develop an instructional model which incorporated Guilford's system.[119] Williams proposed a three-dimensional model for manipulating information transmitted by audiovisual stimuli for the purpose of evoking creative behaviors.

Hutchinson examined the feasibility of an educational theory based on intellectual factors, thinking, learning processes, and the structure-of-intellect. He also attempted to determine which processes were elicited by

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[119]Frank E. Williams, "Models, Summary Lists of Trainable Ideas and Research Areas," Instructional Media, ed. Taylor, pp. 358-361.

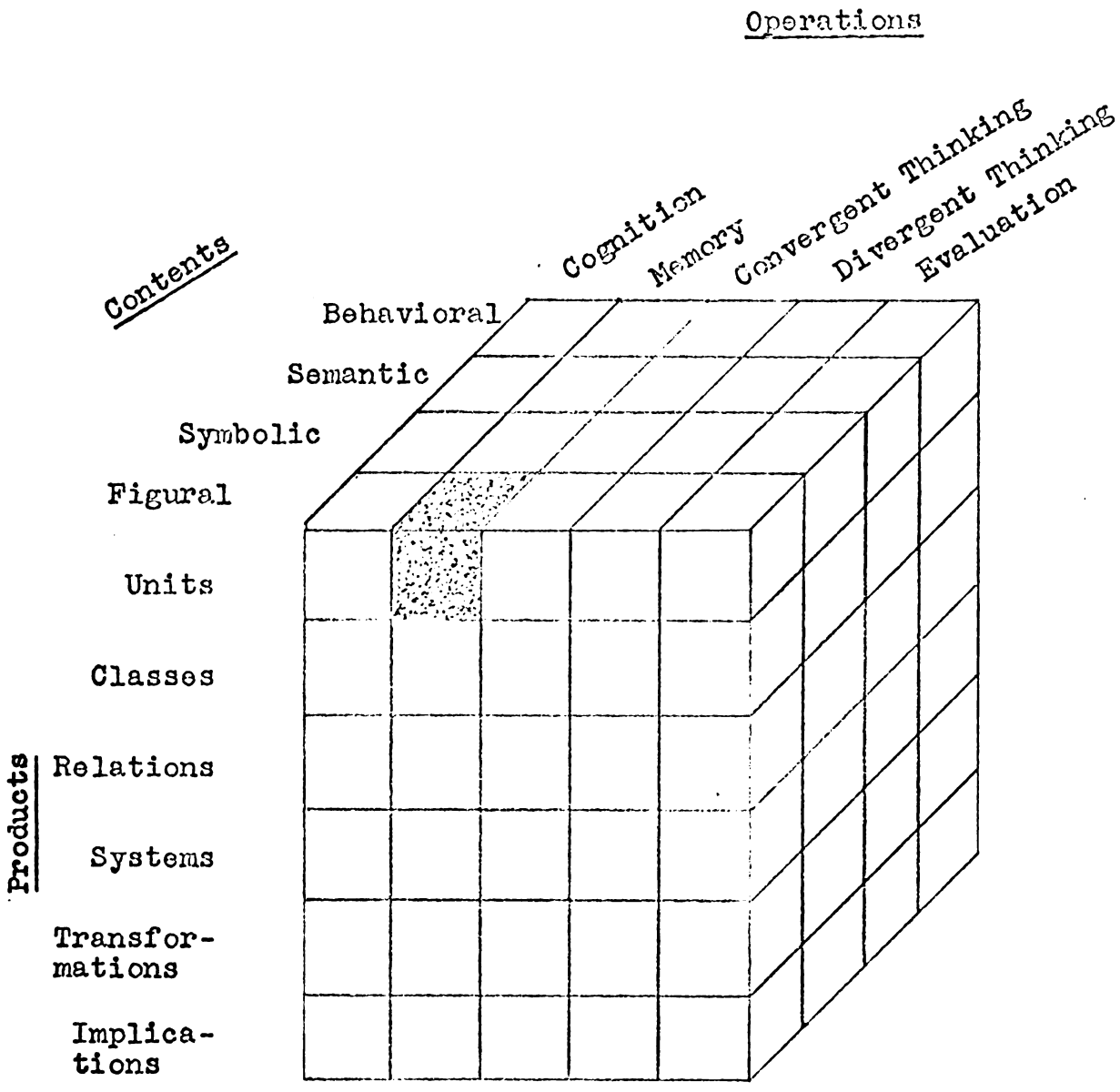

Figure 1

Cubical Model Representing the Structure-of-Intellect

Revised from J. P. Guilford, "Three Faces of Intellect," American Psychologist, XIV, 8 (August, 1959), 469-479.

certain teaching practices.[120]

Knight used Guilford's model to develop learning experiences in the areas of fluency, flexibility, and originality. He concluded, "The highly significant gains made by the experimental groups on tasks of the posttest offers substantial evidence that the training program was effective."[121] He went on to note that pupils can be treated to become more fluent, flexible, and original in their thinking.

These studies indicated that the model has been used successfully to develop methods or materials designed to stimulate creative thinking.

SUMMARY OF THE RELATED RESEARCH

Five categories of literature have been examined in this chapter. They were: (1) theories and the creative process, (2) the individual and the creative act, (3) conditions which affect creativity, (4) teaching for creativity, and (5) developing methods and materials using Guilford's model.

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[120]William L. Hutchinson, "Creative and Productive Thinking," Journal of Creative Behavior, I, 4 (Fall, 1967), 419-427.

[121]Don Alma Knight, "Fluency, Flexibility, and Originality Training as Related to Creativity" (unpublished Master's thesis, University of Utah, Salt Lake City, 1962), p. 133.

Creative Process

Steps of the creative process were noted to be a sequence which included preparation, incubation, illumination, and verification. A system for classifying levels of creative performance was identified.

Creative Traits

Summaries of traits of creative individuals included low authoritarian values, independence, tolerance for ambiguity, more intuitive and highly motivated. A lack of correlation was noted for creativity and intelligence above 120 IQ levels. A number of authors expressed the belief that all individuals are creative to varying degrees.

Theory

In discussing instructional theories, authors and researchers expressed reservations about direct teaching of creativity although they suggested that learning settings could be controlled to enhance creative performance. It was toward this end that the remainder of the literature of this chapter was considered. Thought processes were examined and the relationship to creative thinking noted. A number of studies, which examined the relationship between environmental conditions and creativity, have shown that environment could have a marked effect on

creativity.

Stimulating Creative Thinking

Studies were reviewed which attempted to increase creative performance by a variety of techniques. Attempts to alter behavior, develop self-instructional materials and the use of audio tapes all appeared to be successful in improving creative thinking.

Finally, several of the ways of using the structure-of-intellect model were considered. It was shown to be effective in analyzing teaching strategies and the development of groups of learning experiences.

Chapter 3

IMPLEMENTATION OF THE STUDY

> If we do want the benefits of creativity, we ought to have the wisdom to teach it where it is wanting, to encourage it where it shows signs of developing, and--at the very least--to tolerate it where it threatens to disrupt our comfortable status quo. (Hader, 1966)

PHILOSOPHY OF THE CREATIVITY MATERIALS

The materials designed for this study were generated from the assumptions that: (1) all children are to some degree creative, (2) proper experiences can improve creative performance, (3) individualized instruction is a valuable educational method, and (4) children should have periods of nonevaluated practice and learning. As the creativity materials were developed, these assumptions were regarded and the materials in their present form reflect this philosophical base.

DEVELOPMENT OF MATERIALS

The development of the creative thinking materials followed a prescribed sequence of events. The literature was reviewed to determine (1) the theories, process, and stages of creativity, (2) the nature of creative persons (3) thinking skills, environmental conditions, and

instructional theories which affect creative thinking, (4) the relative success of various teaching programs, methods, materials, and motivation techniques in stimulating creative thinking, and (5) models for developing instructional materials.

Guilford's model of the structure-of-intellect was selected for use in the development of the materials because the model described basic components of intellect and suggested that creativity is associated with specific intellectual components.

Divergent Thinking

The divergent thinking section of the structure-of-intellect model contained twenty-four cells. There were six cells in each of the four content sections. (See Figure 2.) The content sections consisted of: figural, symbolic, semantic, and behavioral sections. Each of these sections consisted of six cells; units, classes, relations, systems, transformations, and implications. Together the four groups of six cells specify twenty-four types of divergent intellectual abilities.

These intellectual abilities include such components as figural fluency, word fluency, ideational fluency, expressional fluency, adaptive flexibility, and symbolic elaboration.

	Units	Classes	Relations	Systems	Transformations	Implications
Figural	To produce many figures conforming to simple specifications	To group figural information in different ways	To generate relations between figural items	To produce composites of figural information	To produce figural information in revised ways	To elaborate on figural information
Symbolic	To produce symbolic units which conform to simple specification not involving meanings	To group items of symbolic information in different ways	To relate symbols in different ways	To organize sets of symbolic information into different systematic arrangements	To generate solutions by transforming well-known operations	To produce implications from given symbolic information
Semantic	To produce elementary ideas appropriate to given requirements	To produce categories of ideas appropriate in meaning to a given idea	To produce relationships appropriate in meaning to a given idea	To organize words in meaningful complex ideas	To produce unusual responses involving reinterpretation of an object or situation	To produce antecedents, concurrents or consequents of given information
Behavioral	To produce elementary behaviors conforming to simple specifications	To produce categories of behavior	To generate relations between given behaviors	To organize behaviors into meaningful systems	To transform a stimulus into behavior	To develop implications from behavioral information

Figure 2

Divergent Thinking Section of the Structure-of-Intellect Model*

*Revised from Mary Nacol Meeker, The Structure of Intellect: Its Interpretation and Uses (Columbus, Ohio: Charles E. Merrill Publishing Co., 1969), pp. 87-99.

Developing Creativity Materials

A number of sources were surveyed for the purpose of identifying learning activities which would fit the divergent thinking section. (A list of sources is given in Appendix A.)

Following a review of the programs and materials available for stimulating creativity, activities were modified and developed for the twenty-four categories of divergent thinking. In the final set, nineteen activities involved figural content, twenty-one activities involved symbolic content, seventeen activities involved semantic content, and thirteen activities involved behavioral content. The total of seventy activities was drawn from the areas of art, dramatics, language arts, music, mathematics, science, and social studies. (Titles of activities classified according to Guilford's categories were given in Appendix B.)

The creative thinking materials were packaged in twenty-four boxes with one box for each of the twenty-four categories of the model. Each box contained from one to four activities. The activities were used by individuals and in small groups of students. An attempt was made to design parallel forms of some of the activities for girls and for boys.

The activities were open-ended in that there were many "correct" answers and children could pursue several

different routes to a solution. (Examples of the activities are given in Appendix C.)

Student's Instructions

In the student's instructions, a short description of creativity was offered. The student was encouraged to think of unusual and different ways of completing the activities. The students evaluated their own work and determined when each activitity had been completed. The students were also informed that the teacher would not grade or evaluate their work unless they requested the teacher evaluate their efforts.

The student's instructions also contained information about the logistics of borrowing materials and accumulating the products of the activities. The instructions were designed to stimulate interest and to motivate the student to undertake the activities. (See Appendix D for Instructions to Students.)

Teacher's Materials

The teacher's manual consisted of a narrative portion and the activity pages for all activities. The narrative portion provided a brief review of the research literature related to creative thinking. In addition, the creative process, the importance of providing creative learning opportunities and types of classroom milieu which affect creativity were described. Also included were

relevant aspects of motivation, deferred judgment and individualized instruction.

Moreover, five principles which were thought to be important in developing creative thinking were stressed.[1]

1. Be respectful of unusual questions.
2. Be respectful of unusual ideas of children.
3. Show children that their ideas have value.
4. Provide opportunities for self-initiated learning and give credit for it.
5. Provide for periods of nonevaluated practice and learning.

The teacher was asked to not make value judgments of the student's work unless the student made a specific request that his work be evaluated. (See Appendix E for the narrative portion of the teacher's manual.)

DESIGN OF EXPERIMENT

The principal question regarding the materials was: Do the materials stimulate creative thinking? The data required to answer this question were sought from the administration of the Torrance Tests of Creative Thinking. Additional subjective evidence was obtained through questionnaires and class observations.

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[1] E. Paul Torrance, "Give the Devil His Dues," Gifted Child Quarterly, 5 (Winter, 1961), 117-118.

Hypotheses Tested

To obtain objective data it was necessary to divide creative productivity into its constituents and to examine the parts directly.[2] The objective evaluation of the materials was, therefore, limited to the degree to which the materials and milieu created by them alter the creative thinking components of fluency, flexibility, originality and elaboration.

Seven hypotheses were tested in an effort to determine the efficacy of the materials. The hypotheses were:

1. The treatment group would score significantly higher on measures of verbal fluency than would the control group.
2. The treatment group would score significantly higher on measures of verbal flexibility than would the control group.
3. The treatment group would score significantly higher on measures of verbal originality than would the control group.
4. The treatment group would score significantly higher on measures of figural fluency than would the control group.

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[2]James J. Gallagher, Teaching the Gifted Child (Boston: Allyn Bacon and Co., 1964), p. 206.

5. The treatment group would score significantly higher on measures of figural flexibility than would the control group.
6. The treatment group would score significantly higher on measures of figural originality than would the control group.
7. The treatment group would score significantly higher on measures of figural elaboration than would the control group.

Population

The population for this study was a sixth grade class of students in the Metcalf Laboratory School at Illinois State University. This group of students could be considered to be a subset of a larger and unspecified population which has similar socioeconomic, intellectual and motivational characteristics. The group consisted of twenty-four students of which thirteen were boys and eleven were girls. Twenty-three of the students were Caucasian and one Oriental. Most of the students were from middle class homes and many of their parents had at least some college training. The treatment group included six boys and six girls. The control group consisted of the remaining seven boys and five girls. The ages of the students ranged from 11 years 7 months to 12 years 5 months with a median age of 12 years on May 10, 1970.

The Lorge-Thorndike Intelligence Test, Form I, Level A, was administered to the class in March 1967. The median intelligence quotient was 107 verbal and 113 nonverbal with a range from 92 verbal and 65 nonverbal to 136 verbal and 138 nonverbal.

Achievement test scores were available for the Iowa Test of Basic Skills, Form W, and the Stanford Achievement Test, Intermediate II, Battery Form. The median total test score for the group on the Iowa Test was 8.0 grade level with the range from 4.1 grade level to 9.9 grade level. The test was administered in October 1969 when the grade equivalent was 6.1. The Stanford Achievement Test revealed grade level class medians of 8.8 for word meaning, 7.9 paragraph meaning, 7.5 spelling, 7.9 language, 6.5 arithmetic computation, 6.7 arithmetic concepts, 7.1 arithmetic applications, 8.1 social studies and 8.8 science. The test was administered in May 1970, when the grade equivalent of the group was 6.8.

Experimental Design

The experimental design compared achievement gains for treatment and control groups through an analysis of covariance.

All children were administered creativity achievement tests to obtain pretest data prior to treatment. The children were then randomly assigned to two groups, using

a stratified random sampling technique. One group was randomly chosen to be the treatment group while the other group was retained as the control.

The children in the control group received science instruction for forty minutes a day, three days per week, for one semester. The treatment group was provided thirty class periods during one semester in which they were permitted to work on the creativity activities. Some children in the treatment group elected to work on science during several of the creativity class periods. A few students in the treatment group who indicated a desire for more time to work on the activities were permitted to do so outside of class. The students in the treatment group received science instruction on the average of one period each week for the semester.

Both groups of children occupied the same classroom during the time the treatment group worked with the creativity materials. The researcher taught both the treatment and control groups. Other aspects of the curriculum for the two groups remained unaltered.

Following treatment, creativity achievement tests were again administered to both groups. Pretest and posttest scores were compared for the two groups through an analysis of covariance. Gains in achievement which accrued during the intervening time period were identified by this procedure.

Analysis of Covariance

In general terms, analysis of covariance takes account of pretest scores when comparing the posttest scores of two groups. In other words, the analysis of covariance controls for differences which may be present in the groups prior to treatment while assessing differences between the group following treatment. Although random assignment of students to groups would normally eliminate the need for controlling for differences existing prior to treatment, the fact that the groups were small (N = 12) suggested that the covariance procedure was a prudent choice.

In an article discussing the appropriate application of the analysis of covariance procedure, Elashoff described the type of experiment for which analysis of covariance is appropriate.[3] She suggested that a number of individuals be selected at random from a population of interests. A measurement is then made on each individual. This measurement is referred to as the pretest or the covariant. Individuals are then assigned to one of two or more treatment conditions. After treatment has been applied, a posttest or criterion measure is made for each individual.

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[3]Janet D. Elashoff, "Analysis of Covariance, A Delicate Instrument," American Educational Research Journal, VI, 3 (May, 1969), 384.

Following the collection of pretest and posttest data Elashoff noted that two research questions could be answered. The research questions were: "Are the average criterion scores significantly different for the . . . treatments? [and] What are good estimates of the average criterion scores for each treatment?"[4] Elashoff went on to specify assumptions to be met in using analysis of covariance:

> Thus, the analysis of covariance is a valid technique for testing differences in average criterion scores among treatments if we can assume: (a) random assignment of individuals to treatment, (b) within each treatment criterion scores have a linear regression on x scores, (c) the slope of the regression line is the same for each treatment (there is no slope treatment interaction), (d) for individuals with the same score x, the same treatment, criterion scores y have a normal distribution, (e) the variance of the distribution of y scores for all students with the same x score in a particular treatment is the same for all treatments and x scores, (f) criterion scores are a linear combination of independent components: an overall mean, a treatment effect, a linear regression on x and an error term.[5]

Assumptions which underlie inferences about treatment effect were enumerated by Hays:

1. For each treatment population the distribution of the random error is assumed normal.
2. For each population the distribution of the random error has a variance of random errors which is assumed to be the

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[4]Elashoff, p. 384. [5]Elashoff, p. 385.

same for each treatment population.

3. The errors associated with any pair of observations are assumed to be independent.[6]

In addition to the three assumptions given by Hays, Winer adds two more.[7]

4. It is assumed that treatment effects and regression effects are additive and that the regressions are homogeneous.
5. It is assumed that the residuals are normally and independently distributed with zero means and the same variance, and that the proper form of regression equation has been fitted.

With regard to assumptions four and five above, Winer reported: "Evidence from the usual analysis of variance indicates that the F tests in the analysis of covariance are robust with respect to the violation of the two assumptions, normality and homogeneity of the residual variance."[8]

In the design of this study assumptions underlying inferences about treatment effects in using the analysis of covariance statistical procedure have been considered and regarded. The groups have been formed through random

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[6]William L. Hays, Statistics for Psychologists (New York: Holt, Rinehart & Winston, 1963), p. 364.

[7]B. J. Winer, Statistical Principles in Experimental Design (New York: McGraw Hill Book Company, 1962), p. 586.

[8]Winer, p. 586.

assignment. It was therefore assumed that the random error and the variance of the random errors were the same for each group. The errors associated with paired observations were also assumed to be independent, and the regression lines have been shown to be parallel with the proper form of the regression equation fitted to the line. (See non-significant F ratios for homogeneity of regression in chapter four.)

PREDICTING CREATIVE PERFORMANCE

Two tests which appeared to be appropriate for this experiment were those developed by J. P. Guilford and E. Paul Torrance.[9] Torrance's test was selected for this study for three reasons. A number of studies have been conducted regarding the reliability and validity of the Torrance Tests of Creative Thinking. The Torrance tests parallel Guilford's structure-of-intellect model although the items are not generated from Guilford's model. Standardized test forms and scoring information were available. The Guilford test was not used because the

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[9]T. R. Christensen, P. R. Merrifield, J. P. Guilford, Southern California Test of Creative Thinking Ability (Beverly Hills, California, Sheridan Supply Company, 1958); see also E. Paul Torrance, Torrance Tests of Creative Thinking, Verbal Test Forms A and B, Figural Test Forms A and B (Princeton, New Jersey, Personnel Press Inc., 1962).

theoretical base used for its development was similar to the base used to develop the creative thinking materials. It was deemed best to verify the hypotheses with an independent measure, developed from a theoretical base different than the one used to develop the creativity materials.

Paulus and Renzuli examined a number of tests of creative thinking. They commented briefly on the Torrance Tests of Creative Thinking and in many respects regarded it as a "breakthrough in the area of creativity measurement."[10] They stated that the tests were based on nearly nine years of research and development by Torrance and his colleagues and that they provided the researcher with a functional instrument for measuring creative thinking potential in children.[11]

These authors noted certain technical problems which related to the level of training on the part of persons who score the tests. Torrance reported correlation coefficients of inter-score reliability ranging from .76 to .96 emphasizing the importance of careful scoring by trained personnel.

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[10]Dieter H. Paulus and Joseph S. Renzuli, "Scoring Creativity Tests by Computer," Gifted Child Quarterly, 12 (Summer, 1968), 79.

[11]Paulus, p. 79.

Content Validity

Torrance reported that content validity is confirmed by a "deliberate and consistent effort to base the test tasks and the scoring procedures on the best theory of research now available."[12] In addition he reported that an analysis of the lives of creative individuals, research concerning the personalities of creative individuals, and theory concerning the functioning of the human mind have all been considered in making decisions about the selection of test tasks.

He also noted that the general purpose batteries attempted to keep test tasks free of technical or subject matter content. The tests, he reported, are appropriate for middle school aged children and make it possible to determine whether children identified as creative ". . . behave in ways similar to the ways eminent creative people of the past behaved when they were children. . . ."[13]

Construct Validity

Studies revealed negative relationships between scores on the creative thinking test and rigidity, and

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[12]E. P. Torrance, "The Minnesota Studies of Creative Behavior: National and International Extensions," The Journal of Creative Behavior, I, 2 (Spring, 1967), 142.

[13]Torrance, "Minnesota Studies," p. 142.

significant relationships between creativity scores and measures of playfulness. Children who scored high on the creativity tests were better able to withstand uncertainty and to resist premature closure, Torrance reported.[14] He also noted, ". . . that the tests reflect growth resulting from various kinds of creative experiences and facilitating conditions."[15]

Concurrent Validity

There have been a variety of studies of concurrent validity, but many have encountered problems of criterion construction. Studies indicated that highly creative children preferred open structured rather than closed structured learning experiences, were more productive on frustrating tasks and reacted less favorably to closed tasks.[16]

Predictive Validity

A number of predictive validity studies were under way but considerable time must lapse before such studies can be completed. Torrance examined a study of high school seniors which covered a seven-year span and observed that

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[14]Torrance, "Minnesota Studies," p. 143.

[15]Torrance, "Minnesota Studies," p. 144.

[16]Torrance, "Minnesota Studies," p. 145.

". . . achievements were also predicted at the .05 level of confidence. . . ."[17]

Test, Retest, Reliability

The test and retest reliability of the Torrance Tests of Creative Thinking rather consistently indicated that reliabilities are higher for older children than for younger children, and that reliabilities are greatly influenced by the motivational factors in the testing situation. Torrance reported that experiments with good motivation and careful testing demonstrated that it is possible to obtain high test and retest reliability even when working with mentally retarded children. He noted the work of other researchers who obtained test and retest reliabilities of .50 to .87, .64 to .80, and .71 to .93 with different groups of normal fifth grade children.

SUMMARY

In chapter three, the implementation of the study was discussed. The two major segments of this chapter

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[17]Torrance, "Minnesota Studies," p. 146.

[18]Torrance, "Minnesota Studies," p. 147.

concern the development of materials and the design of the experiment.

Materials

It was noted that the philosophy underlying development of materials included four elements: all children are creative to some degree, proper experiences can improve creative performance, individualized instruction is a valuable educational method, and periods of non-evaluated practice and learning are important for children.

During the initial stages of development of the material the literature on creativity was reviewed, materials for stimulating creativity were examined, and attempts to use the structure-of-intellect model to develop methods and materials were considered. The first portion of this chapter concluded with a description of the creative thinking materials along with a summary of the instructions for the student and teacher.

Experimental Design

In the portion of the chapter in which the experimental design was considered a more extensive discussion of the hypotheses and population was offered. The model of analysis of covariance was also discussed and assumptions

and limitations of the model noted. The last portion of the chapter dealt with two instruments which have been designed for assessing creative performance. Special attention was given to the Torrance Tests of Creative Thinking and specifically its validity, test and retest reliability.

Chapter 4

ANALYSIS OF RESULTS

> It is the faith of most scientists that only experiments provide the answers on which we can depend. (Guilford, 1965)

INTRODUCTION

Three types of data were gathered for this study, specifically anecdotal data, data from creative thinking tests, and data derived from questionnaires. The first type of data was obtained from field notes recording children's use of the materials. In addition, errors in the content of the materials as well as ideas for revising subsequent versions of the materials were also noted in the field notes. Preceding and following the treatment period, children in the control and treatment groups were administered the Torrance Tests of Creative Thinking. The administration of these tests provided a second type of data. A third type of data was obtained from questionnaires which were completed by children in both the control and treatment groups.

Data were recorded and reported from the three sources which related to the seven hypotheses:

1. The treatment group would score significantly higher on measures of verbal fluency than would the control group.
2. The treatment group would score significantly higher on measures of verbal flexibility than would the control group.
3. The treatment group would score significantly higher on measures of verbal originality than would the control group.
4. The treatment group would score significantly higher on measures of figural fluency than would the control group.
5. The treatment group would score significantly higher on measures of figural flexibility than would the control group.
6. The treatment group would score significantly higher on measures of figural originality than would the control group.
7. The treatment group would score significantly higher on measures of figural elaboration than would the control group.

FIELD NOTES

Excerpts from the field notes were reported to illustrate and describe relevant observed phenomenon apparent during the testing and treatment periods.

The notes provided only a minor portion of the data collected for this study. They indicated that the post-tests were administered on the same days of the week and during the same times during the day as were the pretests. The pretest and posttest sessions were similar and the testing was conducted under analogous circumstances.

The notes also indicated that most children were anxious to use the creative thinking kits while those cast in the control group were apparently disappointed by their role. Two children in the treatment group and three children in the control group were frequently tardy to class because of safety patrol responsibilities. Children were occasionally absent from both the treatment and control groups. No child was absent from either group for an extended period of time and absenteeism was similar for both groups.

Excitement was observed to be high throughout the treatment period for most children in both groups. Several children, however, elected to use a small portion of the creativity class periods to work on science projects, while others spent extra time working after school on the creativity activities. The amount of extra time spent working on the activities by some children approximately balanced the amount of time diverted to science projects by other children in the treatment group. The slight variation in the amount of time spent working on the

activities was not viewed as significant. It was noted, however, that a few children in both the control and treatment groups used only a small portion of class time for what appeared to be productive activities. This condition may have been a significant factor in the outcome of the experiment.

The children involved in the study were a group of sixth grade laboratory school children in the Metcalf School at Illinois State University. This group was chosen for the sake of convenience; aspects of creativity, intelligence, achievement, and motivation were not considered. These children were considered to be a sample of a larger, but undefined, population of children having similar motivational, intellectual, achievement, and socio-economic characteristics. A more extensive description of the population used in this study was given in previous sections.

Both control and treatment groups were taught by the researcher simultaneously. The classroom setting was characterized by a free and open atmosphere in which children worked on science projects and activities which interested them. The instruction was adapted to meet the needs of individual children recognizing variations in motivation, achievement and intelligence levels. Both the control and the treatment groups worked in this milieu, although the treatment group was encouraged and expected

to use the creative thinking activities in place of science activities.

TEST DATA

The Torrance Tests of Creative Thinking provided seven subtest scores. Each subtest score related directly to one of the seven hypotheses tested. (Pretest and post-test data are given in Appendix F.)

Verbal Fluency

The first hypothesis tested was: The treatment group would score significantly higher on measures of verbal fluency than would the control group. The data given in Table 1 related to the testing of that hypothesis.

Table 1

Analysis of Covariance Findings
For Verbal Fluency

Source	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	F Ratio*
Treatments (Adj.)	1	485.22	485.22	0.672 (N.S.)
Within (Adj.)	21	15172.69	722.51	
Total (Adj.)	22	15657.91		

*Homogeneity of regression F = 0.008 (N.S.)

An F-ratio of 4.32 was required to demonstrate significance at the .05 level for each of the seven hypotheses. Clearly the F-ratio of 0.672 fell short of the value needed to demonstrate significance on this measure. Measures of verbal fluency were not significantly different for the treatment and control groups.

A test for homogeneity of regression must be met in order to justify the use of the analysis of covariance procedure. This test was considered to be met at the .05 level if the F-ratio for homogeneity of regression was below 4.35. An F-ratio of 0.008 is well below the prescribed limit and hence the test for homogeneity of regression was met. For measures of verbal fluency the hypothesis: The treatment group would score significantly higher on measures of verbal fluency than would the control group, was rejected. (See Appendix G for the analysis of covariance printouts.)

Verbal Flexibility

The second hypothesis tested was: The treatment group would score significantly higher on measures of verbal flexibility than would the control group. Table 2 summarized the analysis of covariance data which related to this hypothesis.

Table 2 indicated that differences between the control and treatment groups were not significant for the

measures of verbal flexibility. The hypothesis: The treatment group would score significantly higher on measures of verbal flexibility than would the control group, was rejected. The test for homogeneity of regression was met with the nonsignificant F-ratio of 0.006.

Table 2

Analysis of Covariance Findings for Verbal Flexibility

Source	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	F Ratio*
Treatments (Adj.)	1	123.22	123.22	1.518 (N.S.)
Within (Adj.)	21	1704.18	81.15	
Total (Adj.)	22	1827.40		

*Homogeneity of regression F = 0.006 (N.S.)

Verbal Originality

Table 3 summarized the data which concerned the verbal originality portion of the Torrance Tests of Creative Thinking. This portion of the tests was concerned with measuring verbal originality. The hypothesis stated: The treatment group would score significantly higher on measures of verbal originality than would the control group.

Table 3

Analysis of Covariance Findings
For Verbal Originality

Source	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	F Ratio*
Treatments (Adj.)	1	726.71	726.71	1.476 (N.S.)
Within (Adj.)	21	10338.75	492.32	
Total (Adj.)	22	11065.46		

*Homogeneity of regression F = 4.128 (N.S.)

An F-ratio of 4.35 was necessary in order to label the homogeneity of regression a significant factor. The observed F-ratio of 4.128 fell short of the required ratio; therefore, the test for homogeneity of regression was considered to have been met. It is necessary to have a non-significant F-ratio for homogeneity of regression in order to justify using the analysis of covariance procedure. The F-ratio, for the hypothesis, of 1.476 also falls short of the level required for significance, hence the hypothesis: The treatment group would score significantly higher on measures of verbal originality than would the control group, was rejected.

Figural Fluency

The fourth measure of the series examined figural fluency. This data was gathered to test hypothesis four, which stated: The treatment group would score significantly higher on measures of figural fluency than would the control group.

Table 4

Analysis of Covariance Findings for Figural Fluency

Source	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	F Ratio*
Treatments (Adj.)	1	6.52	6.52	0.172 (N.S.)
Within (Adj.)	21	797.74	37.99	
Total (Adj.)	22	804.26		

*Homogeneity of regression F = 0.001 (N.S.

Table 4 summarized the analysis of covariance data for the measure concerned with figural fluency. Significant differences between the groups were not observed on this measure, therefore the hypothesis: The treatment group would score significantly higher on measures of

figural fluency than would the control group, was rejected.

Figural Flexibility

Table 5 summarized data which related to figural flexibility. The fifth hypothesis, which concerned figural flexibility, was stated: The treatment group would score significantly higher on measures of figural flexibility than would the control group.

Table 5

Analysis of Covariance Findings for Figural Flexibility

Source	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	F Ratio*
Treatments (Adj.)	1	1.24	1.24	.063 (N.S.)
Within (Adj.)	21	412.54	19.64	
Total (Adj.)	22	413.78		

*Homogeneity of regression F = 0.416 (N.S.)

The homogeneity of regression ratio was not observed to be significant and again, significant differences were not observed between the two groups on measures of figural flexibility. The test for homogeneity of regression

was met and the hypothesis: The treatment group would score significantly higher on measures of figural flexibility than would the control group, was rejected.

Figural Originality

Table 6 was concerned with the data which related to figural originality. The hypothesis which concerned figural originality was stated: The treatment group would score significantly higher on measures of figural originality than would the control group. The data which was collected to test this hypothesis was summarized in Table 6.

Table 6

Analysis of Covariance Findings for Figural Originality

Source	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	F Ratio*
Treatments (Adj.)	1	104.33	104.33	0.582 (N.S.)
Within (Adj.)	21	3762.85	179.18	
Total (Adj.)	22	3867.18		

*Homogeneity of regression F = 0.122 (N.S.)

Significant differences between the treatment and control groups were not observed for this measure. The hypothesis: The treatment group would score significantly higher on measures of figural originality than would the control group, was rejected. The test for homogeneity of regression was met.

Figural Elaboration

The last hypothesis was concerned with figural elaboration. The hypothesis stated: The treatment group would score significantly higher on measures of figural elaboration than would the control group. Data for this hypothesis was summarized in Table 7.

Table 7

Analysis of Covariance Findings for Figural Elaboration

Source	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	F Ratio*
Treatments (Adj.)	1	1.22	1.22	0.003 (N.S.)
Within (Adj.)	21	9157.76	436.08	
Total (Adj.)	22	9158.98		

*Homogeneity of regression F = 1.042 (N.S.)

The homogeneity of regression F-ratio was not significant and significant differences between the groups were not observed for the measure of figural elaboration. The hypothesis: The treatment group would score significantly higher on measures of figural elaboration than would the control group, was rejected.

Comparison of Means

Although significant differences between the treatment and control groups were not observed for any of the seven measures reported above, the gains for the treatment group exceeded those of the control by a small margin on six of the seven measures. The means were summarized in Table 8 (Verbal Mean Scores) and Table 9 (Figural Mean Scores).

The mean scores for the control group on measures of verbal originality appear to have fallen from a pretest score of 86.9 to a posttest score of 72.6. This apparent inconsistency has been confirmed by a re-examination of the data, and although inexplicable, it is assumed to be a valid measure of the study. Additional comments about the verbal mean scores apply also to the figural mean scores and are given at the end of Table 9.

Table 8

Verbal Mean Scores (Fluency, Flexibility, Originality)

	Control	Treatment	Difference Favoring Treatment (Control)
Fluency			
Pretest	86.3	83.3	(3.0)
Posttest	103.2	109.3	6.1
Posttest (Adj.)	101.7	110.8	9.1
Flexibility			
Pretest	37.8	36.8	(1.0)
Posttest	40.6	44.1	3.5
Posttest (Adj.)	40.1	44.6	4.5
Originality			
Pretest	86.9	73.0	(13.9)
Posttest	72.6	77.6	5.0
Posttest (Adj.)	69.5	80.7	11.2

Table 9

Figural Mean Scores (Fluency, Flexibility, Originality, Elaboration)

	Control	Treatment	Difference Favoring Treatment (Control)
Fluency			
Pretest	21.2	19.0	(2.2)
Posttest	23.0	23.3	0.3
Posttest (Adj.)	22.6	23.7	1.1
Flexibility			
Pretest	15.4	16.0	0.6
Posttest	18.2	18.7	0.5
Posttest (Adj.)	18.2	18.6	0.4
Originality			
Pretest	30.4	31.1	0.7
Posttest	34.8	39.0	4.2
Posttest (Adj.)	34.8	39.0	4.2
Elaboration			
Pretest	63.0	62.2	(0.8)
Posttest	102.0	100.8	(1.2)
Posttest (Adj.)	101.6	101.2	(0.4)

Posttest means and adjusted posttest means for the treatment group surpassed, by a slight margin, the scores of the control group for every measure except figural elaboration. Although the differences are not of a magnitude required for significance, differences were observed which favored the treatment group for six of the seven measures. Only the measure of figural elaboration failed to favor the treatment group.

TWO-WAY ANALYSIS OF VARIANCE WITH REPEATED MEASURES

The fact that six of the seven adjusted posttest means of the treatment group marginally exceed the corresponding means of the control group suggested that further comparisons of the two groups was indicated. Further comparison was accomplished through a two-way analysis of variance with repeated measures. This statistical procedure accumulated the modest differences between each of the seven pairs of measures and assessed the degree of difference between the groups when all seven measures were examined simultaneously.

The assumptions made for the two-way analysis of variance with repeated measures model were similar to the

assumptions made for the analysis of covariance employed earlier in this chapter.[1] These assumptions have been met and verified in the previous description of the analysis of covariance model and in the preceding section.

In Table 10 the seven measures of verbal fluency, flexibility, originality, and figural fluency, flexibility, originality, and elaboration were summarized through the two-way analysis of variance with repeated measures. All seven measures were accumulated by this procedure in an effort to identify differences between the groups for a general quality common to the seven measures.

The two-way analysis of variance with repeated measures procedure failed to identify a significant difference between the control and treatment groups for a general quality common to the seven measures of the creative thinking tests. The test effect F-ratio appeared to be large enough to be considered significant; however, this F-ratio was expected because of the variation in the length of the seven subtests. (See Appendix H for the two-way analysis of variance with repeated measures printout.)

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[1]B. J. Winer, Statistical Principles in Experimental Design (New York: McGraw-Hill Book Co., 1962), p. 298.

Table 10

Two-Way Analysis of Variance
with Repeated Measures

Source	Degrees of Freedom	Sums of Squares	Mean Squares	F Ratio
Between Subjects	23	41006.75	1782.90	0.0 (N.S.)
Groups	1	293.31	293.31	0.16 (N.S.)
Error	22	40713.44	1850.61	0.0 (N.S.)
Within Subjects	144	236445.88	1641.98	0.0 (N.S.)
Test Effect	6	191335.38	31889.23	93.89
Test by Group	6	278.25	46.38	0.14 (N.S.)
Error	132	44832.25	339.64	0.0 (N.S.)
Total	167	277452.62	1661.39	0.0 (N.S.)

Total Mean Scores

The total group pretest and posttest mean scores were given below for the purpose of illustrating the gain of the total group on each of the seven subtests of the Torrance Tests of Creative Thinking.

Table 11

Pooled Mean Scores for Both Groups by Subtests

	Pretest	Posttest	Gains (Losses)
Verbal Fluency	84.7	106.2	21.5
Verbal Flexibility	37.3	43.3	6.0
Verbal Originality	80.0	75.1	(4.9)
Figural Fluency	20.1	23.2	3.1
Figural Flexibility	15.7	18.4	2.7
Figural Originality	30.8	36.9	6.1
Figural Elaboration	62.6	101.4	38.8

Six of the seven pretest-posttest pairs of pooled means reported above revealed posttest gains. The data suggested that the pooled group (treatment plus control) achieved a higher level of creative performance on six of the posttest measures than they had on the pretest measures.

QUESTIONNAIRES

Control Group

The control group received four questions directed toward their involvement in the research endeavor, while

the treatment group received thirteen questions. Written responses were obtained from all children in both the control and treatment groups.

The entire control group responded that they had not worked on any of the creativity activities planned for the treatment group. Most of the control group admitted, however, to examining at least some of the planned activities while several of the group revealed in-depth examinations of most or all of the activities. Most children in the control group indicated interest in working with the creativity activities at a later date and disappointment in exclusion from the treatment group.

Experimental Group

Thirteen questions were asked of the experimental group. These questions concerned interest in the activities and interaction with the control group. None of the activities were undertaken by all children in the treatment group. The activities which included work with figural units, figural classes, figural relations, figural implications, and symbolic implication were most popular. The activities which concerned symbolic classes and behavioral classes were least popular. Of the twenty-four different types of activities two children selected only six types of activities while one student selected twenty-two different types of activities. Most children

undertook about one-half of the different types of activities which were available to them.

The more popular activities seemed to be the figural set, while the less popular ones were in the behavioral set. The degree of popularity of the activities may be related to the order of listing in the student's record book: for example, the figural activities were listed first.

Most of the treatment group stated they had worked on the creativity activities during all or many of the thirty class periods devoted to the use of the creative thinking kits. Two children indicated that they had worked on the creativity materials during only a few of the class periods.

Many of the children in the treatment group declared they liked working on the creativity materials, though few of them thought about the activities outside of school. A majority of the treatment group were pleased to have been selected as the treatment group. (See Appendix I for the questionnaire questions.)

SUMMARY

Field Notes

In this chapter data were reported which were derived from three sources, specifically anecdotal data, data

from creative thinking tests and data derived from questionnaires. Data obtained from field notes taken during the testing period indicated children enjoyed working with the materials and class attendance was regular.

Analysis of Covariance

An analysis of covariance was used to assess data relating to the seven hypotheses stated for the study. The analysis failed to reveal significant differences between the groups on any of the seven measures. Mean scores were also reported and it was noted that gains made by the treatment group exceeded gains made by the control group on six of the seven measures. These gains, however, were not large enough to be judged significant. Mean scores for both groups were pooled and reported by subtest. Gains occurred between the pretest and posttest on six of the seven measures. These gains suggested that both treatment and control groups improved in their ability to perform on the six measures.

Two-Way Analysis of Variance with Repeated Measures

The slight margin of gain of the treatment group over the control group on six of the seven measures suggested that a comparison of all seven measures simultaneously might reveal a significant difference between the groups on qualities common to all seven measures.

The two-way analysis of variance with repeated measures revealed no such significant difference between the control and treatment groups.

Questionnaire Data

Data were also obtained from a questionnaire which determined the students' interest in the activities and the extent to which the control group became familiar with the activities. It was observed that the treatment group enjoyed working with the materials. In addition the treatment group favored the figural activities and they indicated delight in having been selected to use the materials. It was also found that the control group had examined or observed a number of the activities although they had not completed any of the activities themselves.

Chapter 5

SUMMARY AND CONCLUSIONS

> It must be remembered that there is nothing more difficult to plan, more doubtful of success, nor more dangerous to manage than the creation of a new system. For the initiator has the enmity of all who would profit from the preservation of the old institutions and merely lukewarm defenders in those who would gain by the new ones. (Machiavelli, 1513)

SUMMARY

The purpose of this study was to test the efficacy of materials specifically designed to stimulate creative thinking.

The Problem

In the first chapter of this thesis the need for stimulating creative thinking in the educational process was stated. The gap between what is known to educational researchers and what is implemented in the classroom was noted. This study attempted to bridge the gap between educational research and practice by developing materials based on educational theory and research and designed to stimulate creative thinking.

Theoretical Base

The divergent thinking section of Guilford's structure-of-intellect model was used as a matrix and theoretical base for developing the creative thinking materials. These materials were developed with cognizance of research studies concerning motivation and classroom milieu most likely to stimulate creative production.

The Literature

In reviewing the literature attention was given to the theories of creativity relating to mental health, self-fulfillment and intelligence. The creative process was examined along with various levels of creative acts.

It was noted that creative individuals tended to be less repressed, less inhibited, less formal and less conventional. They tended to be more independent, more intuitive and tended to produce novel and unconventional solutions to problems. It was further noted that motivation for creativity was intrinsic and reinforcement resulted from satisfactorily completing tasks. A number of authors expressed the view that all individuals are creative to some degree, although considerable variation in ability and motivation exists.

In discussing instructional theories, authors and researchers expressed reservations about teaching creativity directly, although they noted that learning settings could be controlled in such a manner as to enhance creative thinking. Thought processes and their relation to creative thinking were noted. A number of studies were reviewed which examined the relationship between environmental conditions and creativity. The studies have shown that environment can have a marked effect on creativity.

Studies were summarized in which an attempt was made to increase creative performance by a variety of techniques. Attempts to alter behavior for the purpose of stimulating creative production appeared to be successful. Self-instructional materials and audio tapes also proved to be effective in improving creative performance.

Several uses of the structure-of-intellect model were examined. The model was shown to be effective in analyzing teacher strategy and in developing learning experiences.

Assumptions for Materials

In the third chapter the philosophical assumptions supporting the development of the materials were outlined.

These assumptions included four elements: (1) all children are creative to some degree, (2) proper experience can improve creative performance, (3) individualized instruction is a valuable educational method, and (4) periods of nonevaluated practice and learning are important for children.

Analysis and Results

Data concerning the seven hypotheses tested in this study originated from three sources. Data were obtained from field notes, the Torrance Tests of Creative Thinking, and questionnaires completed by the students. The field notes and questionnaires indicated that children enjoyed completing the creativity activities, attended class sessions regularly, and devoted most of the class time to the completion of the activities.

The analysis of covariance statistical model was selected as the primary method for analyzing the test data collected in this study. This method of analysis was chosen because it enabled the researcher to observe gains following a treatment period while controlling differences which were present in the groups prior to treatment. Test data were gathered for seven hypotheses which were concerned

with verbal fluency, flexibility, originality, and figural fluency, flexibility, originality, and elaboration.

The bulk of the data gathered in this study originated from the creative thinking tests and was analyzed through an analysis of covariance. The statistical procedure failed to identify significant differences between the treatment and control groups on any of the seven measures. A comparison of the means, however, did reveal gains which slightly favored the treatment group on six of the seven measures. Gains were also noted between pretest and posttest scores when the data from both treatment and control groups was pooled.

Conclusions

The seven hypotheses which declared that the treatment groups would score significantly higher on the measures of verbal fluency, flexibility, originality and figural fluency, flexibility, originality and elaboration than would the control group were rejected. Significant differences were not observed for any of the seven measures. Differences favoring the treatment group were noted, however, for six of the seven measures, although the differences were not of a magnitude which could be considered

significant. Further examination of the modest differences through a repeated measures procedure also failed to identify significant differences between the groups.

Discussion

Several reasons were offered to explain the lack of significant post-treatment difference between the groups. It was suggested that the materials did not stimulate the development of creative thinking as expected. Fragmentary evidence suggested that this explanation was inadequate. The possibility does exist, however, that treatment was lacking in intensity or was not continued for a sufficient period of time to fully realize the efficacy of the materials. It was observed that the typical (median) child used only fourteen of the twenty-four types of activities.

Another tenable reason was that the control group had enhanced its creativity thinking skills through the creative atmosphere available to the treatment group. Other creative activities conducted in other subject areas may have also contributed to the gains observed for both groups.

In addition, limitations of the test instrument and the statistical procedure might also be sighted as

explanation for the outcome of this study. The test instrument measured only a portion of the twenty-four different types of intellectual operations thought to have been stimulated by the materials and number of creative thinking processes which remained untested. The creativity test scoring manual is laden with contradictions and inconsistencies which may have had an adverse effect on this study.

The small size of the treatment and control groups necessitated a fairly large F-ratio in order to declare the post-treatment groups significantly different. A larger sample would permit a smaller F-ratio to be significant. This too was offered as a partial explanation of the outcome of the study.

Further Research

Further evaluation and possible revisions of the materials were suggested by both the field notes and statistical analysis. Replication of the study was indicated, but a larger sample should be considered, treatment should be intensified and extended over a longer period of time, and a greater effort made to prevent contamination of the control group. A more valid and efficient measure of creative thinking should be employed.

CONCLUSIONS

Significant differences between the treatment and control groups were not observed for any of the seven measures. It must be concluded, therefore, that:

1. The treatment group did not score significantly higher on measures of verbal fluency than did the control group.
2. The treatment group did not score significantly higher on measures of verbal flexibility than did the control group.
3. The treatment group did not score significantly higher on measures of verbal originality than did the control group.
4. The treatment group did not score significantly higher on measures of figural fluency than did the control group.
5. The treatment group did not score significantly higher on measures of figural flexibility than did the control group.
6. The treatment group did not score significantly higher on measures of figural originality than did the control group.

7. The treatment group did not score significantly higher on measures of figural elaboration than did the control group.

The adjusted posttest means for the treatment and control groups were given in the previous chapter to illustrate that gains made by the treatment group were slightly larger than gains made by the control group for six of the seven measures. Although none of the gains were considered to be significant by themselves, the fact that six sets of scores favored the treatment group was noteworthy. Further analysis, however, confirmed the previous findings of no significant difference. The data concerned with figural elaboration did not demonstrate a superior gain in favor of the treatment group.

Pretest and posttest means were given for the combined treatment and control groups. Notable gains were observed for six of the seven measures with only the measure of verbal originality failing to demonstrate improvement by the total group. This finding suggested that both the treatment and control groups improved in their facility to deal with verbal fluency, flexibility, and figural fluency, flexibility, originality and elaboration.

DISCUSSION

Guilford's Model

Guilford's structure-of-intellect model proved to be a useful tool for developing and categorizing the activities. Classifying the activities into the twenty-four different cells of the matrix was not difficult. Similarly, the general descriptions of the types of activities which identified intellectual functions for each of the cells of Guilford's model provided an adequate base from which new activities were developed.

Individualized Instruction

With some help the children in the treatment group soon identified the four content factors of figural, symbolic, semantic and behavioral and to some extent the product factors of units, classes, relations, systems, transformations and implications. To facilitate the use of these factors in working with the activities, all of the activities were listed on the inside of the front cover of the child's record book and the activities were classified according to the content and product factors. (See Appendix C.) The children could concentrate on certain types of learning activities while becoming

familiar with the creativity materials. As an example, a child with a strong ability to deal with symbolic content would be attracted to the symbolic activities first. He would then work through the symbolic activities and transfer the processes to the other content factors of figural, semantic and behavioral. Similarly, children who were more capable of productivity in certain product areas would begin their efforts with the activities relevant to their greatest productive facility. As an example, a child who was especially capable in the ability to classify could elect to complete the activities dealing with classes first and then enlarge these skills to the other product categories of units, relations, systems, transformations, and implications.

It was thought that the intellectual operations of divergent thinking could be stimulated and developed by having children work from product and content categories in which they had greatest facility to product and content categories for which they had lesser ability. The route taken through the activities would be different for each child and be in keeping with his needs.

The data show, however, that more children completed activities near the top of the list, suggesting

that some children completed activities in the listed order rather than according to their needs. More introduction to the child regarding the order for completing the activities seemed indicated.

Motivation

Intrinsic motivation was the primary motivating factor for completing the activities. Most children worked on the activities because they were "fun to do" or because they felt they were learning from the activities. No attempt was made to evaluate their creative product unless they requested evaluation of their work. Teacher recognition was offered only to children who appeared to need adult recognition in order to sustain their creative efforts.

Outcome of Study

Several reasons were suggested to explain the results of this study. It was suggested (1) that the creative thinking kits simply did not stimulate creative thinking, (2) that the treatment period was insufficient, (3) that creative thinking was stimulated in not only the treatment group but also the control group, (4) that the

limitations of the test instrument resulted in a failure to identify relevant factors and (5) that the limitations of the statistical procedure resulted in a failure to identify significant differences.

The conclusion that the materials did not stimulate creative thinking seemed unfounded. Fragmentary evidence suggested that the treatment group made slightly greater, though not significant, gains on six of the seven measures of the creative thinking test. In addition, the combined groups made notable gains between the pretest and posttest.

A second and more plausible explanation could be that the treatment period was insufficient. Time limitations prevented children from completing all the activities. Two children were able to complete only six of the sets of activities; more energetic children undertook twenty-two of the twenty-four types of activities at most. The median number of activities completed by the twelve children in the treatment group was fourteen or slightly more than half of the twenty-four different types of activities available to them.

The third reason offered as an explanation for the outcome of this study was that creative thinking was stimulated not only in the treatment group, but also in the control group. It was suggested that the control

group had been contaminated by either the presence of the treatment group, or by the presence of the creative thinking activities, or by both. Notable posttest gains were observed when the scores of both the treatment and control groups were pooled. This suggested that both groups improved in their ability to perform tasks measured by the creativity test. The improved performance might be explained by the students gaining experience at taking the test, by having experiences in other areas of the curriculum which stimulate creative thinking, by maturation, or by having been able to work with the creativity materials or observe their use.

A portion of the explanation for the outcome of this study may also lie in the test instrument. The Torrance Tests of Creative Thinking were published as a "research" edition. This caveat should be heeded for the instructions and scoring manuals have numerous shortcomings and inconsistencies which may have had an adverse effect on the study.

Further, the test instrument measures only a portion of the twenty-four different types of intellectual operations thought to have been stimulated by the materials. The remainder of the operations remained untested, and therefore, statements about the untested operations cannot be made.

Finally, the nonsignificant results of this experiment might in part be a result of the small sample used in the treatment population. A sample of twelve necessitates a fairly high F-ratio in order to observe significance. A larger sample would have the effect of permitting a smaller difference between the gains of the treatment and control groups to be declared significant than was permitted in this study.

IMPLICATIONS FOR FURTHER RESEARCH

The field notes taken during the treatment period indicated that the materials were in need of minor revision and that some ambiguities appeared in the instructions. The study indicated that the activities were self-motivating. There is reason to believe that some modification in the experimental design could result in a similar study which would identify significant gains on certain measures associated with creative thinking.

A replication of the study is indicated. The replication study should, however, involve a larger sample and a more vigorous attempt to prevent contamination of the control group. In addition, it should be conducted over a longer time period, and employ a refined or more effective measure of the components of creative thinking. In addition, the measure should evaluate most or all of

the creative thinking operations thought to have been stimulated by the activities.

The creative thinking kits were evaluated through the use of laboratory school children. These children demonstrated achievement, intellectual, and motivational characteristics exceeding those of many of their contemporaries. Similarly their socio-economic level tended to be higher than the level of many of their age group. Specific data regarding achievement, intellectual, and socio-economic characteristics of the population were recorded in a previous section.

Because of the special nature of the population used in this study further research concerning the efficacy of the creative thinking kits should be considered for children of varying achievement, intellectual, motivational, and socio-economic levels. In addition, consideration should be given to appropriate grade placement and to modification of the materials or development of similar materials for other grade levels.

The importance of milieu or classroom atmosphere in the use of these materials is a cogent topic for further investigation. Similarly the use of treatment and control groups juxtaposed in the same class setting is novel and worthy of further consideration.

The structure-of-intellect model was found to be a useful tool in developing creative thinking activities

for this study. It should be noted that other sections of the structure-of-intellect model could also be used to provide a matrix and theoretical base for the development of similar materials designed to stimulate the intellectual operations of convergent thinking and evaluation.

Finally, several impressions were gleaned from the study. The format of the materials appears to be an important motivational factor. The children enjoyed the self-contained nature of each kit and the chance to work on the variety of activities. It appeared that children can be motivated to learn in an atmosphere which is free of competition if the learning materials are sufficiently rewarding.

The individualized instruction concept was implemented with relatively little difficulty. The children selected and pursued learning activities which they deemed appropriate. They did not appear to be overly concerned about finishing a specific number or sequence of activities. The children involved in the study did not express concern about the varying amount of productivity exhibited by other children involved in the study.

Further explication of the content factors of figural, symbolic, semantic, and behavioral is indicated. Particular emphasis should be devoted to the development of materials and teaching techniques which emphasize learning through each of these four content factors.

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APPENDICES

APPENDIX A

Selected Sources for Creativity Materials

APPENDIX A

Selected Sources for Creativity Materials

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APPENDIX B

Activity Titles

APPENDIX B

Activity Titles*

FIGURAL UNITS	FIGURAL CLASSES	FIGURAL RELATIONS
Paper Reinforcements	Colored Shapes	Music and Clay
Three Lines	Sorting Objects	Shapes and Shadows
Sticky Putty		City Builder
Darwin II		
SYMBOLIC UNITS	**SYMBOLIC CLASSES**	**SYMBOLIC RELATIONS**
Coming and Going	Classifying Numbers	Word Pictures
One Nine Six One	Signs and Symbols	Answers Right
Words and Numbers	Letter Groups	Homonyms
		Scrabble
SEMANTIC UNITS	**SEMANTIC CLASSES**	**SEMANTIC RELATIONS**
Things Round	Rhyming Words	Synonyms
Shapes and Words	Plastic Bottles	Your Senses
Cartoons	Word Similarities	Similes
BEHAVIOR UNITS	**BEHAVIOR CLASSES**	**BEHAVIOR RELATIONS**
Stick Figures	Emotions	Actions
Puppets	Things to Say	Getting Help
	Hats	

FIGURAL SYSTEMS	FIGURAL TRANSFORMATIONS	FIGURAL IMPLICATIONS
Crazy Pictures	Paper Sculpture	Fine Line
Trash or Treasure	What Is It?	Notebook
Tom Edison	Soma Cube	Funny Cars or Designing Dresses
	Hidden Pictures	
SYMBOLIC SYSTEMS	**SYMBOLIC TRANSFORMATIONS**	**SYMBOLIC IMPLICATIONS**
Patterns	Changing Letters	Large Numbers
The Code	Indian Signs	Heads or Tales
Word Chains	Picture Notes	Big Words
Three Toes		Number Systems
SEMANTIC SYSTEMS	**SEMANTIC TRANSFORMATIONS**	**SEMANTIC IMPLICATIONS**
Science Puzzle	Story Titles	Sequence Cards
Elephant Jokes	Completing Stories	Making Up Stories
Sentences		
Simile Phrases		
BEHAVIOR SYSTEMS	**BEHAVIOR TRANSFORMATIONS**	**BEHAVIOR IMPLICATIONS**
Inventing Games	Musical Squares	Making Friends
Football--Hop-scotch	Creating Drama	
	Picture Stories	

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APPENDIX C

Selected Activities

APPENDIX C

Selected Activities*

Figural Activities

Title: THREE LINES (FU)

Materials Furnished: Draftsman's template
pencil
colored felt pens

Directions: Notice that the template which is furnished with this activity has three slots cut out. Use these slots as a guide for your pencil in making lines. Arrange these lines so that they make a number of different and interesting figures or designs. Color them with the felt pens.

Title: MUSIC AND CLAY (FR)

Materials Furnished: clay
tape recorded music

Directions: Listen to the tape recording one or more times. Use the clay to make an object which reminds you of the music. When you have finished draw a picture of your clay object below. Explain why your clay figure reminds you of the music.

Title: JUST LIKE TOM EDISON (FS)

Materials Furnished:
dry cells
doorbell buzzer
electric motor
magnets
knife switches
wire
mounting board
terminal clips
nuts and bolts

Directions: Invent and construct one or more useful electric devices.

Title: WHAT IS IT? (FT)

Materials Furnished:
plastic silverware
white glue
tongs
pan and hotplate

Directions: The plastic silverware can be softened in hot water so that it can be bent into unusual shapes. Assemble the plasticware into an interesting or unusual design.

Symbolic Activities

Title: ONE, NINE, SIX, ONE (SU)

Materials Furnished: none

Directions: List all the numbers you can think of which look the same either side up, i.e. 181, 1961.

Title: LETTER GROUPS (SC)

Materials Furnished: plastic letters

Directions: The purpose of this activity is to invent different ways to classify letters. Sort the letters

into three different circles drawn at the bottom of the page. Write a word or phrase which describes the letters in each circle.

Title: HOMONYMS (SB)

Materials Furnished: none

Directions: Make a list of words which have the same sound but different spellings and/or meanings.

Title: HEADS OR TALES? (SI)

Materials Furnished: foreign coin

Directions: Examine the coin closely. At the bottom of the page make a list of all the things that you know as a result of examining the coin about the country which the coin came from.

Semantic Activities

Title: CARTOONS (MU)

Materials Furnished: eight cartoons without captions

Directions: At the bottom of the page there are several cartoons without captions. Write one or more funny captions under each of the cartoons.

Title: PLASTIC BOTTLES (MC)

Materials Furnished: plastic bottles, assorted sizes and shapes

Directions: Examine the plastic bottles which are provided in the kit. In the space below list all the

different uses you can think of for the plastic bottles.

Title: SCIENCE PUZZLE

Materials Furnished: science puzzle (consisting of a red circle which slides under green acetate and appears black)

Directions: Examine the science demonstration carefully. List below all the questions you can think of which would help you to know more about the science puzzle.

Title: STORY TITLES (MT)

Materials Furnished: three tape recorded stories

Directions: Listen to each of the stories which are told you by the tape recording. Try to think of as many different titles for each story as you can.

Title: SEQUENCE CARDS (MI)

Materials Furnished: set of sequence cards

Directions: Shuffle the sequence cards and lay them on the table in front of you. Do not rearrange the sequence cards after you have laid them on the table.

Invent a story about the sequence which you have in front of you.

Behavioral Activities

Title: PUPPETS (BU)

Materials Furnished: cloth
scissors
glue
felt pens
puppet pattern

Directions: Make several hand puppets and demonstrate by their facial expression, their dress, and their voice different emotions such as happiness, sadness, loneliness, hate, anger, fear, etc.

Title: THINGS TO SAY (BC)

Materials Furnished: none

Directions: Make a list of things that you would do or say which would make your parents, teacher, brother or sister happy, angry, or sad.

Title: HATS (BC)

Materials Furnished: selection of hats

Directions: Select one of the hats from the selection of hats and wear it. While you are wearing that hat you are to behave like the person that the hat represents.

Title: INVENTING GAMES (BS)

Materials Furnished:
play money
game board
blank cards
dice
tokens
spinner
paper

Directions: Invent several games which would be of interest to older people, mothers, fathers, or young children.

Title: MUSICAL SQUARES (BT)

Materials Furnished: tape recorded music

Directions: Listen to the music and then color the squares at the bottom of the page in a way which is suggested to you by the music.

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APPENDIX D

Tape Recorded Instructions to Students

APPENDIX D

Tape Recorded Instructions to Students*

CREATIVITY

Introduction to Students

Introduction

Are you wondering what creativity is? Are you asking, is it science, or math, or language arts, or social studies, or art, or music? Are you wondering whether it will be hard, or easy, fun, or interesting? These activities will be all these things and more. They will be much different than many of the things you have done in school and I know that you are going to find that most of the activities are fun.

Now I'm going to talk to you about five questions these lessons raise. First, what is creativity? Second, why you should learn about creativity. Third, what the creativity will be like. Fourth, how can you work with the creativity activities. Finally, how should you use your creativity record book?

Now I want you to look in your creativity record book. You will find the first page has a list of questions on it. Read these questions over and think about them for

a few minutes. Do not write any answers to the questions now, unless you want to. Stop the recorder while you are reading the questions over.

As I tell you more about creativity, you may want to fill in the answers to the questions. To do this you should stop the recorder while you are filling in your answer.

What Is Creativity?

Creativity is doing things differently than they are usually done. Creativity is inventing a new science experiment. Creativity is making up a new game to play. Creativity is writing a poem or funny story. Creativity is making up jokes and pretty pictures and plays and dances.

Many famous people were creative. One reason why people became famous is because they were creative. They found new and better ways of doing things. Thomas Edison invented many uses for electricity and he has become famous for his creative inventions. Edgar Allen Poe is famous for his unusual and creative stories. Leonardo da Vinci is famous because of his unusual inventions and his creative work in art. Many athletes and coaches are famous because they have invented new and different ways to win at their sport.

You could become famous one day for being creative. In order to become creative you must practice and these

activities are designed to help you practice at being creative.

What the Creative Activities Are Like

The activities in this kit will help you to become more creative in science, math, language arts, and social studies. They will also help you to become more creative in art, music, drama, and getting along with others. You will be inventing jokes, cartoons, poems, science experiments, number games, models, pictures, and all sorts of interesting things.

How to Work on the Creativity Activities

There are twenty-four different kinds of creativity activities in this kit. You may work on them in any order you care to, but you should work on one or two new activities each day. On the inside cover of your record book you will find a list of all the activities. Make a circle around each group of activities as you begin them.

You may want to work on some of the activities by yourself. For others you may want to work with one or two of your classmates. You may want to invent things on your own or you may want to work with your friends to develop a joint invention or project.

I told you that these activities would be different than other school work you have done. One way in which they are different is that you can never be completely finished with an activity. There will always be more ideas and more ways in which the activity could be improved. You will be making a record of the activities you do, and you will want to go back to activities finished earlier to improve them as you get new and better ideas.

This is the way creativity comes about. Creative people decide on something they want to do. After they have thought about it for awhile, they develop an idea about how they will do it. After they have done what they wanted to do, they look at it and decide whether or not their idea was good enough. If it was not, they try to improve it by getting other ideas. In your work with these activities, you will go through the same steps that creative people go through in inventing things. These steps are: (1) deciding what <u>you</u> want to do differently, (2) getting an idea about how to do something differently, (3) doing it that way, and (4) deciding whether that was the best way to do it.

The last step is a very important step in these activities. <u>You will be the one</u> who decides whether or not you have done the activity well. Your teacher will not mark your answers right or wrong. You will have to decide whether or not your answers were good ones or not. You

may want to share your activities with your teacher and he may be able to help you when you have a problem which is difficult to solve or if you do not understand the instructions given for an activity.

Your Record Book

As you work through the activities, you will be given some pages which you can place in your record book. These pages will help you keep a record of the activities that you have done. The record book is yours. If you would like to keep it neat you may do so. If you don't want to keep it neat you do not have to. You may show your record book to your teacher whenever you want to. He may ask to see your record book to see how you are progressing with the activities, but he will not make marks or grades in your record book. If you want to grade the pages of your record book, you may do so.

You will want to look through your record book occasionally to see if you have any better ideas for improving some of the things which you have created.

If you are able to fill your record book with many different and unusual ideas, you will have done well on these activities.

Review

Let's review what we have said about creativity. Creativity is doing things in unusual and different ways.

It is important to become creative because that's how changes for a better world are made. Many people who are famous, are famous because they were creative.

The activities in this kit are designed to help you become a more creative person. There are no right or wrong answers for these activities, but successful students are the ones who can list many different answers for the activities.

You will receive pages which go into your record book. The purpose of the record book is to help you keep a record of the things that you have created and invented. Your teacher will not grade or correct your record book, though he will be glad to talk with you about it and learn of the things that you are inventing and creating.

Remember that the purpose of these activities is to invent new and different ways of doing things. Students who had many good ideas will have been most successful at being creative.

You may now use your creativity card to check out one set of the creativity activities. When you are finished with the materials, return them to the teacher and check out a different set. If you have not already done so, complete the questions which are found in your creativity record book. Ask your teacher for the answer key for the questions. If you get more than two questions wrong, listen to the introduction again and then correct

the questions you made mistakes on. (This is the end of the information recorded on this tape.)

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APPENDIX E

Teacher's Instructions

APPENDIX E

Teacher's Instructions*

CREATIVITY

Teacher's Manual

Importance of Creativity

The importance of including opportunities for creative development in the curriculum can be illustrated in a variety of ways. A number of authorities have argued that creativity is essential to good mental health, and that creativity enables people to make adjustments and find solutions to problems confronting them. Other authorities have noted that creative individuals possess a powerful need to be creative; unless they are given an opportunity to be creative in constructive ways these individuals may display their creativity as behavior problems.

Other authors argue that it is the school's responsibility to help children to become fully functioning persons and that the neglect of creative development denies the child his right to become fully functioning. Others have noted that educational achievement is related to creativity and that creative ability can supplement "I.Q." enabling the child to achieve higher levels of academic

performance.

Researchers have noted that individuals who are highly successful in their field are also very creative. This finding suggests that creativity is a necessary condition for high levels of excellence.

Creative Process

Four stages of the creative process have been described by authors. These stages are thought to be sequential in nature but not discrete steps. The stages are preparation, incubation, illumination and verification.

During the period of preparation the student gathers information about the problem or question which confronts him. He begins to understand more fully the implications and limitations of the problem. During the second state, incubation, thought is given to the information gathered and to the problem itself. This stage is characterized by anxiety and unrest. The student is working towards the third period, the moment of illumination. The moment of illumination occurs when an idea or solution to the problem becomes apparent. The final stage consists of evaluating and revising the creative product.

These stages may occur in a period of time as short as a few seconds or minutes or they may take several weeks, months, or in some cases even years to occur. Their occurrence is unpredictable and it would seem naive to expect

that individuals will progress through the stages at similar rates.

Classroom Atmosphere

Studies have repeatedly shown that classroom atmosphere has a marked influence on the level of creativity in a class. It is thought that creativity is best fostered in an environment which is accepting and secure. One of the teacher's primary functions in using these materials is in insuring that such a classroom environment exists.

E. Paul Torrance suggests five principles which teachers should follow in order to provide a more "responsive" environment for creativity. His suggestions are: (1) be respectful of unusual questions, (2) be respectful of unusual ideas of children, (3) show children that their ideas have value, (4) provide opportunities for self-initiated learning and give credit for it, (5) provide for periods of non-evaluated practice or learning.

Children should be encouraged to avoid making premature judgments about their efforts. The teacher should avoid grading or scoring the activities in any way, although recognition may be given to students when they ask for it, or when they seem to need or profit from the recognition.

Individualized Instruction

Some children will prefer to work on these activities by themselves, others will prefer small groups, while

others will work at times with a group and at times by themselves. It is important that the teacher permit such flexibility in grouping arrangements. It is also important that the teacher be cognizant of differences in work rates and needs. Children should be permitted to work at rates best suited to their needs and no effort should be made to keep the children working together.

Evaluation

The children are to be permitted exclusive evaluation of their work. The teacher is not to offer evaluations of the products of the child's effort, either verbally or with grades unless the child specifically asks to have his work evaluated or indicates a strong need for such external evaluation.

For students who appear to be repeatedly neglecting the activities, the teacher may summon the student's record book and point out that he is falling behind. Such an admonishment, however, ought to be a relatively rare occurrence. The author strongly feels that it is better to forego the activities than to impose strong extrinsic forms of motivation in order to bring about participation in the activities.

The teacher has the responsibility, of course, for managing the activities of all students so that they do not infringe upon the rights of their classmates.

Example Responses

The following pages contain examples of the types of responses which might be given by children. These responses are to be considered as examples only and not the correct answer. The responses the children make will and should vary from the example responses given in the samples. There simply are no correct answers for these activities.

The teacher may also use the sample responses to assist children who are extremely frustrated and desperately in need of direction. It must be remembered, however, that to give children these hints denies them the experience of "illumination," a critical element of the creative process. Unless children experience illumination themselves the creative process is not complete.

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APPENDIX F

Verbal and Figural Pretest and Posttest Data

APPENDIX F

Verbal Pretest and Posttest Data
Torrance Tests of Creative Thinking

	Student's Number	Fluency		Flexibility		Originality	
		Pre	Post	Pre	Post	Pre	Post
Control Group Data	3	102	109	42	36	103	84
	6	113	129	42	38	109	82
	13	117	150	44	49	127	100
	19	88	87	40	39	87	52
	45	67	76	36	41	54	71
	47	131	125	48	54	151	101
	52	26	49	16	23	34	37
	67	76	83	36	27	57	39
	73	124	171	47	45	129	93
	75	40	34	27	22	18	19
	76	51	93	33	51	54	73
	87	97	132	43	62	120	120
Treatment Group Data	4	103	114	28	36	136	60
	8	49	86	31	29	38	82
	10	116	130	50	55	128	97
	20	58	109	27	44	60	78
	34	97	76	43	37	68	68
	37	76	152	35	56	52	79
	40	77	104	34	45	51	76
	58	40	30	23	22	47	19
	62	76	75	38	47	76	76
	78	94	94	38	39	83	78
	81	104	163	44	63	71	109
	82	110	179	50	56	66	109

Figural Pretest and Posttest Data
Torrance Tests of Creative Thinking

	Student's Number	Fluency		Flexibility		Originality		Elaboration	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
Control Group Data	3	36	27	22	19	54	38	61	114
	6	25	28	14	23	37	34	117	170
	13	17	20	10	19	24	19	59	116
	19	27	23	21	20	37	36	34	81
	45	19	22	13	17	40	44	95	118
	47	24	26	18	17	31	40	83	145
	52	17	13	15	13	28	7	36	51
	67	22	22	13	18	19	38	52	56
	73	20	32	14	20	27	54	52	124
	75	14	15	13	13	21	22	45	74
	76	19	16	19	14	24	47	40	72
	87	14	32	13	25	23	38	82	103
Treatment Group Data	4	16	18	16	17	24	25	54	59
	8	14	21	11	17	21	23	18	68
	10	23	27	18	19	33	37	109	140
	20	19	24	15	21	25	31	45	88
	34	25	24	18	18	44	49	85	126
	37	17	23	16	19	26	28	56	114
	40	32	27	24	20	64	35	71	95
	58	12	13	11	11	23	37	28	52
	62	19	20	16	14	29	67	94	121
	78	16	16	15	14	25	57	80	106
	81	23	31	21	25	39	33	46	123
	82	12	36	11	29	20	46	60	117

APPENDIX G

Computer Printouts for:

Verbal Fluency

Verbal Flexibility

Verbal Originality

Figural Fluency

Figural Flexibility

Figural Originality

Figural Elaboration

VERBAL FLUENCY

START ANALYSIS 1
ANALYSIS OF COVARIANCE
1 YOUNGS METCALF 1
X= 102.0000000 Y= 109.0000000 FIRST DATA CARD IN F-FORMAT

GROUP	N	SUM X	SUM Y	SUM XX	SUM YY	SUM XY
1	12	0.1032000E 04	0.1238000E 04	0.1016940E 06	0.1457520E 06	0.1200610E 06
2	12	0.1008000E 04	0.1312000E 04	0.9007200E 05	0.1628400E 06	0.1166680E 06

T VALUE FOR ADJUSTED MEANS: 0.8195 (GROUP 1 GROUP 2)

SOURCES	DF	SS X	SP	XX Y	SS YP	DF	MS YP
TREATMENTS(A)	1	42.6875	-98.6875	228.1250	485.2227	1	485.2227
WITHIN(W)	22	19680.6875	20927.6875	37426.3750	15172.6875	21	722.5088
TOTAL	23	19723.3750	20829.0000	37654.5000	15657.9102	22	

F= 0.6716 DF= 1 DF= 21 SQRT(F), 0.8195

HOMOGENEITY OF REGRESSION

SOURCES	DF	SS	MS
AMONG GROUP REGRESSION	1	6.4570	6.4570
DEVIATION FROM GROUP REGRESSION	20	15166.2305	758.3115

HOMOGENEITY OF REGRESSION F= 0.0085 DF= 1 DF= 20

X MEANS
86.0000 83.3333
Y MEANS
103.1667 109.3333
ADJUSTED Y MEANS
101.7488 110.7511

TOTAL N	TOTAL SUM X	TOTAL SUM Y	TOTAL SUM XX	TOTAL SUM YY	TOTAL SUM XY
24	2032.0000	2550.0000	191766.0000	308592.0000	236729.0000

TOTAL R(XY)	TOTAL MEAN X	TOTAL MEAN Y	BETA(WITHIN)	BETA(TOTAL)
0.7643	84.6667	106.2500	1.0634	1.0561

VERBAL FLEXIBILITY

START ANALYSIS 1
ANALYSIS OF COVARIANCE
1 YOUNGS METCALF 2
X= 42.0000000 Y= 36.0000000 FIRST DATA CARD IN F-FORMAT

GROUP	N	SUM X	SUM Y	SUM XX	SUM YY	SUM XY
1	12	0.4540000E 03	0.4370000E 03	0.1809200E 05	0.2147100E 05	0.1929000E 05
2	12	0.4410000E 03	0.5290000E 03	0.1705700E 05	0.2494700E 05	0.2027200E 05

T VALUE FOR
ADJUSTED MEANS GROUP GROUP
1.2322 1 2

SOURCES	DF	SS X	SP	XX Y	SS YP	DF	MS YP
TREATMENTS(A)	1	7.0430	-22.7500	73.5000	123.2173	1	123.2173
WITHIN(W)	22	1765.9180	1696.4180	3333.8359	1704.1833	21	81.1516
TOTAL	23	1772.9609	1673.6680	3407.3359	1827.4006	22	

F= 1.5184 DF= 1 DF= 21 SQRT(F), 1.2322

HOMOGENEITY OF REGRESSION

SOURCES	DF	SS	MS
AMONG GROUP REGRESSION	1	0.4749	0.4749
DEVIATION FROM GROUP REGRESSION	20	1703.7085	85.1854

HOMOGENEITY OF REGRESSION F= 0.0056 DF= 1 DF= 20

X MEANS
37.8333 36.7500
Y MEANS
40.5833 44.0833
ADJUSTED Y MEANS
40.0630 44.6037

TOTAL N	TOTAL SUM X	TOTAL SUM Y	TOTAL SUM XX	TOTAL SUM YY	TOTAL SUM XY
24	895.0000	1016.0000	35149.0000	46418.0000	39562.0000

TOTAL R(XY)	TOTAL MEAN X	TOTAL MEAN Y	BETA(WITHIN)	BETA(TOTAL)
0.6809	37.2917	42.3333	0.9606	0.9440

VERBAL ORIGINALITY

START ANALYSIS 1
ANALYSIS OF COVARIANCE
1 YOUNGS METCALF 3
X= 1.0000000E 00 Y= 1.0000000E 00 FIRST DATA CARD IN F-FORMAT

GROUP	N	SUM X	SUM Y	SUM XX	SUM YY	SUM XY
1	12	0.1043000E 04	0.8710000E 03	0.1105910E 06	0.7335500E 05	0.8806100E 05
2	12	0.8760000E 03	0.9310000E 03	0.7412400E 05	0.7844100E 05	0.6905600E 05

T VALUE FOR
ADJUSTED MEANS GROUP GROUP
1.2149 1 2

SOURCES	DF	SS X	SP	XX Y	SS YP	DF	MS YP
TREATMENTS(A)	1	1162.0625	-417.5000	150.0000	726.7148	1	726.7148
WITHIN(W)	22	30112.9375	13449.6250	10345.8750	10338.7461	21	492.3210
TOTAL	23	31275.0000	13032.1250	10495.8750	11065.4609	22	

F= 1.4761 DF= 1 DF= 21 SQRT(F), 1.2149

HOMOGENEITY OF REGRESSION

SOURCES	DF	SS	MS
AMONG GROUP REGRESSION	1	1768.7227	1768.7227
DEVIATION FROM GROUP REGRESSION	20	8570.0234	428.5010

HOMOGENEITY OF REGRESSION F= 4.1277 DF= 1 DF= 20

X MEANS
86.9167 73.0000
Y MEANS
72.5833 77.5833
ADJUSTED Y MEANS
69.4755 80.6912

TOTAL N	TOTAL SUM X	TOTAL SUM Y	TOTAL SUM XX	TOTAL SUM YY	TOTAL SUM XY
24	1919.0000	1802.0000	184715.0000	151796.0000	157117.0000

TOTAL R(XY)	TOTAL MEAN X	TOTAL MEAN Y	BETA(WITHIN)	BETA(TOTAL)
0.5738	79.9583	75.0833	0.4466	0.4167

FIGURAL FLUENCY

```
 START ANALYSIS    1
ANALYSIS OF COVARIANCE
1   YOUNGS  METCALF          4
X=      36.00000000    Y=      27.00000000   FIRST DATA CARD IN F-FORMAT
```

GROUP	N	SUM X	SUM Y	SUM XX	SUM YY	SUM XY
1	12	0.2540000E 03	0.2760000E 03	0.5802000E 04	0.6784000E 04	0.5982000E 04
2	12	0.2280000E 03	0.2400000E 03	0.4714000E 04	0.6986000E 04	0.5451000E 04

T VALUE FOR ADJUSTED MEANS	GROUP	GROUP
0.4142	1	2

SOURCES	DF	SS X	SP	XX Y	SS YP	DF	MS YP
TREATMENTS(A)	1	28.1680	-4.3320	0.6680	6.5190	1	6.5190
WITHIN(W)	22	807.6680	271.0000	868.6680	797.7383	21	37.9875
TOTAL	23	835.8359	266.6680	869.3359	804.2573	22	

F= 0.1716 DF= 1 DF= 21 SQRT(F), 0.4143

HOMOGENEITY OF REGRESSION

SOURCES	DF	SS	MS
AMONG GROUP REGRESSION	1	0.0398	0.0398
DEVIATION FROM GROUP REGRESSION	20	797.6965	39.8849

HOMOGENEITY OF REGRESSION F= 0.0010 DF= 1 DF= 20

X MEANS	
21.1667	19.0000
Y MEANS	
23.0000	23.3333
ADJUSTED Y MEANS	
22.6365	23.6968

TOTAL N	TOTAL SUM X	TOTAL SUM Y	TOTAL SUM XX	TOTAL SUM YY	TOTAL SUM XY
24	492.0000	556.0000	10516.0000	13770.0000	11433.0000

TOTAL R(XY)	TOTAL MEAN X	TOTAL MEAN Y	BETA(WITHIN)	BETA(TOTAL)
0.3093	20.5833	23.1667	0.3355	0.3190

START ANALYSIS 1
ANALYSIS OF COVARIANCE
1 YOUNGS METCALF 5
X= 22.0000000C Y= 19.0000000 FIRST DATA CARD IN F-FORMAT

GROUP	N	SUM X	SUM Y	SUM XX	SUM YY	SUM XY
1	12	0.1850000CE 03	0.2180000OE 03	2.3083000[illegible] 04	0.4112000OE 04	0.3346000OE 04
2	12	0.1920000OE 03	0.2240000OE 03	0.3246000[illegible] 04	0.4444000OE 04	0.3623000OE 04

T VALUE FOR
ADJUSTED MEANS GROUP GROUP
0.2516 1 2

SOURCES	DF	SS X	SP	XX Y	SS YP	DF	MS YP
TREATMENTS(A)	1	2.0430	1.7500	1.5000	1.2432	1	1.2432
WITHIN(W)	22	324.9154	24.1680	414.3359	412.5381	21	19.6447
TOTAL	23	326.9584	25.9180	415.8359	413.7813	22	

F= 0.0633 DF= 1 DF= 21 SQRT(F), 0.2516

HOMOGENEITY OF REGRESSION
SOURCES DF SS MS
AMONG GROUP REGRESSION 1 8.4016 8.4016
DEVIATION FROM GROUP REGRESSION 20 404.1365 20.2068

HOMOGENEITY OF REGRESSION F= 0.4158 DF= 1 DF= 20

X MEANS
15.4167 16.0000
Y MEANS
18.1667 18.6667
ADJUSTED Y MEANS
18.1683 18.6650

TOTAL N	TOTAL SUM X	TOTAL SUM Y	TOTAL SUM XX	TOTAL SUM YY	TOTAL SUM XY
24	377.0000	442.0000	6249.0000	8556.0000	6969.0000

TOTAL R(XY)	TOTAL MEAN X	TOTAL MEAN Y	BETA(WITHIN)	BETA(TOTAL)
0.0703	15.7083	18.4167	0.0744	0.0793

FIGURAL ORIGINALITY

START ANALYSIS 1
ANALYSIS OF COVARIANCE
1 YOUNGS METCALF 6
X= 54.00000000 Y= 38.00000000 FIRST DATA CARD IN F-FORMAT

GROUP	N	SUM X	SUM Y	SUM XX	SUM YY	SUM XY
1	12	0.3650000E 03	0.4170000E 03	0.1221100E 05	0.1633900E 05	0.1293800E 05
2	12	0.3730000E 03	0.4580000E 03	0.1335500E 05	0.2020600E 05	0.1462900E 05

T VALUE FOR
ADJUSTED MEANS
0.7631

GROUP 1
GROUP 2

SOURCES	DF	SS X	SP	XX Y	SS YP	DF	MS YP
TREATMENTS(A)	1	2.6641	17.0000	108.3750	104.3308	1	104.3308
WITHIN(W)	22	2869.3359	336.2500	3802.2500	3762.8525	21	179.1834
TOTAL	23	2872.0000	353.2500	3910.6250	3867.1833	22	

F= 0.5823 DF= 1 DF= 21 SQRT(F), 0.7631

HOMOGENEITY OF REGRESSION

SOURCES	DF	SS	MS
AMONG GROUP REGRESSION	1	22.7148	22.7148
DEVIATION FROM GROUP REGRESSION	20	3740.1377	187.0069

HOMOGENEITY OF REGRESSION F= 0.1215 DF= 1 DF= 20

X MEANS
30.4167 31.0833
Y MEANS
34.7500 38.0000
ADJUSTED Y MEANS
34.7890 38.9609

TOTAL N	TOTAL SUM X	TOTAL SUM Y	TOTAL SUM XX	TOTAL SUM YY	TOTAL SUM XY
24	738.0000	885.0000	25560.0000	36545.0000	27567.0000

TOTAL R(XY)	TOTAL MEAN X	TOTAL MEAN Y	BETA(WITHIN)	BETA(TOTAL)
0.1054	30.7500	36.8750	0.1172	0.1230

FIGURAL ELABORATION

START ANALYSIS 1
ANALYSIS OF COVARIANCE
1 YOUNGS METCALF 7
X= 61.0000000 Y= 114.0000000 FIRST DATA CARD IN F-FORMAT

GROUP	N	SUM X	SUM Y	SUM XX	SUM YY	SUM XY
1	12	0.75600000E 03	0.12240000E 04	0.55014000E 05	0.13924400E 06	0.85539000E 05
2	12	0.74600000E 03	0.12090000E 04	0.54284000E 05	0.13074500E 06	0.81457000E 05

T VALUE FOR
ADJUSTED MEANS GROUP GROUP
-0.0525 1 2

SOURCES	DF	SS X	SP	XX Y	SS YP	DF	MS YP
TREATMENTS(A)	1	4.1875	6.2500	9.3750	1.2188	1	1.2188
WITHIN(W)	22	15293.6375	14724.5000	23334.2500	9157.7578	21	436.0835
TOTAL	23	15297.8750	14730.7500	23343.6250	9158.9766	22	

F= 0.0028 DF= 1 DF= 21 SQRT(F), 0.0529

HOMOGENEITY OF REGRESSION

SOURCES	DF	SS	MS
AMONG GROUP REGRESSION	1	453.4180	453.4180
DEVIATION FROM GROUP REGRESSION	20	8704.3398	435.2168

HOMOGENEITY OF REGRESSION F= 1.0418 DF= 1 DF= 20

X MEANS
63.0000 62.1667
Y MEANS
102.0000 100.7500
ADJUSTED Y MEANS
101.5988 101.1512

TOTAL N	TOTAL SUM X	TOTAL SUM Y	TOTAL SUM XX	TOTAL SUM YY	TOTAL SUM XY
24	1502.0000	2433.0000	109298.0000	269989.0000	166996.0000

TOTAL R(XY)	TOTAL MEAN X	TOTAL MEAN Y	BETA(WITHIN)	BETA(TOTAL)
0.7795	62.5833	101.3750	0.9628	0.9629

APPENDIX H

Computer Printout for:

Two-Way Analysis of Variance with Repeated Measures

TWO-WAY ANALYSIS OF VARIANCE
WITH REPEATED MEASURES

```
550.00002216.00001802.00000 556.00000 442.00000 885.00002433.00000
COLUMN MEANS
136.25000  92.33333  75.08333  23.16666  13.41666  36.87500 101.37500
SUMMARY TABLE
  DF          SUMS OF SQUARES          MEAN SQUARES      F-RATIOS
  23.        41006.75000000          1782.90209961        0.0
   1.          293.31250000           293.31250000        0.1585
  22.        40713.43750000          1850.61059570        0.0
 144.       236445.87500000          1641.98510742        0.0
   6.       191335.37500000        31889.22656250        93.8918
   6.          278.25000000            46.37500000        0.1365
 132.        44832.25000000           339.63816359        0.0
 167.       277452.62500000          1661.39282227        0.0
TABLE ORDER  SUBJECTS, GROUPS, ERR(B), WITHIN SS, A, GXA, ERR(W), TOTAL

END OF ANALYSIS    1

IHC900I EXECUTION TERMINATING DUE TO ERROR COUNT FOR ERROR NUMBER  217

IHC217I FIOCS - END OF DATA SET ON UNIT    1

TRACEBACK  ROUTINE  CALLED FROM ISN   REG. 14    REG. 15    REG.  0    REG.  1

           IBCOM                      00036672   00037208   00000001   00036FD8

           MAIN                       00009362   01034A00   FFFFFF56   0004CFF8

ENTRY POINT=  01034A00
```

APPENDIX I

Questionnaires

APPENDIX I

Questionnaires

Name_____

QUESTIONNAIRE FOR CREATIVE THINKING KITS

(Control Group)

1. Did you work on any of the creativity activities? If so, which ones?

2. Did you look at any of the activities or did anyone tell you about any of the activities? If so, how much?

3. Would you like to work with the creative thinking kits next year?

4. Did you want to be in the group which worked on the kits?

Name_____

QUESTIONNAIRE FOR CREATIVE THINKING KITS

(Experimental Group)

1. Which creative thinking kits did you check out?
2. Which activities (sheets) did you complete?
3. Which activities (sheets) are you still working on?
4. List the activities (sheets) you liked the best.
5. List the activities (sheets) you did not care for.
6. Have you talked with other people in the control group about the activities?_____If so, how much?
7. Have others in the control group looked at or worked with any of the kits you have been working on?_____ If so, how much?
8. About how many of the creativity class periods did you use to work on other things?
9. How well do you like working on the creative thinking kits? (Compare with other subjects)
10. How much do you think about your creativity activities when you are not in school?
11. Would you like to continue working with the kits next year?
12. Were you happy when you were put in the experimental group at the start of the semester?
13. Are you happy now that you were able to work on the kits?