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## A Study of The Effects of A Creative Thinking Skills Program On Intermediate Grade Educationally Handicapped Children.

Lawrence Wesley Sharpe  
*University of the Pacific*

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A STUDY OF THE EFFECTS OF A CREATIVE THINKING SKILLS PROGRAM  
ON INTERMEDIATE GRADE EDUCATIONALLY HANDICAPPED CHILDREN

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A Doctoral Dissertation  
Presented to  
Members of the Dissertation Committee  
University of the Pacific

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In Partial Fulfillment  
of the Requirements for the Degree  
Doctor of Education

---

by  
Lawrence Wesley Sharpe

December, 1974

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1974

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## ABSTRACT

Statement of the Problem: The problem of this study was to determine if the verbal and figural creative abilities of educationally handicapped children can be appreciably enhanced through an educational environment using brainstorming and programmed instruction techniques.

Procedures: The population of this study consisted of 95 intermediate grade educationally handicapped students in the Hayward Unified School District who were enrolled in EH Special Day Classes. Nine intermediate grade EH classes were randomly assigned to four experimental treatments. The experimental treatments were: (a) brainstorming, (b) programmed instruction, (c) combination of brainstorming and programmed instruction and, (d) control.

Alternate forms of the Torrance Tests of Creative Thinking were administered as pre and posttests. A 1X4 covariance analysis was used for the analysis of the data using the pretest scores as the covariate. The Scheffe procedure for testing all possible comparisons among means was used to analyze the data further.

Findings:

1. Post hoc tests of significance showed that the brainstorming group scored significantly higher than the programmed instruction and control groups on Verbal Fluency.
2. Post hoc tests of significance showed that the brainstorming group scored significantly higher than the programmed instruction and control groups on Verbal Flexibility.
3. Post hoc tests of significance showed that the brainstorming group scored significantly higher than the programmed instruction group on Verbal Originality.
4. Post hoc tests of significance showed that the brainstorming group, the programmed instruction group and the combination group scored significantly higher than the control group on Figural Fluency.
5. Post hoc tests of significance show that the brainstorming group scored significantly higher than the control group on Figural Flexibility.
6. There was no significant difference between the treatment groups on Figural Originality.
7. There was no significant difference between the treatment groups on Figural Elaboration.

Recommendations:

1. This study should be replicated using school psychologists or other examiners trained to administer standardized tests. This would provide a more uniform administration of the Torrance Tests of Creative Thinking, and improve the reliability of the test results.
2. Replications of this study should use the entire verbal battery of the Torrance Tests of Creative Thinking. Each test involves different kinds of thinking and makes a unique contribution to the entire test battery. Such a study would provide greater opportunity to measure the effectiveness of the programmed instruction and the combination treatment.
3. It is recommended that a replication study be designed that will use the Torrance Tests of Creative Thinking and other testing instruments to measure creative thinking. Tests such as those developed at the University of California, Berkeley to test productive thinking may be appropriate. Additional testing may show the programmed instruction treatment to be significant on variables other than Figural Fluency.
4. Experiments designed to study the creative abilities of primary grade EH children are recommended. A study of the development of creative thinking in primary and intermediate grade EH children would allow interesting comparisons to be made.
5. Future studies of the creative abilities of EH children should consider the wide range of IQ scores sometimes found in EH classes, and the effects of medication on creative thinking.
6. In view of the findings of this study, curriculum planning for educationally handicapped classes must include time for the development of verbal creative abilities such as, verbal fluency, verbal flexibility, and verbal originality. The information in this study regarding the creative abilities of figural fluency and figural flexibility, should also be used as it relates to curriculum planning and teaching techniques.

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## Chapter 1

### INTRODUCTION

The mid 1950's saw the beginning of a growing concern for the educational provisions for children with learning disabilities. In California, legislation was enacted in 1963, to provide for the education of neurologically and emotionally handicapped children in a combined public school program for the educationally handicapped (Mahler, 1963). The problems of these children should not be oversimplified, for they often involve self-concept, emotional disturbance, problems of visual and auditory perception, memory impairment, left-right orientation, body image and body concept (Helmuth, 1965).

Currently, children in California are considered to be educationally handicapped (EH) if their learning or behavior problems are associated with a neurological disorder, emotional disturbance, or a combination of these disabilities. The EH child's learning or behavior disorder must be serious enough to affect his functioning in the basic learning skills, and while he may be functioning at a retarded level academically his low level of functioning must not be due to mental retardation (California Education Code, 1971).

Creativity is a highly valued human characteristic and one which is believed to be a natural phenomenon in all children (Anderson, 1959). Torrance (1962) suggested that the individual's creativity is a potential source in helping to cope with problems and learn new skills. However, there is some evidence of a drop in the creative thinking

abilities of children as they grow older, and it appears that some children never recover from this drop in creativity (Torrance, 1962; 1968). It would seem that the lessening of creative behavior would be even greater with educationally handicapped children because of their academic and adjustment problems.

Coupled with the evidence of a drop in creativity is the apparent difficulty with verbal expression often experienced by children who have learning difficulties. It may be that many children lack skill in verbal ability because of their learning disorders (Torrance, 1966). Torrance points out that,

Many children who have learning difficulties manifest tremendously creative behavior on figural tests but apparently their fear of verbal symbols makes them seem to be mentally paralyzed on verbal tests (1966, p. 4).

## THE PROBLEM

### Statement of the Problem

Educational programs dealing with educationally handicapped children must be strongly remedial in nature and often involve new methods for teaching and learning academic skills. The serious nature of the educational and behavioral problems encountered by the teachers of these children, and the demands placed on them to cope with problems of school failure, emotional and neurological disorders, further complicate the teacher's task. The difficulties encountered in teaching these children would seem to point to an educational environment which in many cases does not permit the development of creativity. The problem of this study is to determine if the verbal and figural creative abilities of educationally handicapped children can be appreciably

enhanced through an educational environment using brainstorming and programmed instruction techniques.

### Rationale of the Study

The development of creative thinking skills in all persons seems to be important. Torrance (1965) believes that creative thinking is important in all areas of life, and that the prolonged enforced repression of creative desire may lead to the actual breakdown of the personality. Creative thinking contributes to the acquisition of information, and is essential in the application of knowledge to personal and professional problems. Carl Rogers (Parnes and Harding, 1962) concluded that in education we tend to develop conformists rather than freely creative original thinkers. According to Rogers, both constructive and destructive knowledge is developing rapidly, and there is a need for genuinely creative adaptation if man is to keep abreast of the changes in the world.

Research seems to show that all children including those with learning disabilities have the potential for creative thinking. Taylor (1964) stated that all persons regardless of age or culture are to some degree creative. While there seems to be agreement on creative potential, there is evidence that the creative potential of school children is not being tapped. Olton (1969) suggested that all children regardless of intelligence or initial level of creative ability demonstrate a level of creative thinking far below their potential. The creative abilities of children are thought to be increased or decreased by an educational environment which values creativity (Torrance, 1965). If this is correct it would appear that the creativity of some children

may be so repressed by their education and experience that their creative potential cannot be recognized or realized (Gowan and Demos, 1964).

However, there is evidence which seems to show that training the creative abilities of children can be accomplished (Parnes and Meadows, 1963; Torrance, 1964; Crutchfield and Covington, 1965; Buchanan and Lindgren, 1973). A statement by Parnes and Meadows (1963, p. 320) seems relevant when applied to educationally handicapped children whose creative output is low. They concluded that, "The gap between an individual's innate creative talent and his actual creative output can be narrowed by deliberate education in creative thinking."

Brainstorming. Brainstorming is a method which may be helpful in developing the verbal creative abilities of educationally handicapped children. This training method offers an atmosphere without evaluation, where ideas may be expressed freely. Osborn (1963) described brainstorming as a creative conference for the purpose of producing ideas which lead to the solution of a problem. Research studies (Parnes and Meadows, 1963; Torrance, 1964; Rouse, 1965) using brainstorming have been carried out at various grade levels and with students of different levels of ability. These studies seem to show the value of brainstorming as a method of developing creative thinking.

Programmed instruction. While brainstorming offers many opportunities for the free expression of ideas without immediate evaluation, programmed instruction helps to develop creative thinking even when the teacher is not aware of the value of developing creative abilities (Wardrop, 1969). However, an objection to programmed instruction as a method for developing creativity is its association with rote



learning (Crutchfield and Covington, 1965). Torrance\* does not believe that the traditional principles of programmed learning can be applied completely to the development of creativity. In his opinion creative thinking must be open ended, and the development and encouragement of creative behavior depends upon a responsive environment.

~~Crutchfield and Covington (1974)~~ are coauthors of The Productive Thinking Program (PTP). The PTP is a 15 lesson loosely structured linear program developed for upper elementary grade children. The authors have concluded that the potentially detrimental effects of programmed instruction on creativity can be overcome through lack of rigidity in programming, and inventing new program techniques. Olton (1969) commented that programs can be written in such a way that the student is called upon to use and develop a rich diversity of productive thinking skills.

Certain features of programming give it some decided advantages as a vehicle for developing creative thinking in the student. For one thing, programmed material can provide the individual with great procedural flexibility--he can think, puzzle, and proceed at his own pace, exploring many or few cognitive avenues as he goes. For another thing, programmed instruction requires that the student actively participate, requiring him to do the thinking himself, rather than allowing him passively to fill a notebook with someone else's thoughts. Moreover, it can provide him with immediate guidance, direction and evaluation as he goes (Olton, 1969, p. 17).

Programmed instruction seems to be a useful method for the development of creativity in EH children because of its structure, individual nature, and high interest value. Brainstorming also seems to be valuable because of the emphasis placed on the expression of ideas without immediate judgment. A combination of programmed instruction and

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\*Personal communication with the researcher, December 6, 1972.

brainstorming would seem to be a useful method for the development of creativity in educationally handicapped children. This method would combine the structure, individual nature, and high interest value of programmed instruction with brainstorming's emphasis on the freedom to express ideas.

### Significance of the Study

Developing the creative potential of all children seems to be a legitimate aim of education, and it would be valuable to study means of implementing this aim with educationally handicapped children. The number of EH children in special education programs in California school districts has been limited by State law to two percent of the public school enrollment (California Education Code, Sec. 6752, 1971). However, it appears that the prevalence of neurological and emotional handicaps in school age children may be as high as 10 to 15 percent, and many of these children have severe learning disorders (Arieti, 1959; Wender, 1971).

While there have been some interesting studies dealing with the creative abilities of mentally retarded children (Tisdall, 1962; Smith, 1967), there is a paucity of research dealing specifically with educationally handicapped children and creativity (Tognetti, 1971). This would point to the need for research dealing with the development of the creative abilities of EH children.

### HYPOTHESES

The following research hypotheses will be tested in this study with intermediate grade educationally handicapped children. The

Torrance Tests of Creative Thinking will be used as measures of the dependent variable.

1. Educationally handicapped children who participate in brainstorming sessions to develop their creative thinking abilities demonstrate significantly greater improvement than EH children not participating in the sessions.

2. Educationally handicapped children who participate in programmed instruction to develop their creative thinking abilities demonstrate significantly greater improvement than EH children not participating in the instruction.

3. Educationally handicapped children who participate in a combination program of programmed instruction and brainstorming sessions to develop their creative thinking abilities demonstrate significantly greater improvement than EH children not participating in the program.

4. Educationally handicapped children who participate in a combination program of programmed instruction and brainstorming sessions to develop their creative thinking abilities demonstrate significantly greater improvement than EH children participating in brainstorming, programmed instruction, or those not participating.

#### DEFINITION OF TERMS

##### Creativity

The definition of creativity is assumed to be the same as that measured by the instruments selected. Thus, creativity is viewed as:

A process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, disharmonies and so on; identifying the difficulty; searching for solutions, making guesses, or formulating hypotheses about the deficiencies; testing and retesting these hypotheses and possibly modifying and retesting

them; and finally communicating the results (Torrance 1966, p. 6).

### Verbal Creativity

The term as used in this study refers to verbal responses to the Torrance Tests of Creative Thinking verbal test items.

### Figural Creativity

The term as used in this study refers to drawing responses to the Torrance Tests of Creative Thinking figural test items.

### Creative Thinking Abilities

Creative thinking abilities are those generalized mental abilities presumed to be necessary for creative achievements. Included in these are the qualities of ideational fluency, flexibility of approaches to problem solving, originality of responses, and elaboration or the ability to develop detail (Torrance, 1965; 1968).

### Educationally Handicapped Children

Educationally handicapped children are defined as follows:

Minors who, by reason of marked learning or behavior disorders, or both, cannot benefit from the regular education program, and who, as a result thereof, require the special education programs [learning disability groups; special day classes; home, hospital, or regular established non profit, tax-exempt, licensed children's institution programs] .... Such learning or behavior disorders shall be associated with a neurological handicap or emotional disturbance and shall not be attributable to mental retardation (California Education Code, Sec. 6750, 1971).

### Neurologically Handicapped Children

The neurologically handicapped child's

learning or behavior disorders are specific learning disabilities in the psychological processes involved in understanding or in using spoken or written language. Such learning disabilities include, but are not limited to, those sometimes referred to as

perceptual handicaps, minimal brain dysfunction, dyslexia, dyscalculia, dysgraphia, except aphasic as defined in Section 3600(g) (California Administrative Code, Sec. 3230a, 1972).

### Emotionally Disturbed Children

The emotionally disturbed child's

learning or behavior disorders are specific behavior disorders such that the pupil cannot benefit from the regular educational program. Such behavior disorders include, but are not limited to, those sometimes referred to as school phobia, adjustment reactions, withdrawal, lability, or impulsiveness (California Administrative Code, Sec. 3230b, 1972).

### Special Day Classes

Under this program educationally handicapped pupils unable to function in a regular class are assigned to a special day class. The special day class shall be maintained for not less than the minimum school day. In this program fundamental school subjects shall be emphasized as prescribed by the State Board of Education (California Education Code, Sec. 6751a, 1971).

### Brainstorming

Brainstorming is a conference technique for the purpose of producing spontaneous ideas which lead to the solution of specific problems. Basic to brainstorming is the principle of deferred judgment. This principle allows for the listing of a quantity of ideas without judging the quality of the ideas (Osborn, 1963).

### Programmed Instruction

Programmed instruction in creative thinking abilities means instruction using The Productive Thinking Program. The principal emphasis of the PTP materials is upon creative thinking.

The materials provide the student with a systematically structured, step-by-step progression through the problem solving process, resulting in an orderly, sequential mastery of the essentials of productive thinking (Covington, Crutchfield et al., 1974).

## ASSUMPTIONS AND LIMITATIONS

For the purpose of this study the following assumptions and limitations are set forth:

### Assumptions of the Study

1. All individuals are potentially creative but differ in their degree of creativity.
2. Children in educationally handicapped classes have been selected and placed as directed by the California Education Code.
3. Students in this study who have been certified educationally handicapped by the local admission and discharge committee are typical of the general population in California.

### Limitations of the Study

1. A limitation of this study is the lack of precise diagnosis of emotional disturbance and neurological handicap. The medical and psychological professions often find it difficult to state whether or not emotional disturbance or neurological handicap are the cause of an educational handicap.
2. The study is limited by the size of the population from which the sample can be drawn. No more than two percent of a district's total enrollment shall be enrolled in educationally handicapped classes except by special authorization of the Superintendent of Public Instruction (California Education Code, 1971).
3. Since the sample population will be drawn from only one urban area, the application of the findings of this study will be generalized to students from similar environments.

4. There is no widely accepted definition of creativity and tests purporting to measure creativity tend to mirror the beliefs and preconceptions of their developers.

#### Torrance Tests of Creative Thinking

The Torrance Tests of Creative Thinking were chosen as measures of the dependent variable for the following reasons (Torrance, 1966).

1. They represent over, "nine years of sustained research and development by the author and his associates" (p. 2).

2. The tests may be administered individually or as group tests.

3. The tests may be used with children who cannot read or write.

4. "The types of tasks or activities chosen for the tests were those that could be most easily and economically administered and scored" (p. 2).

5. The tasks or activities chosen for the tests, "Had stood best the tests of reliability and validity while at the same time sampling as many different kinds of manifestations of creative thinking ability as possible" (p. 2).

6. "The author has tried to assemble batteries of figural and verbal activities that require thinking analogous to the thinking involved in recognized creative achievements" (p. 10).

#### STATEMENT OF PROCEDURE

The report of this study involves the following procedure. The introductory chapter presents a statement of the problem, hypotheses to

be investigated, the definition of terms, and the assumptions and limitations of the study. A review of current literature concerning the present study and related studies is included in Chapter II. Chapter III deals with the source of the data as well as the research design and statistical procedures used in this study. Chapter IV presents an analysis and interpretation of the obtained data. The final Chapter concludes the dissertation with a general summary and recommendations for further study.



## Chapter II

### REVIEW OF THE LITERATURE

In this chapter a review of research and related studies dealing with educationally handicapped (EH) children, and creative thinking will be presented. The first section contains a discussion of the descriptive characteristics of educationally handicapped children, and methods of behavior management often used with EH children in public school special day classes. Section two will discuss creativity as it pertains to EH children. The third section will review the literature and research related to two curriculum methods thought to enhance creative thinking. Throughout this chapter the literature selected for review was that which was most directly related to the subjects of this study.

### CHARACTERISTICS OF EDUCATIONALLY HANDICAPPED CHILDREN

#### Historical Overview

Researchers for many years have been interested in the effects of brain damage on speech function, motor defects, the ability to learn, and intelligence. Mahler (1964) summarized the early history and interest in the neurologically handicapped child. In his review Mahler traced the early interest in the effects of brain damage as far back as 1819. In that year Gall, the Viennese physician, described two cases of loss of language function after head injury. Gall suggested that speech functions were localized in the anterior areas of the brain. Following Gall there were several men who continued to be interested in

the effects of brain damage. Broca in 1861 reported on cases of articulated language disorder. He believed that the left half of the brain was the center of language function. Hughlings Jackson in 1864 began to report his observations of speech function and loss, and for 30 years continued to make precise clinical observations. James Hinschelwood, an early investigator of reading problems, in 1871 hypothesized that children who were unable to learn to read but presented no difficulty in visual acuity were congenitally word blind. Samuel T. Orton, an American neuro-pathologist in the 1930's, used the term "strephosymbolia" to describe confusion between letters and a tendency to a changing order of direction in reading. He claimed that at least two percent of the school population had this defect (Mahler, 1964; McBeth, 1966).

Historically, emotional disturbance has also been recognized as a source of learning disorders. Lippman's (1962) review of the literature covered more than 50 years. He found references to reading difficulties ascribed to such areas as fear of castration, expression of aggression, parental neurosis, and weak egos.

Bower and Holmes (1959) reviewed the literature on disabilities in basic school subjects and emotional factors. They found that approximately 100 experimental studies had been completed between 1953 and 1959, attesting to the growing interest in this field. According to Bower and Holmes, many of these studies were well conceived and executed. Other studies however, suffered from small and biased samplings, inadequate or inappropriate statistical treatment, poorly scaled instruments, and ill defined criteria. The studies reported on: (a) the attitudes of the parents of children who read well in contrast to those who read poorly, (b) the personality factors of over and underachievers in arithmetic,

(c) the relationship of personality variables to spelling ability among university students, (d) the emotional adjustment of superior readers contrasted to poor readers, and (e) comparisons of the emotional adjustment of underachieving and overachieving readers.

Programs for educationally handicapped minors (EH) were first authorized by the California State Legislature in 1963 with the passage of AB 464, the "Waldie Act." Information current as of June, 1972, indicated that 558 California school districts and county offices had approval to operate EH programs. The enrollment in these classes was 55,145 pupils from kindergarten through high school, and required \$53,158,295 of state monies to operate (California State Department of Education, 1972).

In the current California Education Code definition of educationally handicapped children it is stated that, "Learning or behavior disorders shall be associated with a neurological handicap or emotional disturbance and shall not be attributable to mental retardation" (California Education Code, 6750, 1972). In the following sections both the neurologically handicapped and emotionally disturbed children will be discussed.

#### Neurologically Handicapped and Emotionally Disturbed Children

To describe their observations early researchers interested in learning disorders used terms such as "amphemia," "strephosymbolia," "congenital symbolamblyopia," "congenital typho-lexia," and "amnesia visualis verbalis" (Mahler, 1964; McBeth, 1966). Apparently many terms continue to be used to describe children who have difficulty learning. Chalfant and Scheffelin (1969) reviewed the literature, and reported

that the terms: "brain injured," "learning disabilities," "developmental imbalance," and "minimal brain dysfunction syndrome" have received wide usage.

More detailed descriptions of the characteristics of neurologically handicapped children have been attempted by some authors. For example; Strauss and Lehtinen's (1957) research dealt with children who before, during, or after birth received an injury or suffered an infection of the brain, with the possible result of organic impairment of the neuromotor system. According to these authors behavior disorders are the most conspicuous manifestation of abnormality in neurologically handicapped children, and they often cannot sit still or be quiet in the classroom for more than a few minutes. Neurologically handicapped children also have difficulty in ruling out other thoughts or feelings, and cannot concentrate or pay attention for substantial periods of time.

Beck (1961) also elaborated on the characteristics of neurologically handicapped children. He concluded that children whose failure and resultant poor adjustment is complicated by a neurological handicap have a defect in the central nervous system not severe enough to result in cerebral palsy, mental retardation, deafness, or blindness. However, as a result of some impairment, deficits of the neuromotor system may be present. These children may show disturbances in perception, thinking and emotional behavior either separately or in combination.

The neurologically handicapped child may lack the ability to retain information, and may have impaired visual and auditory perception.

Teachers and parents have reported that a neurologically

handicapped child has drilled until he is letter perfect on a list of spelling words. However, if immediately thereafter the same words are given to him in a reversed or mixed order he can remember only a few of them. By the next day or the next week he may not recall any words from the list (Los Angeles County Report, 1963, p. 3).

In some cases visual perception may be so affected that the child may not be able to copy a simple geometric design while looking directly at it. He may see objects, drawings or words as reversed or rotated. If shown the parts of his drawing that do not correspond to the model he still may have difficulty in correcting his reversed or distorted mental image (Los Angeles County Report, 1963).

The perceptual disturbance may be visual or auditory, and it often may be difficult for children to make sense out of the learning materials presented in class, or to get accurate meaning from the teacher's explanations or oral instruction (Lehtinen, 1963).

Incidence studies dealing with emotional disturbance leave a disorganized picture. The rates of emotional maladjustment appear to depend upon the instrument used for assessment and the population studied. A working estimate of seriously maladjusted school age children has been given as four to seven percent. This estimate recognizes the variation in criteria and in testing instruments (White and Harris, 1965).

Bower and Lambert (1965) in their study of the behavior of emotionally disturbed children concluded that children with emotional problems show a marked reduction in their ability to work effectively in academic subjects, and in their relationships with others. In the elementary school classroom the following behavior patterns often are evident in emotionally disturbed children.

1. An inability to learn which cannot be adequately explained by intellectual, sensory, neurophysiological or general health factors. This inability to learn is sometimes thought to be the single most significant characteristic of school children with emotional disturbance.
2. ~~An inability to build or maintain satisfactory inter-~~personal relationships with peers or teachers.
3. Inappropriate or immature types of behavior or feelings under normal conditions.
4. A general pervasive mood of unhappiness or depression.
5. A tendency to develop physical symptoms such as speech problems, pain, or fears associated with personal or school problems.

Tognetti (1971) cited Morse's attempt to compile a list descriptive of emotionally disturbed children from a survey of 100 public school programs for the emotionally handicapped. The most frequently occurring types of behavior were: becoming easily upset, a short attention span, teasing, fearfulness, disorganized work, becoming easily angered, defiant of authority, and restlessness.

Lyons and Powers (1965) reported that during the 1960-61 school year 661 children in the Los Angeles City Schools were exempted from school because of extreme behavioral or emotional problems. Of the 661 children exempted 582 were boys and 79 were girls. Pupils were most frequently exempted because of emotional instability and hyperkinetic behavior.

Lyons and Powers summarized their findings in the following table (p. 139).

Table 1  
Total Number of Pupils Exempted from School  
Because of Emotional Problems

Diagnosis	IQ 79 and Below	IQ 80 and Above	No Test Date Available	Totals
Emotional Instability	159	138	133	430
Hyperkinetic Behavior	53	75	57	185
Antisocial Behavior	3	6	1	10
Aggressive Behavior	6	7	5	18
Psychosis and Neurosis	1	4	6	11
Personality Disorder	2	4	1	7
Totals in each IQ Category	224	234	203	661
Percent in each IQ Category	33.9	35.4	30.7	100.0

Since this study by Lyons and Powers took place prior to the authorization of EH classes in California exemption from school apparently was a method often used in dealing with seriously disturbed children. One recommendation of the study was that more special classes with limited enrollments and specially selected teachers be provided for children with learning and behavior problems.

#### Difficulties in Differentiating between the Neurologically Handicapped and Emotionally Disturbed

While it is frequently observed that neurologically handicapped children have emotional problems, not all emotionally disturbed children suffer neurological impairment (McBeth, 1966). Beck (1961, p. 57) in a

discussion of neurologically handicapped children stated that,

In effect a medically diagnosed brain injured child will usually display some psychological symptoms but a child displaying these symptoms may not necessarily be brain injured from a medical viewpoint. This is certainly not the most desirable state of affairs but it nevertheless represents the present situation.

Beck's conclusions were shared by Hewett (1968, p. 20).

Among the maladaptive behaviors often seen in these children are specific learning deficits, perceptual motor deficits, general coordination deficits, hyperactivity, impulsivity, emotional lability, and short attention span and/or distractibility. Since all of these may also be seen in children called emotionally disturbed, a question often asked in special education at the present time is whether such behaviors are organic or functional in origin.

Martin (1967) compiled a list of the behavioral characteristics of hyperkinetic syndrome children, and in some cases he seems to be describing both the neurologically handicapped and emotionally disturbed child. The following are what he considers to be the characteristics of this syndrome:

1. Low frustration tolerance. The child is easily irritated, impatient and may be easily provoked to temper tantrums.
2. Aggressive behavior which may lead to the destruction of toys, clothing, and household possessions. In addition hyperkinetic syndrome children are often cruel to others, they may tease, poke, strike, and kick.
3. Impulsive behavior often recognized by the child's inability to tolerate any delay in gratifying needs and demands. Impulsive children are recognized by their constant nagging, and they often will not accept reasonable explanations for delays. Their behavior is often obnoxious, mean and disagreeable, and they are ungrateful for kindnesses.



4. Lack of ability to concentrate in and out of school. This often affects their school performance as well as performance in other activities. Tasks are often left unfinished, and the hyperkinetic child has no desire to continue them.
5. Searching for companions but often unable to get along with others.
6. Defiant, hostile behavior making control by adults difficult.

More recently Wender and Eisenberg (1971) studied the behavior of children with minimal brain dysfunction syndrome. The behavior characteristics of this syndrome again seem to include behavior often associated with neurologically handicapped and emotionally disturbed children. Wender and Eisenberg mentioned behaviors such as: (a) a high activity level and impaired coordination, (b) short attention span and poor concentration, (c) poor impulse control including low frustration tolerance and antisocial behavior, and (d) learning difficulties in school. Children included in this syndrome also may have difficulty with interpersonal relationships, increased aggressiveness, dysphoria, and increased emotional lability.

Lambert (1964) studied 20 pupils who were considered to be a representative sample of children identified as emotionally handicapped in public school regular and special classes. The children were examined at the Medical Center of the University of California, Los Angeles (UCLA). To determine the reliability of the medical findings from the UCLA Medical Center two other physicians reviewed the work and made independent diagnoses. "The purpose of the medical investigation

was to determine the incidence of neurological impairments in a sample of pupils identified as emotionally handicapped" (p. 40). The medical evidence was collated with the psychological and educational data and evaluated by psychologists for evidence of neurological impairment. It was found that 10 of the 20 pupils were judged to be similar to children assigned to special classes for the neurologically handicapped.

McBeth (1966) also documented the difficulty of precise identification of neurologically handicapped and emotionally disturbed children. While 19% of the patients in a clinic for handicapped were thought to have had only psychological symptoms, after exhaustive examination and assessment the final diagnosis was minimal brain dysfunction.

In summary, the literature reviewed indicated that often the distinction between emotionally disturbed and neurologically handicapped children is not easily made. It may be concluded that Lambert (1964) is correct in her assumption that children can successfully proceed in special education classes without separating neurologically handicapped pupils from other pupils with behavior and learning problems. Regardless of the type of handicapping condition educationally handicapped children need special remedial help for their learning difficulties and many need help in learning to control their behavior. Lambert (1964, pp. 41-42) concluded that,

In the majority of cases in which a pupil identified as emotionally handicapped might have a related organic impairment, his educational needs can be adequately met in a program in which he becomes part of a heterogeneous group of pupils with a variety of problems....In all cases it is essential to develop special programs in terms of educational needs of children and not on the bases of medical, psychological or sociological diagnosis.

### Behavior Management of EH Children

The disruptive behavior of many educationally handicapped children has led to attempts to manage their behavior through drug therapy, psychotherapy, and behavior modification techniques in the classroom. Wender and Eisenberg (1971) in a recent review of drug therapy quoted studies which showed that the use of amphetamines with hyperactive children often has a quieting effect on their behavior. This change in behavior usually occurs without producing drowsiness or grogginess. The use of these drugs also manifest decreased inattentiveness, excitability, tantrums, and daydreaming. Increased responsiveness to social controls and greater self-control also result from amphetamine treatment.

Bradley (1950) has summarized his 12 years of experience with the amphetamine treatment of more than 350 children between the ages 6-11 years. The problems of the children studied were categorized as psychopathic personality, schizoid personality, and behavior problems. During the 12 year period Bradley studied the effects of Benzedrine (dl amphetamine) and Dexedrine (d-amphetamine sulfates) upon their behavior. He found that, "When used judiciously...they may bring prompt and dramatic symptomatic relief to many children suffering from severe and otherwise discouraging disabilities" (p. 35).

Laufer and Denhoff (1957) found that amphetamines favorably counteract the "organic behavior syndrome." According to the authors symptoms of this syndrome are listed as: (a) hyperactivity, (b) short attention span and poor concentration, (c) variability of behavior, (d) impulsiveness, (e) irritability, (f) explosiveness, and (g) poor school performance. They found that the most striking result of

amphetamine treatment was the ability of the child to maintain his attention for longer periods.

Zrull, Westman and Arthur (1963) conducted a study of 16 children whose poor behavior at home and school was due to their hyperactivity, distractibility, impulsivity, and emotional instability. All children regardless of their diagnostic category (organic syndrome to anxiety neurosis) improved on either Librium (chlordiazepoxide) or d-amphetamine.

The Physician's Desk Reference (PDR) (Huff and Clark, 1974, p. 693) lists Ritalin as a drug which also may be used with children who demonstrate, "Chronic history of short attention span, distractibility, emotional lability, impulsivity, moderate to severe hyperactivity, minor neurological signs and abnormal EEG."

The PDR warns that Ritalin should not be used with children under six years of age, since safety and efficacy have not been established for this age group. It is recommended that children over six years-of-age, be administered doses of five mg before breakfast and lunch, and that the dosage be increased in increments of five to ten mg weekly. A daily dosage above 60 mg is not recommended. The drug should be discontinued after one month if improvement is not observed.

Martin (1967) reported on the use of Ritalin in the treatment of more than 60 children ranging from three to twenty-years-of-age. Martin found that within 15 to 30 minutes of the first dose the children began to relax, were able to concentrate better, and were more affectionate. Treatment ranged from one month to two and one-half years, and improvement was noted in the behavior of all the children. The dosages of Ritalin prescribed by Martin varied according to the ages of the children.

The child three to six may be started on 5 mg. t.i.d. If no clinical results occur, dosage may be increased to 10 mg. t.i.d. Twenty mg. t.i.d., p.c. is well-tolerated by youngsters ten to seventeen. However, other older children do well on a daily dose of 80 to 100 mg. (Martin, 1967, p. 24).

Wender and Eisenberg (1971) discovered that side effects of amphetamine treatment occur in an appreciable fraction of children. The side effects may be insomnia, mild stomachaches, headaches, loss of appetite, mild tremor of the extremities, nail biting, eye blinking, nose picking, and other mannerisms.

Martin (1967) reported that with Ritalin no unfavorable side effects other than a slight loss of appetite and/or the need to retire earlier are noticed. Apparently Ritalin's action is very similar to that of amphetamine and has less intense effect on sleep and appetite (Wender and Eisenberg, 1971). However, there is insufficient data on the safety and efficacy of the long term use of Ritalin. "Although a causal relationship has not been established, suppression of growth (i.e., weight gain and/or height) has been reported with the long term use of stimulants in children" (Huff and Clark, 1974, p. 693).

In the light of these and other studies it may be easier to understand the growing popularity of drugs in the treatment of behavior problems. However, the use of stimulant drugs is by no means the only method used in attempting to manage the behavior of hyperactive or hyperkinetic children.

Laufer and Denhoff (1957) have indicated that in some cases psychotherapy as well as drugs are necessary to treat these children. Cowan (1955) has listed several cases of successful psychotherapy with brain injured children. Some authors (Wender, Eisenberg, 1971) believe that the use of psychotherapy is secondary to the use of drugs.

Wender and Eisenberg (1971; p. 109) discussed the use of psychotherapy with minimally brain damaged children. They acknowledged that,

The evidence for the usefulness of drug therapy is something less than perfect, but that supporting the usefulness of psychological intervention is far less convincing; there are no studies evaluating--much less documenting--the usefulness of psychological intervention.

Instructional programs geared specifically for hyperactive children have also been developed. Cruickshank (1961) reported a pilot study in which 40 children characterized by emotional difficulties, hyperactivity and aggressive behavior were included. The classes followed a program based on: (a) the reduction of environmental space, (b) the reduction of unessential visual and auditory environmental stimuli, (c) the establishment of a highly structured daily program, and (d) the increase of the stimulus value of the instructional materials themselves. The results indicated significant rates of progress in academic areas.

The success of behavior modification techniques based on behavioral theory with special education children has been documented by Garvey (1968). He discussed the applicability of behavior modification to autistic children, hyperactive children, tantrum behavior, and phobias. He considered the focus of behavior modification techniques to be on the problem behavior itself. Using these techniques an attempt is made to change the events in the classroom so that learning and school performance will improve. If a child is inattentive and disruptive in the classroom he is not removed from that setting. Rather, an attempt is made to discover the contingencies in the classroom that maintain the problem behavior, and to change the events so that the child's behavior is acceptable.

Hewett (1967) developed an "engineered classroom" using behavior modification techniques to, "bring the non-student behavior of the child into line with standards required for learning" (p. 2). In these classrooms for educationally handicapped students the teachers were assigned the role of behavioral engineer. The teachers attempted to define appropriate task assignments for students, provide meaningful rewards for learning, and maintain well defined limits in order to reduce or eliminate maladaptive behavior in school.

The project was carried out for one school year in the Santa Monica Unified School District located in Santa Monica, California. The project classrooms were located in four elementary schools and one junior high school. Children in the experimental classes were consistently found to have achieved significantly higher scores in arithmetic fundamentals than children in the control classes. Hewett (1968) also found that introduction of the experimental condition in classes which had not previously used a reward system resulted in a statistically significant improvement in task attention.

In many educationally handicapped classes some children may be receiving drugs to help control their maladaptive behavior. Others may be participating in some form of psychotherapy or counseling, and the teacher may be using behavior modification techniques to help control the student's behavior and to improve academic learning. Because of the unique problems of educationally handicapped children these methods appear to be used more often with EH children than children in regular classrooms.

## CREATIVITY

### Definitions of Creativity

Many definitions of creativity have been formed, and research studies dealing with creativity seem to reflect these definitions. McDaniel (1973) after a comprehensive review concluded that, "The literature suggested that there was not a commonly agreed upon definition of creativity" (p. 24). Shivley, Feldhusen and Treffinger (1973) concluded that creative thinking and creative problem solving have been conceptualized in many ways including approaches which have stressed the cognitive as well as the personality or affective components of creative behavior.

The following definitions have been chosen to help evaluate the creativity of children. J. A. Smith's (1967) definition is simple but descriptive. He described creativity as, "The ability to tap past experiences and come up with something new. This product need not be something new to the world, but new to the individual" (p. 9).

Torrance's definition is also cited and is valuable in the measurement of creativity. He defines creativity as,

A process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, disharmonies, and so on; identifying the difficulty; searching for solutions, making guesses, or formulating hypotheses about the deficiencies; testing and retesting these hypotheses and possibly modifying and retesting them; and finally communicating the results (1966, p. 6).

Guilford (1959) has influenced the study of creativity through his factor analytic approach to the characteristics of creative thinking, and his work is important to this study since the Torrance Tests of Creative Thinking are based upon his model. He defines divergent thinking, "As the kind that goes off in different directions. It makes



possible changes of direction in problem solving and also leads to a diversity of answers where more than one answer may be acceptable" (1959, p. 381).

According to Guilford there are four divergent thinking factors; divergent fluency, flexibility, originality and elaboration. The kinds of content in divergent thinking were classified by Guilford as figural, symbolic or semantic. It is upon Guilford's divergent thinking factors that the Torrance Tests of Creative Thinking are based. An attempt is made to assess the results of these test activities in terms of fluency, flexibility, originality, and elaboration (Torrance, 1966).

#### Creative Potential and the Conditions Effecting its Enhancement

Many authorities (Getzels and Jackson, 1962; Taylor, 1964; Haven, 1965; Smith, 1967) have shared the conclusion that all individuals have creative potential although they may differ in their degree of creativity for various fields. McDaniels (1973) reviewed the literature from 1919 to 1970, and he found that research and studies dealing with creativity seemed to show that creative potential is an innate quality of all persons and is possessed in varying degrees.

While there seems to be agreement that all persons are potentially creative the individual's creativity must be released and promoted. Gowan and Demos (1964) state that the problem is not to identify creativity but to keep from inhibiting its development.

Lazar (1972, p. 94) commented that in education the,

Experience has been that although today's graduates are more knowledgeable than their predecessors, few possess ideas about how they might use much of their acquired knowledge. Industry

is finding it increasingly difficult to find personnel capable of spawning original ideas with innovative thinking.

Torrance (1965) has written that the abilities for creative thinking are increased or decreased by education, and an environment which values creativity is essential for its development. Olton (1969) thought that all children regardless of their intelligence or their initial level of competence demonstrate a level of creative thinking far below their potential.

The role of intelligence in creativity has been considered by several authors (Getzels and Jackson, 1962; Gowan and Demos, 1964; Gowan, Demos and Torrance, 1967; Smith, 1967). Gowan and Demos (1967, p. 79) concluded that, "A certain amount of intelligence is required for creativity, but beyond that point being more or less intelligent does not determine the level of a person's creativeness."

Smith (1967) has expressed a somewhat different opinion. He considers creativity to be a form of giftedness, and each person has a measure of creativity. Intelligence determines the quality of the creative product. The highly creative person is always highly intelligent, but the highly intelligent person is not always highly creative.

Intelligence tests are limited in their capacity to assess creative abilities, since they were designed to predict success in school learning (Gowan, Demos and Torrance, 1967). Getzels and Jackson (1962) in an important study of the relationship of intelligence to creativity declared that,

It is commonly observed that many children who are very high in intelligence as measured by IQ are not concomitantly high in such other intellectual functions as creativity, and many children who are very high in creativity are not concomitantly high in intelligence as measured by IQ ( p. 3).

Other authors have discussed factors which appear to be necessary to creative thinking. Taylor (1964) elaborated upon these factors, and among those thought to be important to creativity are: (a) an awareness of problems, (b) drive, (c) dedication to work, (d) resourcefulness, (e) desire to bring order out of disorder, and (f) a desire for discovery.

Steinberg (1964) also discussed the conditions that effect creativity. Among those conditions which he feels are important are the individual's personal feelings about himself and his feeling of freedom to express himself. On the other hand, creativity would seem to be blocked by a poor self-image and a tendency in the individual to hide rather than to express his opinions. Barron (1963) concluded that originality flourishes when suppression is at a minimum. "Where some measure of disintegration is tolerable in the interest of a higher level of integration which may not yet be reached" (p. 212).

Marksberry (1963) has written that creative thinking most often occurs in an environment free of premature evaluation. According to Marksberry the four steps in the creative process are: (a) immersion in the material, (b) playing with and growing familiar with the possibilities in the material, (c) a period of incubation with an apparent decline of interest in the material, and (d) the production of some unusual product.

Getzels and Jackson (1962) relate creative behavior to conflict, and they have summarized the Freudian concepts of creative behavior as follows:

- (1) Creativity has its genesis in conflict, and the unconscious forces motivating the creative "solution" are parallel to the unconscious forces motivating the neurotic solution.
- (2) The psychic function and effect of creative behavior is the discharge of pent up emotion resulting from conflict until a tolerable

level is reached (pp. 91-92).

Barron (1963) also seems to be speaking in Freudian terms when he states that the person who is both intelligent and original finds easy accessibility to both the primary process and secondary process. The effective original person is characterized by, "An ability to regress very far for the moment while being able quite rapidly to return to a high degree of rationality bringing with him the fruits of his regression to primitive and fantastic modes of thought" (p. 214).

Chimento (1973) summarized the opinions of many experts concerning the settings which may influence creativity. He found that experts have concluded that creativity in children is enhanced by: (a) a loose family structure which allows for a great amount of autonomy, freedom for exploration, and decision making, and (b) homes where there is not a strong emphasis upon conformity to social norms. However, creative children even when under strong pressure to conform tend to remain relatively independent. Many experts are also of the opinion that creative children often appear to be rebel-like youngsters relatively free of conventional restraints with their own set of values and ethical standards.

#### Psychological Health and Creativity

It seems obvious that children with learning problems are often marked for failure, and this failure may impair their total adjustment (Arieti, 1959; Helmuth, 1965; Schiffman, 1962). Children who have experienced failure in school for several years may not reach their creative potential, unless they work in a psychologically safe atmosphere which offers them a chance to think creatively (Rogers, 1969).

Psychological blockages, or a lack of certain conditions, may inhibit creativity. Alamshah (1972) suggested that creativity requires inner quietude, and receptivity to new ideas and imaginings. Creative thought is inhibited when an individual is unable to be receptive to ideas and imaginings, and creativity is also inhibited by anxiety or fear. Other blocks to creativity are feelings of inferiority caused by premature or unduly harsh criticism of work, past failures, and absence of certain desired or necessary skills (Alamshah, 1972).

Torrance (1966) wrote that children with learning difficulties manifest an apparent fear of verbal symbols on verbal tests of creative ability. This notion seems to be supported by a U. S. Office of Education report (1965). The authors hypothesized that emotionally disturbed adolescents are handicapped in expressing and profiting from their creativity. The adolescents' fear of criticism and rejection by peers and teachers is responsible for their difficulty in expressing and developing creativity. According to the report emotionally disturbed adolescents need support from their teachers if they are to profit from creative activities.

Kessler (1970) reviewed research concerning the cognitive development of children. He found that research is consistent in showing that high anxiety interferes on verbal tasks, visual motor tasks, and tests of creativity. Although creative performance may be influenced by poor emotional adjustment, some researchers question the assumption that adequacy of psychological functioning contributes directly to the achievement behavior of children (Getzels and Jackson, 1962).

Jackson, Getzels and Xydis (1960) studied the relationship between psychological health and cognition, using as subjects 292 boys

and 241 girls enrolled in a Midwestern private school. The grade levels of the subjects ranged from sixth grade to the senior year in high school, with the sixth, seventh, and eighth graders placed in a single classification. The relationship between psychological health and cognition was examined using five psychological health criteria, and eight types of cognitive performance, including measures of achievement and creativity. The data suggested that the cognitive functioning of girls is more sensitive to aberrations of fantasy than the cognitive functioning of boys. The results showed a general decline with age in the relationship between psychological health and the quality of cognitive performance. "The sixth grade period is the one during which the relationship between psychological health and the quality of cognitive performance appears to be highest" (p. 290).

Getzels and Jackson (1962) emphasized that the neo-psychoanalytic point of view considers as fallacious the notion that a creative person must be mentally ill. Torrance (1967) also argued against the assumption that one must be mentally ill in order to function creatively. Studies which he reviewed seemed to show that the truly creative person is mentally healthy. Torrance pointed out that in the works of Freud, Sullivan, Rank, Rogers, Fromm and others the central goal is to help the individual become more alive, more himself, more open to experience.

Taylor (1968) cited A. Maslow's hypothesis that improved mental health aids creativity, and any event which helps the person move in the direction of greater psychological health helps to change the whole person. According to Maslow, creativity is holistically conceived and any factor which makes a more creative person also makes a better person. The relationship of creativity to psychological health is crucial, but

often is not recognized.

He (Maslow, 1968) commented that

It is terribly impressive...that the relationship with psychiatric health or psychological health is so crucial, so profound, so terribly important, and so obvious, and yet it is not used as a foundation on which to build (p. 368).

Maslow referred to self-actualizing creativity as being secondary to the greater wholeness of the individual. Self-actualizing persons waste less time and energy protecting themselves against themselves. Actualizing one's potential is becoming everything one is capable of becoming.

Torrance (1967) states that according to C. Rogers, "The main-springs of creativity appear to be...the urge to expand, develop, extend, mature--the tendency to express and activate" (p. 75). Rogers (1959) has given what he believes are the necessary conditions for fostering constructive creativity, and these conditions appear to be related to good mental health. The necessary conditions for constructive creativity are:

1. Accepting the unconditional worth of the individual. If the individual is accepted in his own right, no matter what his present condition or behavior, creativity is being fostered.
2. Providing a climate in which external evaluation is absent. Being concerned with what others think leads away from creativity.
3. Understanding empathically is the third condition necessary to foster creativity. With this kind of understanding the real self can emerge and express itself in varied and novel formings as it relates itself to the world.
4. Psychological freedom is also necessary to foster creativity. "This permissiveness gives the individual complete freedom to think, to feel, to be. Whatever is most inward within himself" (p. 80).

Tognetti (1971) discussed the Freudian and Rogerian views of creativity and their relationship to educationally handicapped children.

It appears that children in special day classes for educationally handicapped minors and students in learning disability groups may or may not be creative. If the Freudian view is used to postulate hypotheses then the children in special day classes would be more creative than children in learning disability groups since these children show a higher level of emotional lability....On the other hand, if the Rogerian view is used to form hypotheses, the children in special day classes for educationally handicapped minors would be less creative than children in learning disability groups because they would be less open to their experiences and in general less emotionally sound (pp. 28-29).

Tognetti (1971) concluded that the Freudian viewpoint that a neurotic conflict is necessary before the creative process can unfold, and the Rogerian theory that a creative person must be free from emotional conflicts may be an over-simplification of the creative process. He hypothesized a new theory joining the seemingly opposing views.

In his proposed theory

A tension is needed in order to motivate a person to find an activity which will release this tension but of itself is tension free. This then allows the person to be open to experiences and, in a Rogerian sense, mentally healthy while doing this activity (p. 114).

The literature reviewed emphasized that all individuals are potentially creative, however, there are many traits and personality factors which are believed to be related to creativity. Some authors appear to feel that the Freudian concept of conflict enhances creative thinking. While others hold to the theory that only the psychologically healthy person can be creative, and as psychological health improves the person becomes more creative. It may be that creativity has its genesis in conflict, but good mental health also may aid the development of creativity. There also seems to be evidence that the creative potential of children can be influenced by their educational experiences



and environment. Rogers' conditions for fostering creativity would appear to be applicable to educationally handicapped children.

### PROGRAMS TO DEVELOP CREATIVE THINKING

In many cases educationally handicapped children may not be realizing their creative potential. By placing these children in EH programs improvement may be seen in their academic skills, behavior, and mental health. It would appear that training to enhance their ability to think creatively should be included in the classroom instruction. This section will review two methods for developing creative thinking which appear to be appropriate for the educationally handicapped.

#### Brainstorming

Brainstorming as a creative problem solving technique has been used successfully in business, government and to a limited degree in education (Osborn, 1963; Wood, 1970). Osborn (1963) has described brainstorming as a creative conference for the purpose of producing ideas which lead to the solution of a problem. A number of authors have described studies using brainstorming with school age children, and brainstorming has been used effectively in the classroom (Torrance, 1964; Wilson, 1958; Richstone, 1968; Wood, 1970).

Basic to brainstorming is the principle of deferred judgment (Osborn, 1963). According to this principle the persons brainstorming allow a set period of time for listing ideas regarding a preset problem. During this period there is no evaluation of the ideas being presented. Parnes and Harding (1962) concluded that the principle of deferred

judgment is a practical one, "For overcoming the mental blocks produced by habit and past experiences, thus the derivation of novel solutions to problems" (p. 284). Wood (1970) also comments on the feeling of security a child finds when he learns that he can contribute his ideas in a brainstorming group without the fear of being judged.

Wilson (1958, p. 119) has stated that, "The purpose of brainstorming is to obtain as many ideas as possible in relation to a given problem." The four brainstorming rules which must be followed are:

1. Judgment is ruled out. Criticism of ideas must be withheld until later.
2. Free wheeling is welcomed. The wilder the idea, the better; it is easier to tame down than to think up.
3. Quantity is wanted. The greater the number of ideas the more the likelihood of winners.
4. Combination and improvement are sought. In addition to contributing ideas of their own, participants should suggest how ideas of others can be joined into still another idea (p. 119).

Osborn (1963) has developed a number of questions which may be used in brainstorming to stretch and expand creative thinking. Smith (1966) has summarized these ideas as follows:

1. To what new uses can it be put?
2. How can I adapt the idea to another use?
3. How can I modify the idea? For instance could I change the meaning, color, motion, sound, odor, taste, form, shape -- give it a new twist?
4. How could I magnify the idea? Could I add something to it -- more time, greater frequency, extra value -- make it stronger, higher, longer, thicker, larger, heavier? Could I duplicate, multiply, exaggerate?
5. Could I minify the idea: subtract something, make smaller, condense, put in miniature, lower, shorten, narrow, lighten, omit, slow, streamline, understate?

6. Could I substitute: who else, what else, other ingredients, other material, other process, other place, other power, other plane, other approach, other tone of voice, other time?

7. Could I rearrange it: change components, pattern, layout sequence, schedule, change pace?

8. Could I reverse it: transpose positive and negative, opposites, turn it around, turn it backward, upside down, inside out, reverse roles, turn tables, transfer cause and effect?

9. Could I combine it with something else: a blend, an alloy, an assortment, an ensemble, combine units, purposes, appeals, ideas? (p. 165).

Wood (1970) suggested that brainstorming might be used with elementary school children to solve practical problems that arise during the day. Problems which may be suggested by the teacher or students can become a stimulating, challenging experience in the classroom. Wood maintains that with a minimum of training a class can be divided into groups of from 3 to 11 members, and that several groups can be brainstorming at one time in a classroom. According to Wood each group should have a leader and a secretary. The leader should keep the group actively engaged in the brainstorming process, and the secretary should write in brief form all the ideas that are presented. It is also important to display the principles of brainstorming in the classroom and select problems that will interest the students. Wood also stresses that the problem to be brainstormed should be simple and specific.

Lazar (1972) described a creative thinking elective course developed for seventh grade students. The rationale for the course of study was based on the assumption that the development of creative thinking is neglected and with applied training the development of the creative process could be accelerated. The creative training included

brainstorming activities, group problem solving activities, and creative writing and creative art.

Evaluation of the creativity training was accomplished through the use of the Torrance Tests of Creative Thinking.

Computations were made based on mean pretest scores of seventh grade students and their expected progress as predicted by the Torrance Generalized Development Curve....After one year of training eighth grade students demonstrated a mean raw score gain of 89.49 points; this was 83.30 points more than projected (Lazar, 1972, p. 94).

Torrance and Torrance (1972) described a creative problem solving workshop with creative expressive and investigative activities. The workshop was three weeks in length and was for disadvantaged children 6-13 years of age. Ninety-one young people were enrolled in the workshop. Fifty-nine of the enrollees were boys and 32 were girls; 51 were black children and 40 white children. Most of the children came from large low income families. A 30 minute period each day was devoted to creative problem solving. During the first two weeks, training was given in the rules of brainstorming as well as other component skills. The children worked in four person groups under the supervision of an adult on brainstorming and creative problem solving tasks. Other activities in the workshop included small groups participating in sculpture, painting, creative writing, science, newspaper, and carpentry. Figural Forms A and B of the Torrance Tests of Creative Thinking were administered as pre and posttest. The results, "documented statistically significant gains in ability to produce original ideas" (Torrance and Torrance, 1972, p. 9).

Buchanan and Lindgren (1973) undertook to determine if creativity could be facilitated through brainstorming, and if group brainstorming

in formal classroom settings would effectively stimulate creativity in subsequent individual sessions. The subjects were 122 fourth grade boys and girls who were largely middle class children and were enrolled in private schools. Six groups were given an unusual uses problem, and for a ten minute period either brainstormed as a total group or brainstormed individually. In the second phase, all groups brainstormed for five minutes. Four groups who had engaged in group brainstorming in the first phase made significantly more responses and demonstrated a higher level of creativity than those who brainstormed individually in both phases. Creativity was measured in terms of the number of responses each subject made in the second phase during individual brainstorming, and the level of creativity expressed in the responses he produced. Three judges were trained to rate independently the responses of the subjects. The results tended to show that brainstorming in small informal groups facilitates creativity in subsequent individual problem solving sessions.

Richstone (1968) used brainstorming to develop creativity in fourth grade children. In her study the experimental group of children participated in 25 brainstorming sessions of 15 minutes each for six weeks. The first five minutes of each session were given to written individual practice and ten minutes were given to group brainstorming. The experimental group was also given ten homework assignments. In this study the objective of the brainstorming sessions was to develop word, ideational, associational, and expressional fluency. According to Richstone the experimental group showed improved scores in creativity on portions of the Torrance and Guilford tests of creativity. However it is difficult to measure the significance of this improvement since

the author stated only that the experimental group's "scores soared," and the control group showed only "negligible improvement."

A systematic program including brainstorming, to significantly increase the scores of educable mentally retarded (EMR) children in productive thinking was studied by Rouse (1963). In this study 30 lesson plans were used for approximately 30 minutes daily over a six week period. While brainstorming solutions to problems was the major method used productive expression through drawings, written stories, and poems were also a part of the lessons. The results confirmed the hypothesis that a systematic program including brainstorming would enhance both verbal and non-verbal scores on tests of creative thinking. Rouse concluded that EMR children must be allowed practice in productive thinking skills, and brainstorming appears to be a good method.

The questions or principles suggested by Osborn for stimulating new ideas were used by Torrance (1964) to study creative thinking in 375 primary grade children. To stimulate their thinking the children were given the task of thinking of ideas for improving a toy fire truck. Some of the questions were: (a) what would happen if we made it larger? (b) What would happen if we made it smaller? (c) What could we add? (d) How could we rearrange it? (e) What would happen if we gave it odor? They were then led to generalize these principles, and were told they could use the questions in "thinking up ideas about almost anything" (Torrance, 1964, p. 140).

An interesting outcome of this study was that instructions to produce a large number of ideas without regard to the quality of the ideas, produced fewer responses than when asked to produce clever, interesting, and unusual ideas. These instructions seemed to free

the children to make better responses. Except in the first grade, children who received training produced more ideas, showed more flexibility and cleverness of ideas than the children with no training. However, according to Torrance (1964, p. 144) the results, "Provide no support for motivating pupils in the primary grades to produce a quantity of ideas without consideration for quality."

In some cases the research designs of the studies reviewed were not fully explained and the results were not clear, however, in general the studies using brainstorming seem to support its use as a technique to develop creative thinking skills. It also should be noted that in several studies other creative activities were included with the brainstorming activities and their effect on the results may have been significant. Studies were reviewed covering a range of grade levels from primary to junior high school. Only one study dealt with special education children and these were children in classes for the educable mentally retarded. There appear to be no studies using brainstorming with educationally-handicapped children.

#### Programmed Instruction

A search of the literature revealed that the only published material which may be classified as programmed instructional material to develop creative thinking is the Productive Thinking Program (PTP) (Covington, Crutchfield, Davies and Olton, 1974). The literature and research studies reviewed in this section will deal only with the PTP. The majority of the studies reviewed used the 1966 edition of the PTP which consisted of 16 lessons. The 1972 and 1974 editions of the Program are 15 lessons in length. The Productive Thinking Program is a

linear type program including multiple choice and constructed responses.

The objections to programmed instruction as a method for developing creativity stem from the notion that it is often associated with rote learning (Crutchfield and Covington, 1965). Much of the research for programmed instruction has been drawn from animal experiments, and many believe that any teaching method based on such research would not allow for creative activity on the part of students.

Crutchfield and Covington (1965) thought that the potentially detrimental effects of programmed instruction on creativity could be overcome by a lack of rigidity in programming, and through inventing new program techniques. The self-pacing, directly administering features of programmed instruction lend themselves to the requirements of creative training, and programmed materials to train creativity should be designed to give practice in making creative responses. This training should include a series of actual problems involving insight, hypothesis formation, searching, evaluation, and discovery.

Olton (1969) elaborated on the use of programmed instruction to develop creative thinking in a discussion of research using the Productive Thinking Program.

He wrote that,

Theoretically, then, programmed instruction need not be incompatible with efforts to develop creative thinking, but it remained to be demonstrated that programmed materials, could be used effectively to teach the skills involved in imaginative, resourceful, productive thinking (p. 17).

The development of the Productive Thinking Program was based on four assumptions about the teaching of creative thinking (Olton, 1969). First, it was assumed that virtually all students demonstrate a level of thinking far short of what they are potentially capable. With



appropriate instructional materials a substantial increase in the student's potential for creative thinking could be brought about.

Second, it was assumed that the creative thinking skills are general skills. They are general cognitive abilities involving the production of original ideas, the invention of a unifying principle which integrates several disparate events, and the learning of strategies when one is "stuck" on a complex problem.

Third,...the facilitation of creative thinking could be accomplished without making major changes in the basic cognitive capacities of the student...instructional efforts would seek to develop, strengthen and integrate skills and attitudes which the student already possessed in some measure (p. 18).

Finally, the assumption was that direct training in productive thinking skills and imaginative teaching of curriculum materials would be more effective than either technique alone. The authors (Covington, Crutchfield, Davies and Olton, 1972) contend that the Productive Thinking Program encompasses the entire process of productive thinking, including skills of critical analysis and logical reasoning.

However, the principle emphasis

Is upon those more significant functions that require the use of creative potential--fluency and originality of ideas, spontaneity and openness of mind, intuitiveness of approach. The Program not only provides numerous opportunities for creative thinking but fosters the student's ability to make use of these opportunities through extensive guided practice in the synthesis of the requisite skills and strategies (p. 11).

In two similar studies Covington and Crutchfield (1965) developed 13 and 16 lesson programs for fifth and sixth grade children. The programmed lessons consisted of a series of simplified high interest detective and mystery stories. Each lesson posed a single mystery which the children were asked to solve, and a succession of clues and information led them to discover the solution. At various points they were

required to state the problem, formulate opinions, and generate ideas to explain the mystery. A pretest battery of problems, creative thinking tasks and attitude inventories were administered to all of the children. The results of both studies indicated that the children in the experimental groups out-performed the control group on nearly all the problem-solving tests in the posttest battery.

Wardrop, Goodwin, and others (1969) used the children in 44 fifth grade classrooms for a controlled experimental study. They studied the extent to which creativity and problem solving skills could be nurtured through a series of self-instructional programmed lessons. The Productive Thinking Program lessons described previously by Covington and Crutchfield (1965) were used. The sample of children reflected a wide variety of abilities, backgrounds, and characteristics found in the Racine, Wisconsin school system.

The results of the study were statistically significant in creative thinking and problem solving on a wide variety of productive thinking measures. This was found to be true of virtually all types of students regardless of sex or IQ level. It was especially marked for students in classrooms having environments judged to provide relatively little support and encouragement for the development of creative thinking.

Ripple and Dacey (1967) cited a study which examined the effects of an adaptation of the Productive Thinking Program on the behavioral problem solving performance and verbal creativity of eighth grade students. Paper and pencil tests of imagination and flexibility were used as measures of creativity. The Maier Two String Problem was used as the measure of behavioral problem solving performance. "The two

string problem was used to test whether or not instruction in verbal creativity would transfer to a behavioral measure of problem solving" (p. 241).

The instructional materials consisted of ten programmed lessons from the Productive Thinking Program. The lessons were adapted for the eighth grade level, eliminating six lessons which were the most redundant and/or least appropriate for eighth grade students. The materials were administered one lesson per day and on a self-instructional basis. The instructed pupils solved the two string problem significantly faster than the noninstructed students on the verbal creativity battery. The authors concluded that the results from the verbal creativity battery did not confirm the improved problem solving skills and creative thinking reported by Covington and Crutchfield (1965).

Olton and Crutchfield (1969) reported on a study using the Productive Thinking Program with intermediate grade elementary school children. The mean IQ score of this group of children was 115 and the IQ scores ranged from 80 to 150. Data were reported on two classes of fifth grade children. Half of the children in the two fifth grades were selected for instruction using the Productive Thinking Program, and the other half of each classroom served as a control group. The two groups of students were matched on IQ and achievement. For eight weeks the experimental group was instructed in the PTP as well as supplementary exercises to strengthen the skills taught in the basic lessons. The control group participated in activities consisting of stories, movies and various projects of general educational value but not related to productive thinking.

Results show that the training benefited children regardless of

their initial level of performance. Significant gains in productive thinking skills resulted from the training for children of average and somewhat below average IQ's as well as for higher IQ children.

Crutchfield's (1969, p. 70) evaluation was that the, "Effect of the training is such that trained children of average intelligence (mean IQ of 99) come to score virtually as high on the productive thinking tests as do the untrained children of high intelligence (mean IQ of 124)."

Shivley, Feldhusen and Treffinger (1972) inquired into the development of cognitive and affective aspects of creativity in upper elementary school pupils through direct instructional intervention. Included in the study were 16 fifth grade teachers and their 377 pupils. Eight of the experimental classes used 16 lessons of the Purdue Creative Thinking Program (PCTP), and eight used the Productive Thinking Program. The experiment continued for five weeks. The Torrance Tests of Creative Thinking were used as pre and posttests. Students in all the experimental conditions made significant gains on verbal originality and nonverbal fluency. Pupils who used the PTP outscored the PCTP pupils on a number of other variables.

In a review of research dealing with programmed instruction to develop creative problem solving Treffinger and Ripple (1971) commented that among the most difficult problems confronted by researchers is the question, "Can creativity be developed?" In what appears to be an attempt to answer this question they reviewed research related to the 1966 edition of the Productive Thinking Program. According to these researchers the effects of the PTP as an instructional program in creative problem solving have been contradictory. Support for the program's effectiveness seemed to depend upon (1) the period of time

taken to administer the materials and the amount and availability of supplementary practice, (2) teacher involvement in the program vs self-instruction, and (3) the similarity of the evaluation criteria to the instructional materials.

They concluded that it,

Seems very clear that before broad assertions of the effectiveness or ineffectiveness of the materials are warranted, research must be conducted in which each of the three variables...is systematically varied or controlled (p. 675).

The studies reviewed generally support the use of The Productive Thinking Program as a method useful in the development of creative thinking skills. Several of the studies reviewed used the PTP with students varying in age, sex, and IQ (Wardrop, Goodwin, 1969; Olton, Crutchfield, 1969). No studies were reviewed in which educationally handicapped children received training in the development of creative abilities. The results of this review support the viewpoint that there is a paucity of research dealing with the creative abilities of EH children (Tognetti, 1971).

### Summary

This chapter has presented a brief historical view of the interest in learning difficulties leading to the authorization by the California State Legislature of classes for educationally handicapped minors. In California the educationally handicapped are defined as children with severe learning problems associated with a neurological handicap or emotional disturbance. Neurologically handicapped and emotionally disturbed children were discussed, as well as the difficulties in differentiating between the two groups of children.

Lambert's study (1964) appears significant because it illustrates the

difficulties encountered when attempting to determine whether children are neurologically handicapped or emotionally disturbed.

Three methods of behavior management used successfully with EH children were discussed. Stimulant drugs have been used successfully with hyperactive and hyperkinetic children. Psychotherapy has also been used successfully with some brain injured children and in some cases its use was recommended in conjunction with drug therapy. Behavior modification techniques based on behavioral theory have helped to improve the behavior and academic achievement of children in some educationally handicapped classrooms.

One of the difficulties encountered in the study of creativity is the lack of agreement on its definition. Smith's definition was given because it is simple but descriptive, and Torrance's was chosen because of its value in the measurement of creativity.

Authorities seem to agree that all individuals are potentially creative, although in many cases the development of creativity has been inhibited. While creativity may have been inhibited by past experiences it appears that creative thinking skills can be trained, and this seems to be an important point to consider when planning instructional programs for educationally handicapped children. The theories of Maslow and Rogers stress that creativity is related to psychological health and as a person's psychological health improves his potential for creative thinking increases.

Two methods for the enhancement of creative thinking were reviewed. Brainstorming is a creative problem solving technique which has been used in business, government and education. However, only studies related to the elementary school grades were reviewed. In

general these studies seemed to show significant improvement in creative thinking through the use of brainstorming.

The Productive Thinking Program was the second method reviewed, and is a method of programmed instruction to develop creative thinking. It is a linear program using 15 lesson booklets. In most cases the studies using the PTP showed substantial and enduring gains in creative thinking. Results also seemed to show that the training benefited the children regardless of their initial level of performance.

While brainstorming and programmed instruction have been used to improve creative thinking with elementary school children no studies were found using educationally handicapped children. Only Rouse's study dealt with special education children, and her subjects were educable mentally retarded children.

### Chapter III

#### DESCRIPTION OF THE PROCEDURE AND RESEARCH DESIGN FOR THE STUDY

~~The description of the study, procedures used in collecting the~~  
data, and the research design for this study are presented in this chapter. Each of the hypotheses related to this study is also presented.

#### SETTING OF THE STUDY

The Hayward Unified School District (HUSD) was selected as the site for this experimental study because: (a) it is a district of sufficient size to provide an adequate sample of intermediate grade educationally handicapped (EH) classes, and (b) the HUSD educationally handicapped classes were established according to the guidelines of the California Education Code (1971).

The Hayward Unified School District is located in the city of Hayward, California, in the San Francisco Bay Area. The population growth of Hayward has been steady, however, the greatest growth was between 1950 and 1960, and was due primarily to the postwar "baby boom." In 1930 the city's population was 3,200 residents and will increase to an estimated 135,000 residents by 1980. The HUSD includes 45 elementary schools, junior high schools, and high schools. In the last five years there has been a steady decrease in school enrollment, dropping from 28,063 students in 1969 to approximately 24,000 students at the present time.

HUSD's program for educationally handicapped children includes



five primary, ten intermediate, seven junior high school, and seven high school EH special day classes. Two elementary school learning disability classes offer EH children with less severe learning problems one to three hours daily of remedial instruction in the basic skills. Instructional aides are employed in each EH class for a maximum of four hours daily. These aides are responsible to the EH teacher and assist in managing the students as well as helping with some of the instruction.

The children enrolled in the educationally handicapped classes were individually examined by credentialed school psychologists, and have been certified by the Admissions and Discharge Committee as educationally handicapped. The Hayward Unified School District's Procedure 5172 states that certification includes,

A statement from a credentialed school psychologist that in his professional judgment the pupil's basic learning skills fall below the range of functioning expected from pupils of a similar age and ability and that such functioning is not attributable to limited intellectual capacity for academic learning (1973, p. 2).

## PROCEDURE

### Selection of the Sample

The experimentally assessible population from which the sample was drawn consisted of intermediate grade educationally handicapped students. All students were registered in EH classes as of January 7, 1974, in the Hayward Unified School District. However, the target population may be generalized to the total number of children enrolled in intermediate grade EH classes in California. At the outset of this study, there were nine intermediate educationally handicapped classes, enrolling 102 children between the ages of eight-years-five months

and thirteen-years-five months. The mean age of the children in the sample was eleven-years-three months. During the course of the experiment two of the subjects moved from the school district, one was withdrawn from the EH class at the parent's request, and four were dropped from the study because of program changes. Ninety-five children participated in the study, including 84 boys and 11 girls. Enrollment in EH classes is limited to 12 children by California State law, and the enrollment in the sample classes ranged from nine to twelve children.

Students in the sample population were administered a battery of psychological tests prior to their certification as educationally handicapped by the district Admissions and Discharge Committee. The test battery included an individual intelligence (IQ) test to assess the students' intellectual ability. The majority of the IQ tests were administered during the 1970-1971 school year and the 1972-1973 school year, and in no case were the results more than four years old. The test administered in most cases was the Wechsler Intelligence Scale for Children. In several cases the Stanford-Binet Intelligence Test Form L-M, or some other individual intelligence test was administered. The intelligence quotients (IQ) of the children included in this study ranged from 70 to 120 with a mean IQ score of 91.

Ten of the children who participated in the study received medication prescribed by a physician. Ritalin and d-amphetamine had been prescribed for eight of these children, and Phenobarbital was prescribed for the remaining two.

The nine intermediate EH classes were located in several elementary schools throughout the school district, and in all but one

case there was only one EH class in each school. Because of the distance between schools, and the small number of classes in each school, it was not administratively feasible to randomly assign children to the experimental treatments. Class means were used as the dependent variable since classes rather than individual children were randomly assigned to the experimental treatments.

The following procedure was used for the random assignment of classes to the experimental and the control groups: (a) The names of the teachers were drawn from a container and listed in the order drawn, and (b) the experimental treatments were assigned to classes according to the order in which the teachers' names appeared on the list. Two classes were randomly assigned to the combination treatment of programmed instruction and brainstorming. Two classes were also randomly assigned to the programmed instruction treatment, and two classes were randomly assigned to the brainstorming treatment. The remaining three classes were used for control.

Three coins were tossed for each assignment made to the experimental groups. These assignments were: (a) Three heads, programmed instruction treatment, (b) three tails, brainstorming treatment, (c) two heads, one tail, combination treatment, and (d) two tails, one head, control.

The teachers and the instructional aides normally assigned to the EH classrooms administered the treatments to the experimental classes. The researcher decided to request that the teachers, with the help of the instructional aides, administer the experimental treatments for several reasons.

1. The study may be generalized to classrooms for educationally

handicapped children, and the instructional materials were adapted for use by the regular EH teacher.

2. Because of the nature of their problems educationally handicapped children are often difficult to manage. The regular teacher and instructional aide are best qualified to handle classroom discipline.

3. Campbell and Stanley (1963) suggested that, "Experimentation within schools must be conducted by regular staff of the school concerned, whenever possible, especially when findings are to be generalized to other classroom situations" (p. 191).

#### The Experiment

The Torrance Tests of Creative Thinking (TTCT) were used as measures of the dependent variable, and the TTCT were administered by the teachers assigned to the intermediate grade EH classes. The teachers included in this study were experienced classroom teachers, however, prior to the pretesting the researcher met with each teacher individually to explain the testing procedures, and to make certain that the teachers understood the directions for administering the tests. The standardized procedures for administration were followed.

Since the TTCT Verbal Forms require written responses, and the group administration of this form would appear to limit the performance of children with severe reading and writing handicaps, two of the seven verbal activities were selected for individual administration. The remaining verbal activities were not administered to the subjects.

The researcher corresponded with Dr. E. Paul Torrance, author of the TTCT, concerning the use of the Verbal Tests with EH children.

Torrance\* suggested that Activity 1, Asking, and Activity 4, Product Improvement, be given individually to the subjects. According to Torrance these tests would give the child, "Something fairly concrete to hang on to and generate ideas from."

In Activity 1, Asking, the children asked questions about a picture shown them in the test booklet. They also were allowed to hold a duplicate picture of the one in the test booklet. The directions state,

Ask all of the questions you would need to ask to know for sure what is happening. Do not ask questions which can be answered just by looking at the drawing. You can continue to look back at the drawing as much as you want to (Torrance, 1966, p. 6).

For Activity 4, Product Improvement, the examiner allowed the student to hold a toy animal similar to one pictured in the test booklet. The subjects were instructed to list the cleverest, most interesting and unusual ways they could think of to change the toy so that it would be more fun to play with. They also were instructed not to worry about the cost of the changes (Torrance, 1966). The total administration time for the two Verbal Tests was 15 minutes.

The Figural Forms A and B were administered as a group test. These tests include three activities with a total administration time of 30 minutes. A small amount of writing is required of the examinees when they label or name pictures they have drawn. When necessary, the labeling was accomplished by the teacher and the instructional aide (Torrance, 1966).

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\*Personal communication with the researcher, November 5, 1973.

The Picture Construction Activity required the subjects,

To think of a picture in which the given shape made of colored paper with an adhesive backing (in Form A, a tear drop or pear shape; in Form B, a jelly bean shape) is an integral part. An effort is made to elicit an original response by asking subjects to try to think of something that no one else in the group will produce. Elaboration is encouraged by the instructions to add ideas that will make the picture tell as complete and as interesting a story as possible (Torrance, 1966, p. 14).

The Incomplete Figures Activity required the subjects to complete and provide titles for 10 incomplete figures. The incomplete figures used were created by selecting parts of pictures drawn by subjects in another study (Torrance, 1966).

"The Repeated Figures Activities is similar to the Incomplete Figures Activities. The stimulus material in Form A is 30 parallel lines and in Form B is 40 circles" (p. 15). In this activity the subjects were asked to see how many objects or pictures they could make from the parallel lines or circles.

The preliminary testing using the Verbal and Figural Tests of the TTCT Form B was accomplished between January 7 and January 18, 1974. The experiment continued for eight weeks and was concluded with the posttesting. The posttests consisted of the Verbal and Figural Tests of the Torrance Tests of Creative Thinking Form A, and these tests were administered between March 18 and March 29, 1974. All of the tests were scored by the Personnel Press Scoring Service. The agency used professionally trained scorers. The tests were scored once, and then independently checked, providing an interscorer reliability check.

#### Programmed Instruction Procedures

The Productive Thinking Program (PTP) which was discussed in detail in Chapter II, The Review of the Literature, was administered

to the children assigned to the programmed instruction treatment. It is a set of 15 programmed lessons in individual booklets of approximately 40 pages in length. The 1974 edition of the materials was used. The PTP is written in a cartoon text format consisting of a series of simplified high interest detective and mystery stories. Each lesson poses a single mystery which children solve. A succession of clues and information lead them to discover the solution. The skills taught in the PTP are those thought to be essential for complex and original thinking, and at various points the students are required to state the problem, formulate opinions, and generate ideas to explain the mystery (Covington and Crutchfield, 1965).

During the eight week treatment period the 15 PTP Basic Lessons were divided into 30 sessions, and the programmed instruction groups received instruction four days each week for seven weeks. Only one Basic Lesson was administered during the eighth week allowing time for make up sessions.

In Wardrop's (1969) experiment using The Productive Thinking Program, teachers who had poor readers in their classrooms read portions of the lessons aloud, or otherwise assisted them. Also, Ryan (1968) found that children could learn effectively using programmed instruction even though they were poor readers. He stated that, "There is evidence that students in the intermediate grades frequently learn as well if not better from listening to a presentation as they do in reading from written materials" (p. 68).

Because of the severe nature of the reading and writing problems of the EH children included in this study it was necessary to assist the children with the reading of The Productive Thinking Program, Basic

Lessons. It was suggested to the teachers that the children work together on the Basic Lessons on a page by page basis with the teacher setting the pace. Discussion questions from the Teacher's Guide were suggested for incorporation into the classroom discussions.

### Brainstorming Procedures

Children who were assigned to the brainstorming treatment participated in a total of 30 brainstorming lessons which were held four days a week for seven weeks. Two lessons were scheduled for the eighth week, allowing time for make up sessions.

The brainstorming sessions consisted of instruction in brainstorming procedures, individual written ideation and group brainstorming. A detailed lesson plan was developed for each session following the procedures of several authors (Osborn, 1963; Parnes, 1963; Torrance, 1972). In the lesson plans emphasis was placed on the four basic principles of brainstorming. Osborn (1963) states that the four principles of brainstorming are:

1. Judgment is temporarily ruled out. Criticism of ideas must be withheld until later.
2. Freewheeling is welcomed. The more unusual the idea the better. It is easier to tame down ideas than to make them more exciting or interesting.
3. Quantity is wanted. The greater the number of ideas the more the likelihood of good ideas. Quantity leads to quality.
4. Combination and improvement are sought. Combining one idea with another often makes for a thought better than either of the original ones.



During the brainstorming sessions the children were also taught to ask questions useful in generating new ideas and finding solutions to a problem (Osborn, 1963). These questions were systematically presented in the brainstorming lesson plans. They were:

1. What would happen if we add something?
2. What would happen if we take something away?
3. What would happen if we multiply it?
4. What would happen if we divide it?
5. What would happen if we make it smaller?
6. What would happen if we make it bigger?
7. What would happen if we make it of a different material?
8. What would happen if we take something away and put something in its place?

In addition, the brainstorming lessons emphasized concepts thought to be essential in the teaching of creative thinking. These concepts were: (a) Increasing the ability to produce a quantity of ideas, (b) becoming more sensitive to problems, (c) learning the creative problem solving process, (d) learning to state or define a problem, and (e) allowing a problem to incubate before attempting to solve it (Smith, 1966).

Incorporated in the brainstorming lesson plans were the Scamper Games for Imagination Development (Eberle, 1971). The Scamper games were developed to help children maintain and improve their imaginative ability through learning and practicing idea getting techniques. The Scamper techniques draw heavily on Osborn's idea checklist (Eberle, 1971).

The units taken from the Invitations to Thinking and Doing

(Meyers and Torrance, 1964) are based upon research findings of the Minnesota Studies in Creative Thinking and other studies. The results of the studies, and the use of the exercises, have seemed to indicate that these instructional materials are useful in the development of creative potential. Only the first level of each unit was used in the brainstorming lessons. The first level activities were designed to challenge the pupil and cause him to puzzle, or to search for answers to the ideas presented (Meyers, Torrance, 1964).

Torrance (1965) states that the principles of brainstorming can be used in sessions emphasizing concrete problems, as well as sessions dealing with more abstract problems, including human relationships. Fifteen of the brainstorming lesson plans incorporated special topics, designed to progress from concrete to abstract problems, including human relationships. The topics were:

1. Think of as many ideas as you can for unusual uses of old television sets.
2. Think of as many ways as you can to use a hammer other than for pounding nails.
3. Think of as many ways as you can to use a bicycle in a house.
4. Think of as many ideas as you can for unusual uses of used frisbees.
5. Think of as many ideas as you can for unusual uses of junk automobiles.
6. Suppose you had the power to do anything you wanted to do. Think of as many ideas as you can which would make your school a more interesting place.
7. Just suppose you could not sing. Think of as many ideas as you can that would tell what might happen if it were against the law to sing.
8. Suppose that water animals could live on land and land animals in water. Think of what might happen if water animals could live on land and land animals could live in the water.

9. Suppose that your eight year old friend has started to smoke. Think of as many ideas as you can to help your friend stop smoking.

10. Suppose your six year old sister has temper tantrums. One day your mother left you in charge of your sister until she returned. While you were playing she did not get her way and she started to have a temper tantrum. What would you do? Think of as many ideas as you can.

11. Think of as many ways as you can which will help other boys and girls to like you better.

12. Think of all the things you can do when you feel that adults are too strict with you.

13. Think of all the things you can do when you feel afraid to go to school.

14. What can you do when you feel someone at home does not like you?

15. Think of all the ways you can help someone stop when they feel like fighting and arguing.

#### Combination Group Procedures

This experimental treatment combined instruction in programmed instruction and brainstorming. Each week two brainstorming lessons and two sessions from a Basic Lesson in The Productive Thinking Program were given to the experimental classes. Certain lessons from the PTP were eliminated for this treatment group, and it was suggested by Dr. Robert Olton,\* coauthor of the PTP that Basic Lessons four through ten could be eliminated without disrupting the continuity of the programmed materials. The students in the combination group participated in 14 brainstorming sessions and completed eight Basic Lessons (16 sessions) in the PTP. The lessons were administered four days a week for seven weeks. Two lessons were scheduled for the eighth

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\*Personal communication with the researcher, October 2, 1973.

week, allowing time for make up sessions.

### Instruments

The TTCT Norms-Technical Manual (Torrance, 1966) states that the test battery is the result of an attempt to assemble figural and verbal activities which require the kind of thinking analogous to the thinking involved in recognized creative achievements.

The Torrance Tests of Creative Thinking are a research edition consisting of Verbal Forms A and B, and Figural Forms A and B. All forms may be used from kindergarten through graduate school, and the Figural Forms may be administered as group tests at all levels. The Verbal Forms also may be administered as group tests to children in fourth grade and higher. The Verbal Tests consist of seven parallel tasks taking 45 minutes to administer. The Figural Tests include three activities and the administration time is 30 minutes (Directions Manual-Scoring Guide, 1966).

The Verbal Tests of the TTCT have been designed to assess fluency, flexibility, and originality of ideas. The Figural Tests assess modes of thinking in fluency, flexibility, originality, and elaboration, and the interpretation of the Figural scores is basically the same as for the Verbal scores. Torrance's (1966) interpretation of these scores follows:

1. Fluency. "This score reflects the test taker's ability to produce a large number of ideas" (p. 72).

2. Originality. "This score represents the subject's ability to produce ideas that are away from the obvious, commonplace, banal or established" (p. 73).

3. Flexibility. "This score represents a person's ability to produce a variety of kinds of ideas, to shift from one approach to another, or to use a variety of strategies" (p. 73).

4. Figural Elaboration. "This score reflects the subject's ability to develop, embroider, embellish, carry out, or otherwise elaborate ideas" (p. 75).

The Norms-Technical Manual (1966) reports test-retest reliabilities at one and two week intervals for the subtests of the TTCT. These reliabilities range from .50 -.93 and are based on product-moment coefficients of correlation. Test-retest correlations over a three year period ranged from .35-.73.

Two test-retest reliability studies were conducted using all four of the complete batteries (Verbal Form A, Verbal Form B, Figural Form A, and Figural Form B). The first study included 118 fourth, fifth and sixth grade children in St. Croix, Wisconsin. The second study consisted of 54 fifth graders in a Minnesota suburban school involved in a creative writing experiment. The results of these studies are shown in Table 2 (Torrance, 1966, p. 21).

The Norms-Technical Manual (1966) also reports a number of validity studies with fourth, fifth and sixth grade children using the Verbal and Figural Tests, Forms A and B. Generally the correlation coefficients for construct and concurrent validity range from .36-.55. In several of the validity studies the correlations were found to be statistically significant. The manual does not report the predictive validity of the TTCT, however, Khatena (1972, p. 78) reported on several predictive validity studies. He stated that, "Validity coefficients of around .50 have been obtained with various

Table 2

Product-Moment Coefficients of Correlation Between Scores  
on Forms A and Forms B of the Torrance Tests of  
Creative Thinking in Three Situations

Measure	Coefficients of Correlation		
	Wisc. Gr. 4-6	Minn. Sub. Exper.	Gr. 5 Cont.
Verbal Fluency	.93	.87	.79
Verbal Flexibility	.84	.84	.61
Verbal Originality	.88	.79	.73
Figural Fluency	.71	.50	.80
Figural Flexibility	.73	.63	.64
Figural Originality	.85	.60	.60
Figural Elaboration	.83	.71	.80

indices of creative behavior."

Torrance (1972) reported on five long range predictive validity studies of the Torrance Tests of Creative Thinking. However, he stated that,

No attempt has been made to determine whether creativity tests administered to elementary school children will predict adult creative achievements. Such studies were initiated in 1958 and 1959, and follow-up is planned for 1975 (p. 251).

The following table summarizes the long range predictive validity of the Torrance Tests of Creative Thinking (Torrance, 1972, p. 243).

In the Seventh Mental Measurements Yearbook (Buros, 1972), Thorndike stated that it is difficult to pull together a coherent picture of the validity of the Torrance Tests of Creative Thinking. However,

Table 3

Summary of Long Range Predictive Validity Studies  
of the Torrance Tests of Creative Thinking

Investigator and date	Sample	No.	Length Study	Behavior Predicted	r of Valid.
Torrance, Tan, & Allman, 1970	Junior Elem. Ed. Majors	114	8 yrs.	Creative teach. behavior	.62* .57*
Torrance,	12th Graders	46	7 yrs.	Highest Creat. Achievement	.50*
				Quantity of Creative Ach.	.46*
				Creativeness of Aspirations	.51*
Cropley, 1971	7th Graders	111	5 yrs.	Creative Ach. Out of School Outstanding	.51*
Witt, 1971	2-4 Graders	16 (Sel.)	6 yrs.	Achievements in creative arts and science	--
Torrance, 1971	7-12 Graders	236	12 yrs.	Quantity and Quality of Creative Achievements	.51*

NOTE:--\*Significant at better than the .01 level.

Buros' reviewers state that the reliability and validity of the TTCT are well enough established to make the test useful for further research in creativity.

#### Pupil Behavior Rating Scale

The Pupil Behavior Rating Scale (PBRs) (Lambert, 1973) was used to describe the behavior characteristics of the children assigned to the EH classes in this study. The PBRs is divided into two independent

groups of 11 attributes allowing the classroom teachers to rate their students on descriptors for each attribute. The attribute scales are organized into a booklet and each attribute appears on a single page. The behavior descriptors are arranged vertically in a continuous graphic rating format.

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A numerical value is assigned,

To each descriptor on a scale from "0.0" (indicating that a child described by that statement would not possess the attribute to any degree) to "3.0" (indicating that a child described would possess the attribute to an extreme degree, the most one would ever expect to encounter) (Lambert, 1973, pp. 14-15).

The six adaptation attributes are:

1. Is easily distracted
2. Has no enthusiasm for school and does not respond to or maintain interest in learning tasks
3. Has difficulty following direction in the classroom or in games on the playground
4. Is overly dependent on the teacher for choice of activity and becomes uneasy without continuous supervision
5. Gets into fights and quarrels
6. Has difficulty learning (Lambert, 1973, p. 11).

The five adjustment attributes developed to detect chronic problems in emotional adjustment are:

1. Has to be coaxed or forced to work or play with others
2. Manifests immature or inappropriate behavior
3. Gets sick or upset when faced with a difficult school situation
4. Is often unhappy or depressed
5. Behaves in ways which are dangerous to self and others (Lambert, 1973, p. 73).

A comparison of the adaptation and adjustment attributes reveals



differences in content and tone. The adaptation attributes focus on behaviors which indicate the readiness of a pupil for learning tasks. However, the adjustment attributes concentrate on behaviors which seem to point to interpersonal and intrapersonal stress.

Lambert reported that each of the adaptation attributes showed inter-rater and retest reliability coefficients in the high .70's to low .80's. Coefficients reflecting stability over eight and twelve month intervals were .50 to .70.

According to Lambert (1973) the, "Adaptation ratings were assured content validity by the nature of the procedures employed in their construction" (p. 30). Teachers produced the behavior descriptions used as examples on the continuum of behaviors representing each adaptation attribute. Also, the content of the scales seems to adequately represent the range of school based behavioral alternatives associated with each attribute.

Findings with respect to discriminant validity were mixed but suggested substantial method variance which at this state of their development, caution against the assignment of comparative diagnostic significance of the individual attributes (Lambert, 1973, p. 85).

Cluster analysis of the adaptation and adjustment attributes for the total group of first to sixth grades yielded three dimensions of classroom behavior problems: (a) problems in classroom adaptation, (b) problems in interpersonal adjustment, and (c) problems in intrapersonal adjustment (p. 80).

Lambert concluded that these cluster analyses suggested that the dimensions may be useful in the study of school failure.

#### RESEARCH DESIGN

The research design for this study is a pretest, posttest, control group design using random assignment of classes to the treatments.

According to Kerlinger (1964) the before and after design is appropriate for data which are to be analyzed by the analysis of covariance. A 1X4 covariance analysis was used for the analysis of the data using the pretest scores as the covariate (Campbell and Stanley, 1963). Advantages of the analysis of covariance are: (a) It allows the experiment to be conducted in its natural setting, (b) it allows for precision of the analysis and the information it can yield, and (c) it eliminates initial bias (Kerlinger, 1964).

The Scheffe procedure for testing all possible comparisons among means was used to analyze the data further. The Scheffe method is a conservative test, and the probability of a false conclusion for any comparison does not exceed the level of significance specified for the overall hypotheses (Roscoe, 1969).

### Hypotheses

Prior to this investigation, the decision was made to accept the .05 level of significance. This is a commonly accepted significance level in educational research which seems to balance the probabilities of making a false conclusion and that of overlooking a true difference. The following were the research hypotheses tested in this study.

1. Educationally handicapped children who participate in brainstorming sessions to develop their creative thinking abilities demonstrate significantly greater improvement than EH children not participating in the sessions.

2. Educationally handicapped children who participate in programmed instruction to develop their creative thinking abilities

demonstrate significantly greater improvement than EH children not participating in the instruction.

3. Educationally handicapped children who participate in a combination program of programmed instruction and brainstorming sessions to develop their creative thinking abilities demonstrate significantly greater improvement than EH children not participating in the program.

4. Educationally handicapped children who participate in a combination program of programmed instruction and brainstorming sessions to develop their creative thinking abilities demonstrate significantly greater improvement than EH children participating in brainstorming, programmed instruction, or those not participating.

#### SUMMARY

In this chapter the procedures for conducting this study have been described and the research hypotheses to be tested stated. The statistical analyses, needed to test these hypotheses, were also stated. In the following chapter the results of the statistical analyses are presented, and brief interpretations follow each of the sets of the data presented.

## Chapter IV

### ANALYSIS OF THE DATA

This chapter describes the sample further, presents the statistical analyses, and summarizes the findings of the analyses. The independent variable (instructional treatments) was evaluated by two verbal tests and three figural tests of the Torrance Tests of Creative Thinking. Each of the tests was used as a measure of the dependent variable, and seven separate 1X4 analyses of covariance were performed on the following: (a) Verbal Fluency, (b) Verbal Flexibility, (c) Verbal Originality, (d) Figural Fluency, (e) Figural Flexibility, (f) Figural Originality, and (g) Figural Elaboration.

A test for homogeneity of within-class regression slopes was run for each dependent variable. This assumption was tenable at the .05 level for all analyses. From the 95 participating subjects there were 85 complete sets of verbal test scores and 90 complete sets of figural test scores. Missing data due to technical problems or incomplete testing were deleted.

A brief description of the two verbal and three figural tests administered to the subjects follows (Torrance, 1966):

1. Activity One, Asking, "Is designed to reveal the individual's ability to sense what he cannot find out from looking at the picture and to ask questions that will enable him to fill in the gaps in his knowledge" (p. 11).

2. The Product Improvement Activity permits the subjects to,

"Regress in the service of the ego and enables them to play with ideas that they would not dare express in a more serious task" (pp. 11-12).

3. The Figural Picture Construction Activity, "Sets into motion the tendency toward finding a purpose and to elaborate it in such a way that the purpose is achieved" (p. 16).

4. "The Incomplete Figures Activity calls into play the tendency toward structuring and integrating" (p. 16).

5. "The Circles and Parallel Lines Activities requires an ability to return to the same stimulus again and again and perceive it in a different way" (p. 16).

The study took place in the Hayward Unified School District. The sample population consisted of intermediate grade educationally handicapped (EH) students who were enrolled in nine EH Special Day Classes. The nine intermediate grade EH classes were randomly assigned to the experimental and control groups. One experimental group included the two classes assigned to the brainstorming treatment. A second experimental group consisted of two classes assigned to the programmed instruction treatment, and a third experimental group was made up of two classes receiving a combination treatment of brainstorming and programmed instruction. The three classes assigned to the control group received the regular classroom instruction.

The Torrance Tests of Creative Thinking (TTCT) were used as measures of the dependent variable. Alternate forms of the TTCT were administered as pretests and posttests. The problem of this study was to determine if the verbal and figural creative abilities of educationally handicapped children can be appreciably enhanced through an educational environment using brainstorming and programmed instruction techniques.

### Description of the Sample

Interrelationships between age, IQ, achievement and teacher ratings of the students were studied. The analysis of variance was used to test for differences between the treatment groups on these variables.

A summary of the analysis of variance for age, intelligence quotient (IQ), and achievement is presented in Table 4. The data in Table 4 do not show significant differences between the ages, IQ, or achievement of the students in the treatment groups. The critical value for the F statistic at the .05 level of significance is 2.76.

TABLE 4

Summary of the Analyses of Variance for  
Age, Sex, IQ, and Achievement

Variable	F
Age	1.314
Wechsler Intelligence Scale for Children	
Verbal Scale IQ	.217
Performance Scale IQ	1.025
Full Scale IQ	.582
Wide Range Achievement Test Standard Scores	
Reading	2.026
Spelling	.829
Arithmetic	.389

The number of subjects and the treatment group means of the sample for age, IQ, and achievement are shown in Table 5. In nearly all cases the subjects had been administered the Wechsler Intelligence Scale for Children (WISC) and the Wide Range Achievement Test (WRAT).

TABLE 5  
Treatment Group Means for Age,  
Sex, IQ, and Achievement

Variable	Treatment Group	N	Mean
Age	Brainstorming	24	11.3
	Programmed Instruction	23	11.0
	Combination	18	11.4
	Control	30	11.5
Wechsler Intelligence Scale for Children			
Verbal Scale IQ	Brainstorming	23	87.1
	Programmed Instruction	20	87.9
	Combination	16	89.0
	Control	27	89.1
Performance Scale IQ	Brainstorming	23	87.8
	Programmed Instruction	20	91.0
	Combination	16	97.2
	Control	28	95.2
Full Scale IQ	Brainstorming	24	92.2
	Programmed Instruction	23	88.8
	Combination	17	92.3
	Control	27	90.8
Wide Range Achievement Test Standard Scores			
Reading	Brainstorming	24	78.7
	Programmed Instruction	22	79.1
	Combination	15	79.0
	Control	26	75.3
Spelling	Brainstorming	24	77.7
	Programmed Instruction	22	75.0
	Combination	15	76.7
	Control	25	74.8
Arithmetic	Brainstorming	23	83.0
	Programmed Instruction	22	81.1
	Combination	15	83.0
	Control	25	81.0

The WISC Full Scale intelligence quotient (IQ) of the four treatment groups ranged from 88.8 to 92.3. The Verbal Scale IQ's ranged from

87.1 to 89.1, and the Performance Scale IQ's from 87.7 to 97.2. According to the WISC Manual (Wechsler, 1949), the mean IQ's of the subjects in this study fall in the dull normal to average range of mental ability.

The Wide Range Achievement Test mean standard scores for each treatment group indicate that the students assigned to the EH classes in this study had serious learning problems. It should be noted, however, that in most cases both the achievement and intelligence test data do not represent scores of tests administered during the 1973-74 school year. Both the achievement and intelligence test data were taken from the psychological records of the students, and in several cases the records were not available or were incomplete. The majority of the tests were administered prior to the certification of the students as educationally handicapped by the district Admissions and Discharge Committee.

The low reading and spelling standard scores of the treatment groups point out the difficulties these children have in attempting to read and respond to curriculum materials at their grade levels.

The sample population of the study included 84 boys and 11 girls, and to determine the proportion of male and female students in the treatment groups a Chi Square analysis was performed. The Chi Square analysis of the proportion of male and female subjects in the treatment groups is displayed in Table 6. The analysis shows that there was no significant difference in the proportion of male and female students in the treatment groups.

Interrelationships between the teacher's ratings on the Pupil Behavior Rating Scale (PBRs) were also studied. Summary data of the analysis of variance for the PBRs adjustment attributes are presented in Table 7. The data reported in Table 7 do not show significant differences between the ratings of the teachers on the five adjustment



TABLE 6

Chi Square Analysis of the Proportion of Male and  
Female Subjects in the Four Treatment Groups

	Male	Female	Total
Brainstorming	20	2	22
Programmed Instruction	18	5	23
Combination	18	2	20
Control	28	2	30
Total	84	11	95 <sup>a</sup>

<sup>a</sup>At 3 degrees of freedom  $\chi^2 = 3.18$ .

The critical value of Chi Square at the .05 level of significance is 7.86.

attributes. These attributes are (Lambert, 1973, p. 73):

1. Has to be coaxed or forced to work or play with others
2. Manifests immature or inappropriate behavior
3. Gets sick or upset when faced with a difficult school situation
4. Is often unhappy or depressed
5. Behaves in ways which are dangerous to self and others

Summary data of the analysis of variance for the PBRS adaptation attributes are presented in Table 8. The F statistic shows significant differences exist between the treatment group means for the adaptation attributes. The six adaptation attributes are (Lambert, 1973, p. 11):

1. Is easily distracted
2. Has no enthusiasm for school and does not respond to or maintain interest in learning tasks
3. Has difficulty following directions in classroom or in games on the playground

TABLE 7

Summary of the Analysis of Variance for the Adjustment  
Attributes of the Pupil Behavior Rating Scale

Source	SS	DF	MS	F <sup>a</sup>
Between Groups	31.69	3	10.56	1.38
Within Groups	680.67	89	7.65	
Total	712.	92		

<sup>a</sup>Critical F-value at the .05 level is 2.76.

4. Is overly dependent on the teacher for choice of activity and becomes uneasy without continuous supervision
5. Gets into fights and quarrels
6. Has difficulty learning

TABLE 8

Summary of the Analysis of Variance for the Adaptation  
Attributes of the Pupil Behavior Rating Scale

Source	SS	DF	MS	F <sup>a</sup>
Between Groups	106.94	3	35.65	3.04*
Within Groups	1044.49	89	11.74	
Total	1151.	92		

<sup>a</sup>Critical F-value at the .05 level is 2.76.

\* $p < .05$ .

Scheffe' post hoc tests of significance showed that teacher ratings on the adaptation attributes of the Pupil Behavior Rating Scale

were significantly higher for the control group than for the brainstorming group. No significant differences can be concluded between other pairs of means. The treatment group means for the adjustment and adaptation attributes of the Pupil Behavior Rating Scale are reported in Table 9.

TABLE 9

Treatment Group Means for the Adaptation and Adjustment  
Attributes for the Pupil Behavior Rating Scale

Variable	Treatment Group	Mean
Adjustment	Brainstorming	5.6
	Programmed Instruction	5.5
	Combination	7.1
	Control	6.2
Adaptation	Brainstorming	7.7
	Programmed Instruction	8.2
	Combination	9.9
	Control	10.2

Lambert (1973, p. 73) in her review of the adjustment attributes explained that, "The adaptation statements focus strongly on behaviors which indicate the readiness of a pupil for accomplishing learning tasks." The teacher ratings seem to suggest that the classes in the control group may have been less ready for the learning tasks required of them than the classes in the brainstorming treatment.

### Analysis

The measures of the dependent variable were analyzed in terms of the variables mentioned previously. Seven separate analyses of the Torrance Tests of Creative Thinking were carried out, and seven null

hypotheses were formulated. Where the F statistic reached the .05 level of significance the Scheffe' multiple comparison procedures for testing all possible comparisons among means were used to specify where the differences were. Because the Scheffe' method is a conservative test (Roscoe, 1969) the decision was made to accept the .10 level of significance. The seven null hypotheses for the dependent variable follow:

H<sub>1</sub>. There is no difference between the mean performances in Verbal Fluency for all four treatment groups.

H<sub>2</sub>. There is no difference between the mean performances in Verbal Flexibility for all four treatment groups.

H<sub>3</sub>. There is no difference between the mean performances in Verbal Originality for all four treatment groups.

H<sub>4</sub>. There is no difference between the mean performances in Figural Fluency for all four treatment groups.

H<sub>5</sub>. There is no difference between the mean performances in Figural Flexibility for all four treatment groups.

H<sub>6</sub>. There is no difference between the mean performances in Figural Originality for all four treatment groups.

H<sub>7</sub>. There is no difference between the mean performances in Figural Elaboration for all four treatment groups.

Analysis of verbal fluency. Verbal Fluency "reflects the test taker's ability to produce a large number of ideas with words" (Torrance, 1966, p. 72). The analysis of covariance was used to test H<sub>1</sub>. The hypothesis stated that, there is no difference between the mean performances in Verbal Fluency for all treatment groups.

A summary for the analysis of covariance for Verbal Fluency is

presented in Table 10. The F statistic shows statistically significant differences between the treatment group means, and the data reported in Table 10 support the rejection of  $H_1$ .

TABLE 10  
Summary of the Analysis of Covariance Results with  
the Torrance Tests of Creative Thinking Verbal  
Fluency as the Dependent Variable

Source	SS	DF	MS	F <sup>a</sup>
Between Groups	1226.247	3	408.749	5.446*
Within Groups	6004.143	80	75.052	
Total	7230.390	83		

<sup>a</sup>Critical F-value at the .05 level is 2.76.

\* $P < .01$ .

Scheffe' post hoc tests of significance for Verbal Fluency showed that the brainstorming group scored significantly higher than the programmed instruction group, and significantly higher than the control group. The brainstorming group approached but failed to score significantly higher than the combination group. There were no significant differences between the programmed instruction and combination group. The adjusted Verbal Fluency means for each treatment group are shown in Table 11.

Analysis of verbal flexibility. Verbal Flexibility "represents a person's ability to produce a variety of kinds of ideas, to shift from one approach to another or to use a variety of strategies" (Torrance, 1966, p. 73). The analysis of covariance was used to test  $H_2$ . The

TABLE 11

## Adjusted Means for Treatment Groups Verbal Fluency

Brainstorming	Programmed Instruction	Combination	Control
32.556	22.629	25.637	24.820
N = 24	N = 19	N = 16	N = 29

hypothesis stated that there is no difference between the mean performances in Verbal Flexibility for all four treatment groups.

A summary of the analysis of covariance for the measurement of Verbal Flexibility is presented in Table 12. The F statistic shows significant differences exist between the treatment group means, and the data reported in Table 12 support the rejection of  $H_2$ .

TABLE 12

## Summary of the Analysis of Covariance Results with the Torrance Tests of Creative Thinking Verbal Flexibility as the Dependent Variable

Source	SS	DF	MS	F <sup>a</sup>
Between Groups	338.142	3	112.714	5.989*
Within Groups	1505.572	80	18.819	
Total	1843.714	83		

<sup>a</sup>Critical F-value at the .05 level is 2.76.

\* $p < .01$

Scheffe' post hoc tests of significance for Verbal Flexibility showed that the brainstorming group scored significantly higher than the

programmed instruction group and significantly higher than the control group. The brainstorming group failed to score significantly higher than the combination group. There were no significant differences between the programmed instruction and combination group. The adjusted Verbal Flexibility means for each treatment group are shown in Table 13.

TABLE 13

## Adjusted Means for Treatment Groups Verbal Flexibility

Brainstorming	Programmed Instruction	Combination	Control
16.412	11.612	14.402	12.055
N = 24	N = 19	N = 16	N = 29

Analysis of verbal originality. Verbal Originality "represents the subject's ability to produce ideas that are away from the obvious, commonplace, banal, or established" (Torrance, 1966, p. 73). The analysis of covariance was used to test  $H_3$ . The hypothesis stated that there is no difference between the mean performances in Verbal Originality for all four treatment groups.

A summary of the analysis of covariance for the measurement of Verbal Originality is presented in Table 14. The F statistic shows that significant differences exist between the treatment group means and the data reported in Table 14 support the rejection of  $H_3$ .

Scheffe' post hoc tests of significance for Verbal Originality showed that the brainstorming group scored significantly higher than the programmed instruction group. The brainstorming group approached but failed to score significantly higher than the combination group. There

TABLE 14

Summary of the Analysis of Covariance Results with  
the Torrance Tests of Creative Thinking Verbal  
Originality as the Dependent Variable

Source	SS	DF	MS	F <sup>a</sup>
Between Groups	1543.281	3	514.427	2.977*
Within Groups	13820.948	80	172.761	
Total	15364.229	83		

<sup>a</sup>Critical F-value at the .05 level is 2.76.

\*P<.05

were no significant differences between the brainstorming and the control group, and between the programmed instruction and combination group. The adjusted Verbal Originality means for each treatment group are shown in Table 15.

TABLE 15

Adjusted Means for Treatment Groups Verbal Originality

Brainstorming	Programmed Instruction	Combination	Control
33.996	23.301	24.216	29.894
N = 24	N = 19	N = 16	N = 29

Analysis of figural fluency. Figural Fluency is the ability to produce a large number of ideas through drawings (Torrance, 1966). The analysis of covariance was used to test H<sub>4</sub>. The hypothesis stated that there is no difference between the mean performances in Figural Fluency



for all four treatment groups.

A summary of the analysis of covariance for the measurement of Figural Fluency is presented in Table 16. The F statistic shows that significant differences exist between the treatment group means, and the data reported in Table 16 support the rejection of  $H_4$ .

TABLE 16

Summary of the Analysis of Covariance Results with the  
Torrance Tests of Creative Thinking Figural  
Fluency as the Dependent Variable

Source	SS	DF	MS	F <sup>a</sup>
Between Groups	1141.	3	380.538	6.390*
Within Groups	5061.767	85	59.550	
Total	6203.383	88		

<sup>a</sup>Critical F-value at the .05 level is 2.76.

\* $P < .01$

Scheffe' post hoc test of significance showed that the brainstorming group, the programmed instruction group, and the combination group scored significantly higher than the control group. There were no significant differences between the brainstorming and combination groups, or the programmed instruction and combination groups. The adjusted Figural Fluency means for each treatment group are shown in Table 17.

Analysis of figural flexibility. "This score represents a person's ability to produce a variety of kinds of ideas, to shift from one approach to another, or to use a variety of strategies...with figural

TABLE 17

## Adjusted Means for Treatment Groups Figural Fluency

Brainstorming	Programmed Instruction	Combination	Control
25.027	25.659	28.432	18.714
N = 24	N = 23	N = 16	N = 29

rather than verbal modes of thinking" (Torrance, 1966, pp. 73, 74). The analysis of covariance was used to test  $H_5$ . The hypothesis stated that there is no difference between the mean performances in Figural Flexibility for all four treatment groups.

A summary of the analysis of covariance for the measurement of Figural Flexibility is presented in Table 18. The F statistic shows significant differences between the treatment group mean, and the data reported in Table 18 support the rejection of  $H_5$ .

TABLE 18

## Summary of the Analysis of Covariance Results with the Torrance Tests of Creative Thinking Figural Flexibility as the Dependent Variable

Source	SS	DF	MS	F <sup>a</sup>
Between Groups	338.545	3	112.848	3.712*
Within Groups	2583.807	85	30.397	
Total	2922.353	88		

<sup>a</sup>Critical F-value at the .05 level is 2.76.

\* $P < .05$ .

The results of Scheffe' post hoc tests of significance for Figural Flexibility show that the brainstorming group scored significantly higher than the control group. The programmed instruction and combination groups approached but failed to score significantly higher than the control group. There were no significant differences between other pairs of means. The adjusted Figural Flexibility means for the treatment groups are shown in Table 19.

TABLE 19  
Adjusted Means for Treatment Groups Figural Flexibility

Brainstorming	Programmed Instruction	Combination	Control
19.022	17.390	17.440	14.017
N = 24	N = 23	N = 16	N = 29

Analysis of figural originality. This score represents the subject's figural ability, "to produce ideas that are away from the obvious, commonplace, banal or established" (Torrance, 1966, p. 73). The analysis of covariance was used to test  $H_6$ . The hypothesis stated that there is no difference between the mean performances in Figural Originality for all four treatment groups.

A summary of the analysis of covariance for the measurement of Figural Originality is presented in Table 20. The data reported in Table 20 do not show statistically significant differences between the treatment group means, and support the acceptance of  $H_6$ . The adjusted Figural Originality means for the treatment groups are shown in Table 21.

TABLE 20

Summary of the Analysis of Covariance Results with the  
Torrance Tests of Creative Thinking Figural  
Originality as the Dependent Variable

Source	SS	DF	MS	F <sup>a</sup>
Between Groups	248.558	3	82.852	0.460
Within Groups	15303.591	85	180.042	
Total	15552.149	88		

<sup>a</sup>Critical F-value at .05 level is 2.76.

TABLE 21

Adjusted Means for Treatment Groups Figural Originality

Brainstorming	Programmed Instruction	Combination	Control
31.446	30.562	32.222	27.882
N = 24	N = 19	N = 16	N = 29

Analysis of figural elaboration. "This score reflects the subject's ability to develop, embroider, embellish, carry out, or otherwise elaborate ideas" (Torrance, 1966, p. 75). The analysis of covariance was used to test  $H_7$ . The hypothesis stated that there is no difference between the mean performances for Figural Elaboration for all four treatment groups.

A summary of the analysis of covariance for the measurement of Figural Elaboration is presented in Table 22. At 3 and 85 degrees of freedom the F statistic at the .05 level of significance is 2.76. The

data reported in Table 22 do not show statistically significant differences between the treatment group means, and support the acceptance of  $H_7$ . The adjusted Figural Elaboration means for the treatment groups are shown in Table 23.

TABLE 22

Summary of the Analysis of Covariance Results with the  
Torrance Tests of Creative Thinking Figural  
Elaboration as the Dependent Variable

Source	SS	DF	MS	F <sup>a</sup>
Between Groups	2302.865	3	767.621	0.921
Within Groups	70809.847	85	833.057	
Total	73112.712	88		

<sup>a</sup>Critical F-value at .05 level is 2.76.

TABLE 23

Adjusted Means for Treatment Groups Figural Elaboration

Brainstorming	Programmed Instruction	Combination	Control
86.458	81.269	73.113	74.629
N = 24	N = 23	N = 16	N = 29

#### Summary of the Analysis

Chapter IV included the presentation and analysis of the data collected for this research project. Computations were made to determine the significant differences between the experimental and control groups on seven variables. After significant differences were

established in the F statistic, the Scheffe' multiple comparison procedures were used to specify the data further. A summary of the findings follows:

1. There were no significant differences between the ages, sex, IQ or achievement of the subjects in the four treatment groups.

2. There were no significant differences between the teachers' ratings of the treatment groups on the five adjustment attributes of the Pupil Behavior Rating Scale.

3. There was a significant difference between the teachers' ratings of the brainstorming and control groups for the six adaption attributes of the Pupil Behavior Rating Scale. The Scheffe' test revealed that the control group had more adaptation problems and was less ready to accomplish learning tasks than the brainstorming group. No significant differences can be assumed between other pairs of means.

4. Post hoc tests of significance showed that the brainstorming group scored significantly higher than the programmed instruction and control groups on Verbal Fluency. The data support the rejection of  $H_1$ .

5. Post hoc tests of significance showed that the brainstorming group scored significantly higher than the programmed instruction and control groups on Verbal Flexibility. The data support the rejection of  $H_2$ .

6. Post hoc tests of significance showed that the brainstorming group scored significantly higher than the programmed instruction group on Verbal Originality. The data support the rejection of  $H_3$ .

7. Post hoc tests of significance showed that the brainstorming group, the programmed instruction group and the combination group scored significantly higher than the control group on Figural Fluency. The

data support the rejection of H<sub>4</sub>.

8. Post hoc tests of significance show that the brainstorming group scored significantly higher than the control group on Figural Flexibility. The data support the rejection of H<sub>5</sub>.

9. There was no significant difference between the treatment groups on Figural Originality, and the data support the acceptance of H<sub>6</sub>.

10. There was no significant difference between the treatment groups on Figural Elaboration, and the data support the acceptance of H<sub>7</sub>.

## Chapter V

### SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter is organized into three major sections. The first section summarizes the study. The second section discusses the conclusions and interpretations relative to the data reported in Chapter IV. The third section presents recommendations for further study based on these conclusions and interpretations.

#### SUMMARY OF THIS STUDY

The problem of this study was to determine if the verbal and figural creative abilities of educationally handicapped (EH) children could be appreciably enhanced through an educational environment using brainstorming and programmed instruction. In January, 1974, nine classes of intermediate grade EH children in the Hayward Unified School District, were randomly assigned to the experimental treatments. Class means were used as the independent variable. Ninety-five children participated in the study including 84 boys and 11 girls.

The nine intermediate EH classes were located in several elementary schools throughout the school district, and in all but one case there was only one EH class in each school. Two classes were randomly assigned to the brainstorming treatment. Two classes were randomly assigned to the programmed instruction treatment, and two classes were randomly assigned to the combination treatment of



brainstorming and programmed instruction. The remaining classes were used for control.

Although the ages of the subjects ranged from eight-years-five months to thirteen-years-five months, there was no difference between the class means. There was no difference between the class means for IQ and achievement, and there was no difference in the proportion of male and female students in the experimental classes.

The Pupil Behavior Rating Scale (PBRs) (Lambert, 1973) was used to describe the behavior characteristics of the children assigned to the EH classes. The PBRs is divided into two independent groups of 11 attributes, allowing the classroom teachers to rate their students on adjustment and adaptation attributes.

The Torrance Tests of Creative Thinking (TTCT) were used as measures of the dependent variable, and the TTCT were administered by the classroom teachers. The standardized procedures for administration were followed. The two verbal tests were administered individually, and the three figural tests were administered as group tests.

The research design for this study was a pretest, posttest, control group design using random assignment of classes to the treatments. A 1X4 analysis of covariance was used for the analysis of the data using the pretest scores as the covariate. The Scheffe' procedure for testing all possible comparisons among means was used to specify where the differences were.

## DISCUSSION OF THE FINDINGS

### Verbal Fluency

Null hypothesis one was rejected indicating that there were

significant differences between the treatment group means for Verbal Fluency. The post hoc tests of significance showed that the brainstorming group scored significantly higher than the programmed instruction and control groups. The data presented in Chapter IV indicate that brainstorming increases the ability to produce a large number of ideas with words. The results indicate the superiority of brainstorming over programmed instruction and regular classroom instruction for the production of a quantity of ideas. While there were no significant differences between the brainstorming and combination treatments, the direction of the means seemed to suggest the superiority of the brainstorming treatment over the combination treatment.

#### Verbal Flexibility

Null hypothesis two was rejected indicating that there were significant differences between the treatment group means for Verbal Flexibility. The post hoc tests of significance revealed that the brainstorming group scored significantly higher than the programmed instruction treatment and the control group. The data indicate that brainstorming increases educationally handicapped students verbal ability to produce a variety of ideas, to shift approaches, and to use a variety of strategies. The data show the superiority of brainstorming over programmed instruction and regular classroom instruction when used with EH students.

#### Verbal Originality

Null hypothesis three was rejected indicating that there were significant differences between treatment group means for Verbal Originality. Post hoc tests of significance showed that the brainstorming

treatment scored significantly higher than the programmed instruction group. The data show that brainstorming increases the verbal ability of EH children to produce ideas which are not obvious, commonplace, established or banal. The data indicate the superiority of brainstorming over programmed instruction in developing the ability to produce original ideas.

### Figural Fluency

Null hypothesis four was rejected indicating that significant differences did exist between the treatment group means for Figural Fluency. Post hoc tests of significance indicate that the brainstorming, programmed instruction, and combination treatments scored significantly higher than the control group. The data show that brainstorming, programmed instruction, and the combination of the two treatments increase the ability of EH students to produce a large number of ideas through drawings.

### Figural Flexibility

Null hypothesis five was rejected indicating that significant differences exist between the treatment group means for Figural Flexibility. Post hoc tests of significance showed that the brainstorming group scored significantly higher than the control group. The data show that EH children assigned to the brainstorming treatment were better able than children in the control group to produce through drawings, a variety of ideas, to shift approaches, and to use a variety of strategies. While there were no significant differences between the programmed instruction treatment or the combination treatment and the control group, the direction of the means seemed to suggest the

superiority of these treatments over regular classroom instruction.

### Figural Originality

Null hypothesis six was accepted indicating that there were no differences between the treatments on Figural Originality. From the data it may be concluded that the treatments did not increase the subjects' figural ability to produce ideas which are not obvious, commonplace, established, or banal.

### Figural Elaboration

Null hypothesis seven was accepted indicating that there were no differences between the treatment group means on Figural Elaboration. It may be concluded that the treatments did not increase the subjects' figural ability to develop, embroider, embellish, carryout, or otherwise elaborate ideas.

### Implications

The results of this study seem to support other studies using brainstorming as a method for developing creative thinking skills. While no studies dealing directly with educationally handicapped minors were reviewed, some comparisons between the results may be made.

The findings of this study are consistent with those of Rouse (1963). Rouse found that a daily training program using brainstorming with educable mentally retarded (EMR) children showed significant gains in Verbal Fluency, Verbal Flexibility, and Verbal Originality. In Rouse's study only the Verbal Test 4: Product Improvement was used. The results also partially confirm Rouse's study which showed significant improvement in figural creative abilities. She found that with

brainstorming as an instructional method significant gains could be made in Figural Fluency, Figural Flexibility, Figural Originality, and Figural Elaboration.

Contrary to Rouse's results with EMR children, there were no differences between the treatment groups in this study on Figural Originality or Figural Elaboration. It appears that the EH children in the experimental groups learned through drawing to produce a large number and variety of ideas. However, they did not produce drawings expressing original ideas or add pertinent ideas to their responses. It may be hypothesized (Torrance, 1966) that low elaboration scores are associated with a lack of keenness or sensitivity in observation. Apparently the children in the experimental groups did not develop an increased keenness of observation on figural tasks as a result of the experimental treatments.

The lack of differences between the groups on Figural Originality seems to reflect an inability on the part of the experimental subjects to summons the intellectual energy to produce high quality figural responses. Torrance (1966, p. 73) concluded that, "The making of original responses requires the ability to delay immediate gratification or reduction of tension in order to get away from the obvious, easy but low quality response."

The findings are also consistent with the work of Torrance and Torrance (1972). In their study of disadvantaged children, brainstorming facilitated significant gains in the production of original ideas. Buchanan and Lindgren (1973) also found that regular classroom subjects participating in brainstorming made significantly more responses, and demonstrated a higher level of creativity.

The findings of this study offer some encouragement for the use of programmed instruction to develop creative thinking skills in EH children. While the results of this treatment generally were not shown to be significant, there was evidence which seemed to point to the need for further research with EH children. The results showed that the programmed instruction treatment group scored significantly higher than the control group on Figural Fluency and approached significance for Figural Flexibility.

There were no studies reviewed in which the Productive Thinking Program (PTP) was used with special education children. However Wardrop, Goodwin et al. (1969) reported statistically significant results with a sample of children reflecting a wide variety of abilities, backgrounds, and characteristics. Shivley, Feldhusen and Treffinger (1972) used the PTP with fifth grade children, and significant gains were found on the Verbal Originality and Figural Fluency tests of the TTCT.

There may be several reasons why the Productive Thinking Program was not shown to be effective in training educationally handicapped children to think creatively.

1. The children in the educationally handicapped classes were severely disabled readers, and it was necessary for the teachers to read at least some of the material to them. In some cases it was necessary for the teachers or instructional aides to read the complete PTP lesson to their student. Teachers may have varied in their enthusiasm for this method, although they reported that their students enjoyed the materials.

2. Eight weeks may have been too short a period of time for educationally handicapped children to understand the concepts taught

in the PTP materials.

3. Only the 15 PTP Basic Lessons were used. Supplementary materials which were planned by the authors of the PTP to extend and strengthen the skills taught in the Basic Lessons were not used.

The results of the combination treatment were not statistically significant except for Figural Fluency. However, it should be noted, that a comparison of the combination and programmed instruction treatment group means favored the combination treatment. This trend may be observed on all of the dependent variables except Figural Elaboration.

The results of the combination treatment may have been affected by the failure of one teacher to follow all of the posttest procedures. The testing procedures were carefully reviewed with her, however, she administered the verbal posttest as a group test rather than individually. Although the TTCT may be given as a group test the effect of this change on the results of the study is not known.

The creative potential of EH children in many cases may have been overlooked. The results of this study seem to support those who contend that creative thinking abilities can be enhanced through training (Parnes and Meadows, 1963; Torrance, 1964; Crutchfield and Covington, 1965; Buchanan and Lindgren, 1973).

It appears that brainstorming has increased the ability of EH children to sense what they cannot find out, and to ask questions which enable them to fill in the gaps in their knowledge. It also seems that the training program has helped them to learn to play with ideas that they might not otherwise express in more structured situations. The data show that brainstorming has helped the children in this study to ask questions, and to produce ideas which are original or statistically

infrequent.

Several authorities (Parnes and Harding, 1962; Torrance, 1965; Lazar, 1972) have suggested that the creative thinking process has been neglected in education, and the neglect of creativity can no longer be justified. Brainstorming is a method unique to the development of creativity, and curriculum planning for EH children must include instruction which stresses the brainstorming concepts. It often is true that educationally handicapped children need more classroom structure than children in the regular classroom. However, educationally handicapped students may learn to express many ideas, and use flexible and original thinking through brainstorming.

The inclusion of brainstorming need not cause changes in the remedial nature of the existing curriculum. The brainstorming lessons may be included in a language development program, and could extend through the school year. This would provide a sequential plan for the development of creative thinking including concepts thought to be essential in the teaching of creativity.

The data in Chapter IV show that EH children can learn to express a variety and quantity of ideas through drawings. Torrance (1966) has suggested that children with learning disabilities have a fear of verbal symbols. A brainstorming curriculum planned to develop creativity in children with expressive language difficulties might begin with the figural creative thinking skills. Thus, children with poor expressive language, would first participate in a curriculum designed to enhance figural creativity, and then would progress to the more difficult verbal creative thinking skills.



## RECOMMENDATIONS

1. This study should be replicated using school psychologists or other examiners trained to administer standardized tests. This would provide a more uniform administration of the Torrance Tests of Creative Thinking, and improve the reliability of the test results.

2. Replications of this study should use the entire verbal battery of the Torrance Tests of Creative Thinking. Each test involves different kinds of thinking and makes a unique contribution to the entire test battery (Torrance, 1966). Such a study would provide greater opportunity to measure the effectiveness of the programmed instruction and the combination treatment.

3. It is recommended that a replication study be designed that will use the Torrance Tests of Creative Thinking and other testing instruments to measure creative thinking. Tests such as those developed at the University of California, Berkeley to test productive thinking (Wardrop, Goodwin et al., 1969) may be appropriate. Additional testing may show the programmed instruction treatment to be significant on variables other than Figural Fluency.

4. Experiments designed to study the creative abilities of primary grade EH children are recommended. Torrance (1962; 1968) hypothesized a drop in creativity between the third and fourth grades. A study of the development of creative thinking in primary and intermediate grade EH children would allow interesting comparisons to be made.

5. Future studies of the creative abilities of EH children should consider the wide range of IQ scores sometimes found in EH classes, and the effects of medication on creative thinking.

6. Future research also should be designed to control the differences in teacher personality. Studies should consider variables such as teacher attitude toward creative thinking, and authoritarian vs. nonauthoritarian personality.

7. In view of the findings of this study, curriculum planning for educationally handicapped classes must include time for the development of verbal creative abilities such as, verbal fluency, verbal flexibility, and verbal originality. The information in this study regarding the creative abilities of figural fluency and figural flexibility, should also be used as it relates to curriculum planning and teaching techniques.

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## Appendix A

## FOREWORD

There is a considerable amount of evidence which seems to show that all children have the potential for creative thinking. However, while there seems to be agreement that all are creative it appears that the creative potential of many children is not being tapped. It may be that the creative abilities of children are increased or decreased depending on whether or not the educational environment values creativity.

Some authorities believe that the creative abilities of children can be improved through training. It is the goal of these brainstorming lessons to provide systematic training in creative thinking, and the lessons have been developed to stimulate the creative thinking abilities of educationally handicapped children. Research studies using brainstorming have been carried out at various grade levels. These studies seem to show the value of brainstorming as a method for developing creative thinking by offering an atmosphere without evaluation, and which allows ideas to be expressed freely.

The brainstorming lessons emphasize certain concepts thought to be essential in the teaching of creative thinking.

These concepts include:

a. Application of the following principles of brainstorming.

Judgment is ruled out. Criticism of ideas is to be withheld.

Free-wheeling is welcomed. The wilder the idea, the better; it is easier to tame down than to think up.

Quantity is wanted. The greater the number of ideas, the more chances there are of good ones.

Combination and improvement are sought. Combining one idea with another often makes for a thought better than either of the original ones.

b. Use of the idea checklist which includes the following questions:

What would happen if we add something?

What would happen if we take something away?

What would happen if we multiply it?

What would happen if we divide it?

What would happen if we make it smaller?

What would happen if we make it bigger?

What would happen if we make it of a different material?

What would happen if we take something away and put something in its place?

c. The use of activities which allow the child to increase his ability to produce a quantity of ideas.

d. Helping children to become more sensitive to problems.

e. Learning the creative problem solving process.

f. Learning to carefully state or define a problem.

g. Allowing a problem to incubate before attempting to solve it.

### Specific Instructions

1. The brainstorming lessons include activities which allow the students to work individually and in groups. There are several lessons which require written answers, and in these lessons it is important to stress to the children that spelling, punctuation, and writing ability are not as important as the expression of their own ideas. When necessary the teachers may help the children with their writing and spelling.

2. In addition to the individual and group activities each lesson concludes with either a period for imagination development or a period of group brainstorming. For the group brainstorming sessions each class should be divided into two groups. The leader and recorder of one group should be the teacher, and the leader and recorder of the other group should be the instructional aide. Each group leader should record in writing the ideas presented by the children during the group brainstorming period. Please keep these group brainstorming ideas in the notebook. Also keep a careful log in this notebook of all lessons listing your suggestions, lesson outcomes and evaluations.

3. The Brainstorming Rules Chart and the Idea Checklist should be displayed during each lesson, even though they may not be a part of that particular lesson.

4. Several lessons mention toys and other objects. If possible these toys and objects should be shown to the class during that activity.

5. Directions for playing the SCAMPER Games for Imagination Development are given on pages 15 to 16 of the SCAMPER book. Pages 8 to 16 are helpful in understanding the SCAMPER Games and the nature of creativity.

6. Although the lessons are written in detail the teacher may vary the instructions and comments as seem necessary for his/her class.

7. It is suggested that the lessons be given at the same time of day on four school days each week. The group brainstorming sessions should not exceed 10 to 15 minutes, and the total lesson should conclude in approximately 30 minutes. The same children should remain in the brainstorming groups for the entire series of lessons. There is no special grouping for the imagination development games.

Please telephone Mr. Sharpe at 2619 if you have any questions concerning this program.

BRAINSTORMING

LESSON PLANS

FIRST WEEK--January 21-25

Lessons 1,2,3,4, pp.1-8

SECOND WEEK--January 28-February 1

Lessons 5,6,7,8, pp.9-17

THIRD WEEK--February 4-8

Lessons 9,10,11,12, pp.18-25

FOURTH WEEK--February 11-15

Lessons 13,14,15,16, pp.26-34

FIFTH WEEK--February 18-21

Lessons 17,18,19,20, pp.35-42

SIXTH WEEK--February 25-March 1

Lessons 21,22,23,24, pp.43-51

SEVENTH WEEK--March 4-8

Lessons 25,26,27,28, pp.52-60

EIGHTH WEEK--March 11-15

Lessons 29,30, pp. 61-64

## Lesson 1

### Objective

To help the children begin to understand how to use their imaginations.

### Materials

Dittoed worksheet number one.

Scamper Games for Imagination Development, page 19.

### Procedure

1. SAY, "How many of you have had a problem which you have been unable to solve?"

Spend a few minutes discussing these problems.  
Discuss several types of problems.

SAY, "You are going to learn a new way to think. It is a method that will help you discover solutions to problems, and it will help you learn to solve problems in a new and better way. This new way to solve problems has a special name. It is called 'brainstorming.'"

SAY, "Many people have had new ideas which have helped us. By learning how to brainstorm you will learn to use your imaginations to find new ideas."

Give the children dittoed worksheet number one.

SAY, "Here is a chance to use your imaginations. Using the lines on the paper complete the drawing in anyway you like."

2. Ask the students what they think keeps them from using their imaginations? Discuss the following points:

A positive attitude. We need to think that we can find new ways to find solutions to our problems. Some people said the steamboat would not work. Others thought only wooden ships would float. Some people said man could never reach the moon.



We forget to ask why. Some people always do what others tell them to do and never try to figure out things for themselves.

Lack of effort. You probably know more about almost anything than you think you know. Many people do not try to use their imaginations.

3. SAY, "We are going to play a game and you will get a chance to use your imaginations."
- 

Present the "Cardboard Box;" Scamper Games for Imagination Development, page 19.

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 2

### Objectives

To discuss the four rules of brainstorming.

To practice group brainstorming.

### Materials

Brainstorming rules chart

### Procedure

1. SAY, "How many of you can recognize and name ten varieties of birds?"

Allow the children to work as a group. Write their answers on the chalkboard.

Most of the children will probably say they cannot name ten varieties of birds. Possible answers are: canary, parakeet, chicken, turkey, owl, pigeon, sparrow, robin, duck, pheasant, crow, eagle.

SAY, "Did you try to use your imagination in thinking of these birds? These are all birds but you did not think of them. Was it because you did not use your imaginations?"

2. Show the rules chart for brainstorming and read each rule. Discuss the meaning of each.

Judgment is ruled out. Criticism of ideas is to be withheld.

"Free-wheeling" is welcomed. The wilder the idea, the better; it is easier to tame down than to think up.

Quantity is wanted. The greater the number of ideas, the better.

Combination and improvement are sought. Combining one idea with another often makes for a thought better than either of the original ones.

3. SAY, "Now we are going to try brainstorming to find some answers to a problem. Here are some rules we need to follow so we will not all be talking at once."

Raise your hand,

Wait your turn.

Your teacher will point to the person who is next.

Divide the class into two groups. One group is to be led by the teacher and one by the instructional aide. The teacher aide should act as the recorder of the ideas for their group.

Ask the children if they have ever wondered what happens to old television sets. Briefly discuss their ideas of what might happen to old T.V. sets.

SAY, "Think of as many ideas as you for unusual uses of old television sets."

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

### Lesson 3

#### Objectives

To practice the principle of deferred judgment.

To practice imagination development.

#### Materials

Brainstorming rules chart

Paper and pencil for each student

Scamper Games for Imagination Development, page 21.

#### Procedure

1. Ask the students to tell what they recall about imagination and brainstorming. Review what keeps us from using our imagination, and the brainstorming rules.
2. Individual brainstorming as well as group brainstorming is important in developing creative thinking abilities. During this lesson individual ideation will be introduced. When children are asked to make lists of ideas they should always be instructed not to be concerned about spelling, but to write their ideas as best they can.

SAY, "I am going to ask you for ideas and I want you to think of all the good ideas you can. Write your ideas on the paper. Do not put down any ideas unless you believe they are good ones."

SAY, "List all of the good uses you can think of for an ordinary brick." Stress good uses.

After the students have had time to list their ideas ask the following questions. Discuss their answers.

Did you have an idea you did not reveal? If yes, why?

Did you worry about what the others would think about your ideas? If so, why?

Were you afraid your ideas would seem silly?  
If so, why?

3. SAY, "Now I am going to ask you for your ideas again. Do not be afraid of what others will think about your ideas. No one will criticize them. I want you to think in a certain way. When I give you the problem, list all of the ideas you can think of without judging whether or not they are good or bad ideas. Forget about how good they are. We will only count the number of ideas. You can add to an idea or change it anyway you want to. No one else will see your paper."

SAY, "List all of the uses you can think of for a mans belt other than wearing it."

Ask the students to compare their lists. Which was longer, the one asking for good ideas or the one asking only for ideas?

Which had the more interesting ideas?

Count the ideas.

Show the brainstorming rules chart. Point out to the students that on the second problem they were deferring judgment.

4. Play the "New Zoo" game, Scamper Games for Imagination Development, page 21.

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 4

### Objectives

To introduce the idea checklist.

To practice group brainstorming.

### Materials

Idea checklist.

Unit 6, Invitations to Thinking and Doing.

One carpenter's hammer.

### Procedure

1. Present to the children the Unit 6 worksheet from Invitations to Thinking and Doing. Answer these questions as a group activity. List the answers on the chalkboard.
2. Display the idea checklist chart. Tell the children that these are questions which will help them think about a problem. Read the questions to the students, but comment is not necessary since there will be activities involving the checklist later. Tell the students to think about these questions during the group brainstorming session which will follow.
3. Group brainstorming. Briefly review the brainstorming rules and remind the children of the checklist of questions. Read these again if it seems necessary. Divide the class into the two brainstorming groups.

Show the children an ordinary carpenter's hammer.

SAY, "Think of as many ways as you can to use a hammer other than for pounding and pulling out nails."

### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on behavior of children.

## Lesson 5

### Objectives

To review the brainstorming rules.

To begin to learn to use the idea checklist.

To practice imagination development.

### Materials

Idea checklist

Toy rubber ball

Scamper Games for Imagination Development, page 27.

### Procedure

1. Review with the students the four rules of brainstorming.  
  
Discuss the brainstorming problem of Lesson four. Did the children apply the brainstorming rules? If there was a tendency to criticize the ideas of other children, or to make fun of their ideas, discuss the rule of deferred judgment again.
2. Display the idea checklist chart. Tell the students that they will work on a problem using these questions.  
  
Explain that these questions are helpful in solving problems, and in helping them to use their imagination.
3. SAY, "Today lets look around our classroom and see how many ways it could be improved. Look at things like the furniture, the windows, the way it was designed etc. Don't worry about how much it would cost, just so it would make our classroom a better place to spend the day."  
  
List the suggestions on the board without comment on "Goodness" or "badness" of the suggestions. Give praise for fluency of ideas.



If the children have difficulty making suggestions, proceed to ask the following questions:

What would happen if we made it larger?

What would happen if we made it smaller?

What could we add?

What would happen if we took something away?

What would happen if we took something away and put something in its place?

What would happen if we multiplied it?

What would happen if we made it out of a different kind of material?

What would happen if we gave it light?

What would happen if we gave it sound?

What would happen if we changed the color?

What would happen if we changed the shape?

What would happen if we made it stronger?

What would happen if we put it to other uses?

Discuss the list developed from this problem. Count the ideas.

4. Play the "Doughnuts" game, Scamper Games for Imagination Development, page 27.

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on behavior of children.

## Lesson 6

### Objectives

To review the principles of brainstorming.

To practice individual and group brainstorming.

### Materials

Unit 18, Invitations to Thinking and Doing.

Brainstorming rules chart.

Pencil and paper for each child.

### Procedure

1. The children will work individually on the next two problems. Each child should have a pencil and paper.

Stress that they should not judge their ideas. The teacher and instructional aide may help the students write their ideas.

SAY, "What would happen if everyone in the world were suddenly to become deaf?"

SAY, "List as many uses as you can for old magazine covers."

Discuss their responses with the children.

2. Present to the students the Unit 18 worksheet from Invitations to Thinking and Doing. These questions may be answered as a group activity or answered individually. The teacher and instructional aide may help the students write their ideas.

3. Group brainstorming. Prior to the presentation of the problem review the brainstorming rules chart.

Divide the class into the two brainstorming groups.

Ask the children to visualize a bicycle and a house.

SAY, "Think of as many ways as you can to use a bicycle in a house."

Comments

Did the lesson go as planned? If not, why not?

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Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 7

### Objectives

To learn to list and to improve the attributes of a particular object.

To practice imagination development.

### Materials

Idea checklist

Scamper Games for Imagination Development, page 21.

### Procedure

1. Attribute listing. Attribute listing is an activity which helps the child focus on a particular question. In this activity, the children are asked to list the attributes of a particular object, and then to think of ways to improve each attribute.

Discuss with the students the meaning of an attribute.

Place a chair in front of the class. Ask the students to name all of the attributes of the chair. List these attributes on the chalkboard.

Ask the children to think of ways each attribute could be improved. List the improvements on the chalkboard next to the attributes.

Suggest that the children might have used the idea checklist to help them think of improvements.

2. SAY, "Here is another problem. List all of the attributes of a wristwatch."

Follow the same procedure as in the previous activity, except this time list the improvements using the idea checklist.

Were there differences in the lists? Was the second list longer? Discuss these differences with the children.

Count the number of ideas in each list.

3. Play the "New Zoo" game, Scamper Games for Imagination Development, page 21.

Comments

Did the lesson go as planned? If not, why not?

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Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 8

### Objectives

To begin to learn to ask problem solving questions.

To practice group brainstorming.

### Materials

Unit 7, Invitations to Thinking and Doing.

One used frisbee.

### Procedure

1. Creative problem solving process. The creative problem solving process involves three kinds of questions.

These are: fact finding, idea finding, and solution finding questions. This lesson will emphasize fact finding questions.

SAY, "One way of solving problems is getting facts about the problem. I am going to read a problem and I want you to listen for the facts given in the problem."

Read the following paragraph:

Jamie was acting very badly on the school bus. He hit another boy with his fists, yelled at the bus driver, and would not sit in his seat. Because of his behavior the bus driver almost had an accident. The bus driver told the school principal and the principal punished Jamie by keeping him in the office at recess. The principal called his parents but this did not help.

Ask the children to tell the facts in this story. List these on the chalkboard.

Ask the children what other facts they would like to know about this problem. Where might they get this information?

SAY, "How can peace be kept on the school bus?"

Write the ideas on the chalkboard stressing deferred judgment. After the children have given their ideas, ask them which they think are the best.

2. Give the students the Unit 7 worksheet from Invitations to Thinking and Doing. Answer these questions as a group activity.

3. Divide the class into the two brainstorming groups.  
Group brainstorming. Show the children a used frisbee.

SAY, "Think of as many ideas as you can for unusual uses of used frisbees."

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.



## Lesson 9

### Objectives

To review the blocks to creative imagination.

To review the principles of brainstorming.

To practice imagination development.

### Materials

Scamper Games for Imagination Development, page 31.

Paper and pencil for each group of two children.

Brainstorming rules chart.

### Procedure

1. Review the blocks to creative imagination. See Lesson one. The areas covered were:

Lack of positive attitude.

Forgetting to ask why.

Lack of effort.

Divide the students into groups of two, allow each pair of students to record their ideas. Be certain the children know what a hula hoop is.

SAY, "Try to use your imagination in solving this problem. Think of as many ideas as you can for unusual uses of a broken hula hoop."

Discuss the lists. Ask the children which they thought were the most imaginative ideas. Ask why they were the best ideas.

2. Discuss the two principles of brainstorming: deferred judgment and quantity of ideas.

Ask the children what deferred judgment means.

Stress producing a quantity of ideas without judgment. This is particularly important because the children may be reluctant to express their ideas due to past failures.

- 
3. Play the "Stuffed Animals" game, Scamper Games for Imagination Development, page 31.

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 10

## Objectives

To review and practice the group brainstorming rules.

To practice group brainstorming.

## Materials

Paper and crayons for each pair of children  
Invitations to Thinking and Doing, Unit 25

## Procedure

1. Squiggle Stories. Group the children into pairs. Each pair should have a piece of drawing paper and several crayons of various colors.

Instruct one child in each group to draw three random lines anywhere on the paper. The paper is then exchanged and the one who receives the "squiggle" draws three lines incorporating the lines into the picture. This is continued until a complete picture is drawn.

Explain that they are to produce either a picture or a design.

Ask each pair of children to tell about their drawing.

2. Present to the students the Unit 25, page 97, worksheet from Invitations to Thinking and Doing. These questions may be answered as a group activity or answered individually. The teacher and instructional aide may help the students write their ideas.

3. Group brainstorming. Review the group brainstorming rules. If children have been having difficulty in a particular area, spend a few minutes extra reviewing that rule.

Divide the children into the two brainstorming groups.

Ask the children if they have seen junk automobiles.

SAY, "Think of as many ideas as you can for unusual uses of junk automobiles."

## Comments

Did the lesson go as planned? if not, why not?

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Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 11

### Objectives

To learn to use specific questions to develop problem sensitivity.

To practice attribute listing.

To practice imagination development.

### Materials

Paper and pencil for each student.

A book.

Scamper Games for Imagination Development, page 27.

### Procedure

1. Sensitivity to problems. In order for children to be able to solve a problem they must be aware that the problem exists. Often pupils take for granted what they see and the way things are in their daily living. Questions such as, what would happen if. . . and, what would it be like if . . . help in developing sensitivity to problems (Wilson, 1958).

The answer to the following problem is to be written by each student. They may be helped as necessary by the teacher or instructional aide.

SAY, "Think of as many ideas as you can to answer the question, 'What would happen if everyone always told the truth about everything?'"

Ask each child to pick his best answer. Discuss the responses.

2. Attribute listing. Show the class a book. Explain that they will be listing the attributes of the book.

Review the meaning of an attribute.

On the chalkboard list the attributes of a book mentioned by the students.

Ask the students how these attributes might be improved to make the book better. List the improvements given on the chalkboard.

Apply the idea checklist to improve the attributes.

3. Play the "Doughnuts" game, Scamper Games for Imagination Development, page 27.

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 12

### Objectives

To develop the principles of magnification and minification.

To practice group brainstorming.

### Materials

Unit 20, Invitations to Thinking and Doing.

### Procedure

1. Draw on the chalkboard a set of squares in the following order:

a 4 x 4 square

a 6 x 6 square

a 2 x 2 square

Discuss with the students how this can be done with other figures. Be certain the children understand that it is still a square even though it has been made larger or smaller.

Ask the children to think of as many illustrations of the same principle as they can where the shape remains the same but the size changes.

Ask the children to write their ideas. Discuss the responses.

2. Give the students the Unit 20 worksheet from Invitations to Thinking and Doing. This activity may be completed as a group activity.

Write the students answers on the chalkboard.

3. Group brainstorming. Divide the children into the two brainstorming groups.

SAY, "Suppose you had the power to do anything you wanted to do. Think of as many ideas as you can which would make your school a more interesting place."

#### Comments

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Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.



## Lesson 13

### Objectives

To practice producing a quantity of ideas.

To develop principles involved in effecting change by adding something.

To practice imagination development.

### Materials

Pencil and paper for each group of two children.

Dittoed worksheet with six inch square drawn on it.

Scamper Games for Imagination Development, page 35.

### Procedure

1. The first exercise will be carried out in teams of two. Stress that in this activity you want to see how many ideas can be produced in a certain time limit. No judgment is to be made of the ideas, only the number of ideas will be counted.

The children will need a pencil and paper. Appoint one child in each team to be the recorder.

SAY, "Write on your paper the names of as many things as you can think of that are square in shape." (five minutes)

Ask the children if they were able to think of ideas without judging them. Ask if they tried to think of ideas as quickly as they could.

SAY, "Suppose that you couldn't go outside to play, what could you do to entertain yourself in the house? As fast as you think of ideas, write them down on your paper." (five minutes)

Discuss the ideas, and have each team count their ideas.

2. Display the idea checklist chart and review the questions on it.
  - a. Draw a large square on the chalkboard. Ask a child to come up and add something to the square.
  - b. Erase and ask a second child to add something else.
  - c. Ask another child to come to the chalkboard and ~~attach something outside the square.~~
  - d. Erase what has been previously drawn on the square and draw a circle on each corner.
  - e. Explain that in each case something was added to the square.
  - f. Give each student a dittoed sheet with a six inch square drawn on it.

SAY, "Add as many things as you want. Try to add things no one else will think of." (five minutes)

3. Play the "Sticks" game, Scamper Games for Imagination Development, page 35.

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 14

## Objectives

To analyze a problem using the creative problem solving process.

To practice group brainstorming.

## Materials

Unit 24, Invitations to Thinking and Doing.

## Procedure

1. Creative problem solving process. As presented in Lesson 8, there are three kinds of questions which are asked in creative problem solving. These are: fact finding questions to help define the problem, idea finding questions listing all possible ideas which could lead to a solution, and solution finding questions to help decide on and implement the best solutions. This lesson will emphasize all three types of questions.

SAY, "We are going to try to solve a problem." Read the following paragraph:

Julie went to a Giants baseball game with her friend Sara and her family. Before they went into the ballpark Sara's father told them they must tell him where they were going if they left their seats. Both girls said that they understood. In the middle of the seventh inning Julie quickly left her seat and ran up the aisle. She did not come back until the end of the eighth inning. Sara's father was very angry. Julie would not say where she went. What do you suppose happened?

SAY, "What other facts would you like to know about this problem?"

List these facts on the chalkboard.

SAY, "What ideas can you think of that would help to solve this problem?"

List these ideas on the chalkboard.

SAY, "What is the best solution for this problem?"

Write the solution on the chalkboard. Discuss why it is the best solution.

2. Present the Unit 24, page 93, worksheet from Invitations to Thinking and Doing. The teacher should read the problems on this worksheet to the class. Answers should be given orally.
3. Group brainstorming. Divide the class into the two brainstorming groups.

SAY, "Just suppose you couldn't sing. Think of as many ideas as you can that would tell what might happen if it were against the law to sing."

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 15

### Objectives

- To introduce the forced relationships technique.
- To produce new ideas through attribute listing.
- To practice imagination development.

### Materials

Book

Newspaper

Ruler

Scamper Games for Imagination Development, page 39.

### Procedure

1. Forced relationships. The technique of forced relationships has been developed to help produce original ideas. The technique relies upon a "forced relationship" between two unrelated objects or ideas. This technique also helps the student to think imaginatively and to break away from old patterns of thinking.

Explain to the children that they are going to use their imaginations in thinking about two problems.

Stress deferred judgment.

SAY, "How are a book and a newspaper alike?" Write their answers to the problem on the chalkboard.

After a number of responses have been given, present the second part of the problem.

SAY, "How could a book be improved by making it more like a newspaper?"

Write these ideas on the chalkboard also. Discuss the relationship of a book to a newspaper. Ask the children to select the best ideas, and circle these ideas.

SAY, "In what ways are a desk and a chair alike?"

Proceed as in the previous problem.

SAY, "How could a desk and a chair be improved by combining them?"

Proceed as in the previous problem.

2. Attribute listing. Review attribute listing with the children. Determine if the children understand the meaning of an attribute.

In this activity an object will be shown the children, and they will be asked to list the attributes of the object. The students will then be asked to think of ways each attribute can be improved.

Show the children a ruler.

SAY, "List all of the attributes of a ruler."

List these ideas on the chalkboard.

SAY, "In what ways can the ruler be improved?"

List these ideas on the chalkboard. Ask the children to choose the best two suggestions for improving the ruler.

3. Play the "Alphabet Cake" game, Scamper Games for Imagination Development, page 39.

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 16

### Objectives

To produce new ideas through attribute listing.

To practice group brainstorming.

### Materials

Unit 4, Invitations to Thinking and Doing.

A small sponge.

### Procedure

1. Attribute listing. Review attribute listing with the children. This is a continuation of the activity in Lesson 15.

In this lesson, an object will be shown the children and they will be asked to list the attributes of the object. They then will be asked to think of ways each attribute can be improved.

Show the children a small sponge.

SAY, "List all of the attributes of a sponge."

List these ideas on the chalkboard

SAY, "What ways can this sponge be improved?"

List these ideas on the chalkboard. Ask the children to choose the best two suggestions for improving the sponge.

2. Present the Unit 4, page 13, worksheet from Invitations to Thinking and Doing. Read the instructions to the students, and allow them to answer orally.
3. Divide the class into the two brainstorming groups.  
Group brainstorming. Review the rules of brainstorming. Stress the rules which have been difficult for the children to use or understand.



Give particular emphasis to Rule 4, "Building on the ideas of others to make better ideas."

SAY, "Suppose that water animals could live on land and land animals in water. Think of what might happen if water animals could live on land and land animals could live in the water."

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 17

## Objectives

To practice producing ideas using the principles of subtraction.

To practice imagination development.

## Materials

Pencil and paper for each child.

Scamper Games for Imagination Development, page 31.

## Procedure

1. SAY, "Today we are going to see how things may be changed by taking something away."

Draw a 12 inch square on the board. From the center of the square, draw lines to each bottom corner and erase the bottom line.

SAY, "See, I have taken something away, and the first shape now looks different because I have done this. You can change the looks of anything by taking something away, but let's think of ideas where taking something away from a car might even make it better. For instance, this was before your time, but there are a few of these cars still around that have running boards on the sides by the doors for you to step on before getting into the car. You could even stand on them if you wanted to. Well, the new designs do not have running boards on the sides-- they have been taken away."

SAY, "Can you think of other ideas where taking something away from a car might make it better?"

If it is difficult for the children to think of ideas ask the following questions:

How about the size? (Smaller--compact cars)  
How about the height from the ground? (lower)  
How about the width? (narrower)  
What are some things that could be left off?  
How about speed? (slower, save gas)

Ask the children if they can think of other things that might be made better by taking something away from them (i.e., furniture, household appliances, clothing, etc.).

2. The following activity is designed to help the children produce a quantity of ideas in a short period of time. The children are to work individually.

SAY, "I am going to give you some special instructions. ~~Listen carefully for you will have only a short time to complete each exercise.~~"

Each child should have a pencil and paper to record his ideas.

SAY, "Write on your paper all of the uses you can think of for:

A drinking glass (five minutes)

An old tire (five minutes)

3. Play the "Stuffed Animals" game, Scamper Games for Imagination Development, page 31.

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 18

### Objectives

To practice producing a quantity of ideas.

To practice group brainstorming.

### Materials

Unit 17, Invitations to Thinking and Doing.

Pencil and paper for each child.

### Procedure

1. The following activity is a continuation of Activity 2, Lesson 17. It is designed to help the children produce a quantity of ideas in a short period of time. The children are to work individually.

SAY, "I am going to give you some special instructions. Listen carefully for you will have only a short time to complete each exercise."

Each child should have a pencil and paper to record his ideas.

SAY, "Write on your paper all of the uses you can think of for:

A brick (five minutes)

An old pair of eye glasses (five minutes)

Discuss the answers.

2. Present the Unit 17, page 65, worksheet from Invitations to Thinking and Doing. Read the instructions to the students, and allow them to answer orally. Write the titles on the chalkboard.

3. Group brainstorming. Divide the children into the two brainstorming groups.

SAY, "Suppose that your eight-year old friend has started to smoke. Think of as many ideas as you can to help your friend stop smoking."

4. An important part of creative thinking is to be able to think about a problem and let the problem incubate before trying to find a solution. It has been found that by being able to think about a problem before trying to solve it better ideas are often produced.

Explain to the children that in the following lessons you will give them a problem to think about, and that it will be in a later brainstorming session.

SAY, "Here is a problem which I would like you to think about. Suppose your six-year old sister has temper tantrums (make sure the children understand what is meant by a tantrum). One day your mother left you in charge of your sister until she returned. While you were playing she did not get her way and she started to have a temper tantrum. What would you do? Think of as many ideas as you can."

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 19

### Objectives

To begin to develop sensitivity to problems.

To practice imagination development.

### Materials

Pencil and paper for each child.

Scamper Games for Imagination Development, page 41.

### Procedure

1. Redefining problems. Key questions to ask the children when they are trying to define a problem are:

What do I really want to find out?

What words could be changed to help to better understand the problem?

Ask your class to help you list problems which have been of concern to them during the past week. Put the list on the chalkboard.

Choose the two or three problems that the children feel are the most important.

Using the two questions listed above, ask the children to help you restate the problems.

If the children have shown considerable interest in any one of these problems, practice brainstorming solutions to the problems.

2. Problem sensitivity. The following exercises are developed to help the children become aware of problems and to help them to not take for granted the way things are in their daily living.

Allow the children to work by themselves on the following problems. Each student should have a pencil and paper.

Stress deferred judgment and quantity of ideas.

SAY, "Think of as many ideas as you can to answer the question, 'What would happen if pills were developed which would substitute for food?'" (five minutes)

SAY, "Think of as many ideas as you can to answer the question, 'What would happen if the ocean dried up?'" (five minutes)

~~Discuss the answers of these problems with the children.~~

3. Play the "Crazy" game, Scamper Games for Imagination Development, page 41.

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 20

### Objectives

To practice producing ideas through the forced relationships technique.

To practice group brainstorming.

### Materials

Knife

Fork

Unit 16, Invitations to Thinking and Doing.

### Procedures

1. Forced relationships. The technique of forced relationships was introduced in Lesson 15. You may recall that the technique relies upon a forced relationship between two unrelated objects or ideas. It is used to help children think more imaginatively.

Stress building on the ideas of other children, and deferring judgment of ideas.

SAY, "In what ways are a knife and a fork alike?"

List the answers on the chalkboard.

SAY, "How could a knife and a fork be improved by combining them?"

List the answers on the chalkboard.

Ask the children to select the best idea or ideas from the lists of combinations.

Discuss why they thought they were the best ideas.

2. Present the Unit 16, page 61, worksheet from Invitations to Thinking and Doing. Write the items on the chalkboard, i.e., magnet, can opener, etc.

Read the instructions to the students and allow them to answer orally.



3. Divide the children into the two brainstorming groups.

Group brainstorming. Review the brainstorming rules. The group brainstorming problem is the one given in Lesson 18.

SAY, "Suppose your six-year old sister has temper tantrums. One day your mother left you in charge of your sister until she returned. While you were playing she did not get her way and she started to have a temper tantrum. What would you do? Think of as many ideas as you can."

4. Incubation

SAY, "I am going to give you a problem which I would like you to think about. It will be the next brainstorming problem. Sometimes all of us have trouble getting along with other boys and girls and sometimes we think that they do not like us. Think of as many ways as you can which will help other boys and girls like you better."

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 21

### Objectives

To review the steps in creative problem solving.

To give further practice in attribute listing.

To practice imagination development.

### Materials

Pencil

Coffee cup

Scamper Games for Imagination Development, page 45.

### Procedure

1. Creative problem solving process. This exercise will review the three types of questions necessary in creative problem solving. These are:

Fact finding questions which help to define the problem.

Idea finding questions to help find all possible leads to a solution.

Solution finding questions to help decide on the best solution.

Tell the students that they will try to solve a problem by asking certain kinds of questions.

SAY, "I am going to read you a short story and I want you to listen carefully because we will be trying to solve a problem."

Jack was having trouble at school and he thought some of the boys did not like him. Coming into the room from recess a boy started to argue with him. Jack became angry and pushed him, and they started to fight. A teacher came and tried to stop them but Jack was so angry that he would not stop. The teacher took both boys to the principal's office. Because the other boy said that Jack had started the fight, Jack had to stay in the office.

SAY, "What other facts would you like to know about this problem?"

List these facts on the chalkboard.

SAY, "What ideas can you think of that would help to solve this problem?"

List these ideas on the chalkboard.

SAY, "What is the best solution for this problem?"

Write the solution on the chalkboard. Discuss why it is the best solution.

2. Attribute listing. This lesson will help the students focus on a particular problem by listing the attributes of an object and suggesting possible improvements. Use the idea checklist to improve the attributes.

Hold up a pencil so that all of the children can see it.

SAY, "List all of the attributes of this pencil."

List these ideas on the chalkboard.

SAY, "What ways can this pencil be improved?"

List these ideas on the chalkboard. Ask the children to choose the best two suggestions for improving the pencil.

Hold up a coffee cup so that all of the children can see it.

Proceed as in the previous problem.

3. Play the "Light Bulb" game, Scamper Games for Imagination Development, page 45.

## Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 22

### Objectives

- To practice producing ideas using the idea checklist.
- To develop the principle of substitution.
- To practice group brainstorming.

### Materials

Idea checklist.

Unit 9, Invitations to Thinking and Doing.

### Procedure

1. Review the idea checklist chart. Point out that objects can be changed by using the questions on the chart.  
  
SAY, "Let's see what happens when we use the idea of substitution. Substituting means using something to take the place of something else. For example, when I am sick and cannot be here they send a substitute teacher."  
  
SAY, "I want you to think of as many things as you can that can be substituted for something else. See if you can make it better by substituting something for it."  
  
List the ideas on the chalkboard. (Some suggested ideas are: Nylon and dacron for silk; plastic for china, glass, and leather; frozen vegetables for garden fresh vegetables.)
2. Present Unit 9 worksheet from Invitations to Thinking and Doing. Read the instructions to the students, and allow them to answer orally. Write the answers on the chalkboard.

3. Group brainstorming. Divide the class into the two brainstorming groups.

SAY, "Remember, I gave you a problem to think about before we tried to solve it? Here is the problem. Think of as many ways as you can which will help other boys and girls like you better."

4. Incubation.

SAY, "Here is another problem which I want you to think about until the next time we have a brainstorming lesson. Think of all the things you can do when you feel that adults are too strict with you."

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 23

### Objectives

To develop problem sensitivity.

To practice redefinition of problems.

To practice imagination development.

### Materials

Paper and pencil for each child.

Scamper Games for Imagination Development, page 37.

### Procedure

1. Problem sensitivity. This is a review of a previous Lesson 19, which dealt with developing sensitivity to problems. The following exercises will help the children become aware of problems that might exist.

This is an exercise in individual ideation. Allow the children to work by themselves. Answers should be written without regard to spelling or writing ability. Stress the use of deferred judgment and quantity of ideas.

Each child should have a pencil and a sheet of paper.

SAY, "Write as many ideas as you can think of to answer the question, 'What would happen if everyone had only three fingers.'"

SAY, "Write as many ideas as you can think of to answer the question, 'What would happen if we had to live underground because of air pollution?'"

2. Redefinition of problems. The following activities are developed to help students solve a problem by improvising with the materials at hand.

Present the problem to the class. List the solutions on the chalkboard.

SAY, "The top of a salt shaker is stuck and you are not able to twist it off with your hand. You don't want to damage it by banging on it with a knife. Think of all the ways you can that you might use to get the top off."

Discuss the answers.

3. Play the "Alphabet Cake" game, Scamper Games for Imagination Development, page 39.
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#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.



## Lesson 24

## Objectives

To practice producing original ideas through forced relationships.

To practice group brainstorming.

## Materials

Wastebasket

Bottle

Paper and crayons for each pair of children.

## Procedure

1. Forced relationships. This is a continuation of the technique of forced relationships introduced in earlier Lessons 15, 20. The technique requires the students to think of a relationship between two unrelated objects or ideas. It is used to help children to think more imaginatively.

Stress building on the ideas of other children, and deferring judgment of ideas.

SAY, "In what ways are a wastebasket and a bottle alike?"

List the answers on the chalkboard.

SAY, "How could a wastebasket and a bottle be improved by combining them?"

List the ideas on the chalkboard.

Ask the children to select the best idea or ideas from the list of combinations.

2. Squiggle stories. Group the children into pairs. Each pair should have a piece of drawing paper and several crayons of various colors.

Instruct one child in each group to draw three random lines anywhere on the paper. The paper is then exchanged and the one who receives the "squiggle" draws three lines incorporating the lines into the picture. This is continued until a complete picture is drawn.

Explain to the children that they are to produce either a picture or a design.

Ask each pair of children to tell about their drawing.

3. Group brainstorming. Divide the class into the two brainstorming groups.

SAY, "Remember, I gave you a problem to think about before we tried to solve it? Here is the problem. Think of all the things you can do when you feel that adults are too strict with you."

4. Incubation.

SAY, "Here is another problem to think about until next time. Think of all the things you can do when you feel afraid to go to school."

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 25

### Objectives

- To practice restating a problem in broader terms.
- To practice attribute listing.
- To practice imagination development.

### Materials

A transistor radio.

Scamper Games for Imagination Development, page 49.

### Procedure

1. Redefining problems. Problems sometimes are not stated in broad enough terms, and it may be necessary to restate a problem in broader terms before a solution to the problem is found.

As stated in Lesson 19, key questions to ask the children when they are trying to define a problem are:

What do I want to find out?

What words could be changed to help to better understand the problem?

This exercise is designed to help the children decide on a problem and restate it in broader terms.

SAY, "We are going to make a list of problems. Let's make a list of as many problems as we can that face special class children at school."

Put the list on the chalkboard.

Choose the problem that the children feel is most pressing.

Have the children restate the problem using the key questions listed above.

Discuss the problem and see if the children can come to a solution.

2. Attribute listing. This will not be a new exercise for the students. Encourage them to express their ideas as quickly as possible.

SAY, "Think of all the attributes of a transistor radio."

List the attributes on the chalkboard.

SAY, "In what ways can a transistor radio be improved?"

Encourage the children to use the idea checklist to think of improvements.

List these ideas on the chalkboard. Ask the children to choose the best suggestions for improving a transistor radio.

3. Play the "What in the World Did You Find" game, Scamper Games for Imagination Development, page 49.

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 26

### Objectives

To practice solving a problem using the creative problem solving process.

To practice group brainstorming.

### Materials

Unit 12, Invitations to Thinking and Doing.

### Procedure

1. Creative problem solving process. This exercise will review the creative problem solving process using the three types of questions helpful in creative problem solving. These are;

Fact finding questions which help to define the problem.

Idea finding questions to help find all possible leads to a solution.

Solution finding questions to help decide on the best solution.

Tell the students that they will try to solve a problem by asking certain kinds of questions.

SAY, "I am going to read you a short story and I want you to listen carefully because we will be trying to solve a problem."

SAY, "Emile was visiting her aunt after school one day when she discovered her 10-year old nephew smoking in the garage. She talked to him but he would not stop smoking. Emile decided that she should tell her aunt. However, her aunt did not believe her and she yelled at Emile for lying. Emile felt badly. She wondered why her aunt didn't believe her."

SAY, "What facts would you like to know about this problem?"

List these facts on the chalkboard.

SAY, "What ideas can you think of that would help to solve this problem?"

List these ideas on the chalkboard.

SAY, "What is the best solution for this problem?"

Write the solution on the chalkboard. Discuss why it is the best solution.

2. Present the Unit 12, page 45, worksheet from Invitations to Thinking and Doing. Read the instructions to the students, and allow them to answer orally. Discuss their answers with them.
3. Group brainstorming. Divide the class into the two brainstorming groups.

SAY, "Remember the problem I gave you to think about? Here is the problem. Think of all the things you can do when you feel afraid to go to school."

4. Incubation.

SAY, "Here is another problem to think about until our next brainstorming lesson. What can you do when you feel that someone at home does not like you?"

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 27

### Objectives

To produce a quantity of original ideas useful in solving a problem.

To review and practice using the idea checklist to improve a product.

To practice imagination development.

### Materials

Idea checklist.

Scamper Games for Imagination Development, page 55.

### Procedure

1. The purpose of the following exercise is to produce a large quantity of ideas in a short period of time.  
  
Encourage deferrment of judgment and a quantity of ideas.  
  
The exercises are to be oral, and the ideas should be written on the chalkboard. The time limit for each exercise is five minutes. Discuss the best ideas for each exercise.  
  
SAY, "In how many ways can water be made to work for you?" (five minutes)  
  
SAY, "Give all of the uses you can think of for a brick." (five minutes)  
  
SAY, "If you were in an extremely cold place what things might you want that would make you comfortable?" (five minutes)
2. Play the "Repmacs" game, Scamper Games for Imagination Development, page 55.



### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 28

### Objectives

To review the use of the idea checklist.

To practice group brainstorming.

### Materials

Unit 10, Invitations to Thinking and Doing.

The idea checklist.

Mechanical can opener.

### Procedure

1. Present the Unit 10, page 37, worksheet from Invitations to Thinking and Doing. Read the instructions to the students, and allow them to answer orally. Discuss their answers with them.
2. Idea checklist. Review the entire list of questions with the students.

Discuss how the checklist may be used in solving problems.

Show the children a mechanical can opener.

SAY, "What ways can you think of that this can opener can be combined with something else so that it would be more useful or sell better?"

Examples: combine it with parts that might have other uses; display it with related items; a gift with a purchase.

3. Group brainstorming. Divide the class into the two brainstorming groups.

SAY, "Remember the problem I gave you to think about? Here is the problem. Think of all the things you can do when you feel that someone at home does not like you."

4. Incubation.

SAY, "Here is another problem to think about until our next brainstorming lesson. Think of all the ways you can help someone to stop when they feel like fighting and arguing."

Comments

~~Did the lesson go as planned? If not, why not?~~

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 29

### Objectives

To practice redefinition of problems.

To practice group brainstorming.

### Materials

Unit 11, Invitations to Thinking and Doing.

### Procedure

1. Redefinition of problems. It is sometimes necessary to solve a problem by improvising with the materials at hand.

The following problem is to be solved by the whole class.

List the solutions given by the students on the chalkboard.

SAY, "Think of as many solutions as you can for the following problem."

You are going on a hiking trip in the Sierras and you find a nice spot on the river to stop for lunch. There are many large rocks on the river bank; there are small trees and a sandy beach for swimming. You are hungry and decide to eat but find that you have forgotten the frying pan to cook the steak and potatoes. You have nothing else to cook with except forks, knives, and paper plates. You do have matches and enough wood to make a fire. How will you cook the steak and potatoes?

Discuss the possible solutions to the problem, and list these on the chalkboard.

Ask the students to decide on the best solution.

2. Present to the children the Unit 11, page 41, worksheet from Invitations to Thinking and Doing. Read the instructions to the students, and allow them to answer orally. Write their answers on the chalkboard.
3. Group brainstorming. Divide the class into the two brainstorming groups.

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SAY, "Remember the problem I gave you to think about? Here is the problem. Think of all the ways you can help someone when they feel like fighting and arguing."

#### Comments

Did the lesson go as planned? If not, why not?

Were the objectives achieved?

Comment on the behavior of the children.

## Lesson 30

### Objectives

To review the reasons for using our imaginations.

To practice imagination development.

### Materials

Idea checklist.

Scamper Games for Imagination Development, page 45.

### Procedure

1. Review brainstorming. Ask the children why it is important to learn to use their imaginations.

Discuss the reasons some people don't use their imaginations (see Lesson 1).

2. Display the idea checklist.

SAY, "One of the ways to change something is to make it larger. Can you think of other ways to change something?"

List them on the chalkboard. Refer to the idea checklist.

3. SAY, "Why is it important for people to have ideas that are different from the usual kind of ideas?"

List and discuss the reasons.

4. Play the "Light Bulb" game, Scamper Games for Imagination Development, page 45.

### Comments

Did the lesson go as planned? If not, why not?

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Were the objectives achieved?

Comment on the behavior of the children.

## Appendix B



## PRODUCTIVE THINKING PROGRAM

Because of the severe nature of the reading and writing problems of educationally handicapped children it will be necessary to assist the children with the reading of the Productive Thinking Program Basic Lessons. It is suggested that the children work together on the Basic Lessons on a page by page basis with the teacher setting the pace. The students should write down their ideas in their reply booklets when applicable.

As suggested in the Teacher's Guide (p. 4) each student needs to keep a Reply Notebook for writing his responses to the questions posed in the Basic Lessons. This can be an ordinary spiral notebook, or any kind of a folder or binder in which the student can keep his replies. The Basic Lesson booklets are non-consumable and should not be marked in.

Each student is allowed to write his own ideas in his Reply Notebook. The children should be instructed to express their ideas as best they can. It is important to stress to the children that spelling, punctuation, and writing ability are not as important as the expression of their own ideas. When necessary the teacher may help the children with their writing and spelling.

Each Basic Lesson has been divided into two sessions, and two Basic Lessons are to be covered each week for eight weeks. The Problem Sets included in the lesson booklets are not to be included in this study, and they should not be included in the instruction. The discussion questions in the Teacher's Guide are suggested so that the

teacher may incorporate them into the classroom discussions. Student Reply Notebooks should be reviewed periodically by the teacher.

The lessons should be given at the same time of day on four school days each week. Please telephone Mr. Sharpe at 2619 if you have any questions concerning this program.

## PRODUCTIVE THINKING PROGRAM

### LESSON PLANS

#### FIRST WEEK--January 21-25

##### BASIC LESSON 1: THE CANNONS OF ELMTOWN

Session 1, pp. 7-20; Teacher's Guide, question 1, p. 14.  
Session 2, pp. 21-39; Teacher's Guide, questions 2,3,  
4, pp. 14-15.

##### BASIC LESSON 2; THE RIVERBOAT ROBBERY

Session 3, pp. 3-22; Teacher's Guide, questions 2,  
4, p. 18.  
Session 4, pp. 24-47; Teacher's Guide, questions 1,3,  
p. 18.

#### SECOND WEEK--January 28-February 1

##### BASIC LESSON 3: THE SEARCH FOR MR. SEARCH

Session 5, pp. 3-23; Teacher's Guide, questions 1,2,  
p. 22.  
Session 6, pp. 24-39; Teacher's Guide, questions 3,4,  
p. 22.

##### BASIC LESSON 4: THE DISCOVERY OF MR. SEARCH

Session 7, pp. 3-22; Teacher's Guide, questions 2,  
4, p. 26.  
Session 8, pp. 23-39; Teacher's Guide, questions 1,  
3, p. 26.

#### THIRD WEEK--February 4-8

##### BASIC LESSON 5: A DISAPPEARANCE IN THE DESERT

Session 9, pp. 3-22; Teacher's Guide, questions 3,  
4, p. 31.  
Session 10, pp. 23-47; Teacher's Guide, questions 1,  
2, pp. 30-31.

##### BASIC LESSON 6: CATCHING FISH WHILE CLIMBING TREES

Session 11, pp. 3-27; Teacher's Guide, question 1, p.35.  
Session 12, pp. 28-47; Teacher's Guide, questions  
2,3, p.35.

FOURTH WEEK--February 11-15

BASIC LESSON 7: THE RIDDLE OF THE RARE COINS

Session 13, pp. 3-24; Teacher's Guide, questions 1, 2, p. 39.

Session 14, pp. 25-47; Teacher's Guide, questions 3, 4, p. 40.

BASIC LESSON 8: LILA FINDS THE PRIZE PACKAGE

Session 15, pp. 3-23; Teacher's Guide, questions 1, 2, pp. 43-44.

Session 16, pp. 24-47; Teacher's Guide, questions 3, 4, p. 44.

FIFTH WEEK--February 18-22

BASIC LESSON 9: JIM EXPLORES THE DESERTED HOUSE

Session 17, pp. 3-30; Teacher's Guide, question 1, pp. 47-48.

Session 18, pp. 31-55; Teacher's Guide, questions 2, 3, pp. 48-49.

BASIC LESSON 10: A QUESTION OF MAGIC

Session 19, pp. 3-26; Teacher's Guide, question 3, pp. 53-54.

Session 20, pp. 27-47; Teacher's Guide, questions 1, 2, p. 53.

SIXTH WEEK--February 25-March 1

BASIC LESSON 11: THE TRICKSTER UNMASKED

Session 21, pp. 3-25; Teacher's Guide, question 2, p. 57.

Session 22, pp. 26-47; Teacher's Guide, questions 1, 3, pp. 57-58.

BASIC LESSON 12: THE DREAM DETECTIVES

Session 23, pp. 3-27; Teacher's Guide, question 3, p. 62.

Session 24, pp. 28-47; Teacher's Guide, questions 1, 2, p. 61.

SEVENTH WEEK--March 4-8

BASIC LESSON 13: THE PUZZLE OF THE DEEP-SEA DIVE

Session 25, pp. 3-23; Teacher's Guide, questions 1, 2, pp. 66-67.

Session 26, pp. 24-47; Teacher's Guide, question 3, p. 67.

BASIC LESSON 14: THE RETURN TO THE DESERTED HOUSE

Session 27, pp. 3-23; Teacher's Guide, questions 1, 2, p. 72.

Session 28, pp. 24-47; Teacher's Guide, questions 3,4, pp. 72-73.

EIGHTH WEEK--March 11-15

BASIC LESSON 15: JIM AND LILA CRACK THE SECRET CODE

Session 29, pp. 3-24; Teacher's Guide, question 1, pp. 77-78.

Session 30, pp. 25-47; Teacher's Guide, questions 2,3, p. 78.

## Appendix C

COMBINATION PROGRAM  
PROGRAMMED INSTRUCTION AND BRAINSTORMING

This instructional program combines instruction in programmed instruction and brainstorming. The lessons are to be given four days a week. Each week two brainstorming lessons and two sessions from a Basic Lesson in the Productive Thinking Program (PTP) will be given to the class. The schedule of lessons will follow on another page. The Problem Sets which are included in the (PTP) lesson booklets are not to be included in the classroom instruction.

Specific Instructions for the Productive Thinking Program

1. It is suggested that the children work together on the Basic Lessons on a page by page basis with the teacher setting the pace. The students should write their ideas in their Reply Notebooks when applicable. It is important to stress to the children that spelling, punctuation, and writing ability are not as important as the expression of their own ideas. When necessary the teacher may help the children with their writing and spelling. Student Reply Notebooks should be reviewed periodically by the teacher.

2. As suggested in the Teacher's Guide (p.4) the student Reply Notebook can be an ordinary spiral notebook, or any kind of a folder or binder in which the student can keep his replies. The Basic Lesson booklets are non-consumable and should not be marked in.

3. Each Basic Lesson has been divided into two sessions. Two Basic Lessons, or four sessions, are to be covered each week for eight weeks.

4. The discussion questions in the Teacher's Guide are suggested so that the teacher may incorporate them into the classroom discussions.

Specific Instructions for Brainstorming

1. The brainstorming lessons include activities which

allow the students to work individually and in groups. There are several lessons which require written answers, and in these lessons it is important to stress to the children that spelling, punctuation, and writing ability are not as important as the expression of their own ideas. When necessary the teachers may help the children with their writing and spelling.

2. In addition to the individual and group activities each lesson concludes with either a period for imagination development or a period of group brainstorming. For the group brainstorming sessions each class should be divided into two groups. The leader and recorder of one group should be the teacher, and the leader and recorder of the other group should be the instructional aide. Each group leader should record in writing the ideas presented by the children during the group brainstorming period. Please keep these group brainstorming ideas in the notebook. Also keep a careful log in this notebook of all lessons listing your suggestions, lesson outcomes and evaluations.

3. The Brainstorming Rules Chart and the Idea Checklist should be displayed during each lesson, even though they may not be a part of that particular lesson.

4. Several lessons mention toys and other objects. If possible these toys and objects should be shown to the class during that activity.

5. Directions for playing the SCAMPER Games for Imagination Development are given on pages 15 to 16 of the SCAMPER book. Pages 8 to 16 are helpful in understanding the SCAMPER Games and the nature of creativity.

6. Although the lessons are written in detail the teacher may vary the instructions and comments as seem necessary for his/her class.

7. It is suggested that the lessons be given at the same time of day on four school days each week. The group brainstorming sessions should not exceed 10 to 15 minutes, and the total lesson should conclude in approximately 30 minutes. The same children should remain in the brainstorming groups for the entire series of lessons. There is no special grouping for the imagination development games.

Please telephone Mr. Sharpe at 2619 if you have any questions concerning this program.



COMBINATION PROGRAM  
PROGRAMMED INSTRUCTION AND BRAINSTORMING  
LESSON PLANS

FIRST WEEK--January 21-25

BRAINSTORMING

Lesson 1, pp.1-2  
Lesson 3, pp.5-6

PROGRAMMED INSTRUCTION

Basic Lesson 1: The Cannons of Elmtown  
Session 1, pp.7-20; Teacher's Guide, question 1, p.14.  
Session 2, pp.21-39; Teacher's Guide, questions 2,  
3,4, pp.14-15.

SECOND WEEK--January 28-February 1

BRAINSTORMING

Lesson 5, pp.9-11  
Lesson 6, pp.12-13

PROGRAMMED INSTRUCTION

Basic Lesson 2: The Riverboat Robbery  
Session 3, pp.3-22; Teacher's Guide, questions 2,  
4, p.18.  
Session 4, pp.23-47; Teacher's Guide, questions  
1,3, p.18.

THIRD WEEK--February 4-8

BRAINSTORMING

Lesson 8, pp.16-17  
Lesson 11, pp.22-23

PROGRAMMED INSTRUCTION

Basic Lesson 3: The Search for Mr. Search  
Session 5, pp.3-23; Teacher's Guide, questions 1, 2, p.22.  
Session 6, pp.24-39; Teacher's Guide, questions 3,  
4, p.22.

FOURTH WEEK--February 11-15

### BRAINSTORMING

Lesson 12, pp.24-25  
Lesson 13, pp.26-27

### PROGRAMMED INSTRUCTION

Basic Lesson 11: The Trickster Unmasked  
Session 7, pp.3-25; Teacher's Guide, question 2, p.57.  
Session 8, pp.26-47; Teacher's Guide, questions 1,  
3, pp.57-58.

## FIFTH WEEK--February 18-22

### BRAINSTORMING

Lesson 15, pp.30-32  
Lesson 17, pp. 35-36

### PROGRAMMED INSTRUCTION

Basic Lesson 12: The Dream Detectives  
Session 9, pp.3-27; Teacher's Guide, question 3, p.62.  
Session 10, pp.26-47; Teacher's Guide, questions 1,  
3, pp.57-58.

## SIXTH WEEK--February 25-March 1

### BRAINSTORMING

Lesson 18, pp.37-38  
Lesson 20, pp.41-42

### PROGRAMMED INSTRUCTION

Basic Lesson 13: The Puzzle of the Deep Sea Dive  
Session 11, pp.3-23; Teacher's Guide, questions 1,  
2, pp.66-67.  
Session 12, pp.24-47; Teacher's Guide, question 3, p.67.

## SEVENTH WEEK--March 4-8

### BRAINSTORMING

Lesson 22, pp.46-47  
Lesson 26, pp.54-56

### PROGRAMMED INSTRUCTION

Basic Lesson 14: The Return to the Deserted House  
Session 13, pp.3-23; Teacher's Guide, questions 1,  
2, p.72.  
Session 14, pp.24-47; Teacher's Guide, questions 3,  
4, pp. 72-73.

EIGHTH WEEK--March 11-15

PROGRAMMED INSTRUCTION

Basic Lesson 15: Jim and Lila Crack the Secret Code  
Session 15, pp.3-24; Teacher's Guide, question 1, pp.77-78.  
Session 16, pp.25-47; Teacher's Guide, questions 2,  
3, p.78.

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## Appendix D

To: E.H. Teachers--Shirley Detty, Peggy Collett, Tom O'Callaghan,  
Gwen Green, Linda Vincent, John Yokela,  
Mimi Foust, Rena Foster, Phyllis Miller.

From: Wes Sharpe, School Psychologist

Re: Creative Thinking Skills Program  
Torrance Tests of Creative Thinking (TTCT)

Date: 1/2/74

1. The following is the schedule for the Creative Thinking Skills Program.

A. Pretesting using the TTCT Figural and Verbal Tests, Form B, will begin January 7 and conclude January 18.

B. Instruction begins January 20. Attached are the curriculum assignments for each teacher. I will be meeting with each group of teachers to explain the materials. The instructional part of the study will continue for 8 weeks.

C. Posttesting using the TTCT Figural and Verbal Tests, Form A, will begin on March 18 and conclude on March 29.

2. TTCT Figural Tests Form B, Thinking Creatively with Pictures, will be administered first, and these tests are to be administered as a group test. Administration instructions for the Figural Tests are given on pages 4 to 7 of the Directions Manual. The teacher and aide may help the children write the titles for their drawings. Testing time is 30 minutes.

3. TTCT Verbal Tests Form B, Thinking Creatively with Words, should be administered following the administration of the Figural Tests. Only two of the tests will be given, Activity 1: Asking, and Activity 4: Product Improvement. These tests are to be administered individually. Specific administration instructions for Activities 1 and 4 are given on pages 5 to 7 of the Directions Manual. Also read administration instructions for individuals, pages 9 to 10.

The administration of the Verbal Tests requires special materials which are to be given to the students as they take the tests. These materials will need to be shared by the teachers and they will be given first to Shirley Detty, Peggy Collett, Tom O'callaghan, Gwen Green, and Rena Foster. As soon as these teachers have completed the Verbal Tests I will distribute them to the other teachers. The total testing time for the Verbal tests is 15 minutes.

Creative Thinking Skills Program (cont.)

4. The Pupil Behavior Rating Scale will be given to you at the same time you receive the pretest booklets. Please complete the rating of your class and return the Scale to me by January 19.

5. The proper administration of these tests is very important. Please call me at 2619 if you have any questions.

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To: E.H. Teachers--Shirley Detty, Peggy Collett, Tom O'Callaghan,  
Gwen Green, Linda Vincent, John Yokela,  
Mimi Foust, Rena Foster, Phyllis Miller.

From: Wes Sharpe, School Psychologist

Re: Instructional Assignments for the Creative Thinking Skills  
Program

Date: 1/2/74

The following are the classroom assignments to the experimental  
treatments. These assignments were made at random by the toss  
of a coin.

Programmed Instruction

Shirley Detty  
Gwen Green

Brainstorming

Tom O'Callaghan  
Phyllis Miller

Combination, Programmed Instruction and Brainstorming

Rena Foster  
Linda Vincent

Control, Regular Classroom Instruction

Peggy Collett  
John Yokela  
Mimi Foust

## INTER-OFFICE COMMUNICATION

E.H. Teachers - Shirley Detty, Peggy Collett,      DATE: March 11, 1974  
Tom O'Callaghan, Gwen Green, Linda Vincent,  
John Yokela, Mimi Foust, Rena Foster, Phyllis Miller.

FROM: Wes Sharpe, School Psychologist

SUBJECT: Creative Thinking Skills Program  
Torrance Tests of Creative Thinking (TTCT)

Posttests, March 18-29.

The posttesting using the TTCT Figural and Verbal Tests, Form A, will begin on March 18 and conclude on March 29. The TTCT Figural Tests Form A, Thinking Creatively with Pictures, should be administered first, and they are to be administered as a group test. Administration instructions for the Figural Tests are given on pages 6 to 9 of the Directions Manual. The teacher and aide may help the children write the titles for their drawings. Testing time is 30 minutes.

TTCT Verbal Tests Form A, Thinking Creatively with Words, should be administered following the administration of the Figural Tests. Again, only two of the tests will be given, Activity 1: Asking, and Activity 4: Product Improvement. These tests are to be administered individually. Specific administration instructions for Activities 1 and 4 are given on pages 6 (Activity 1) and 7 (Activity 4). The administration time for Activity 1 is 5 minutes, and the administration time for Activity 4 is 10 minutes. Also read the administration instructions for individuals, pages 9 to 10. As in the pretests, the administration of the Verbal Tests requires special materials which are to be given to the students as they take the tests.

The proper administration of these tests is very important, please follow the standardized procedures given in the Direction Manuals for the Figural and Verbal Tests. If you have any questions call me at 2619.

S.  
:jw