# THE EFFECT OF SYNECTICS TRAINING ON GIFTED AND NONGIFTED KINDERGARTEN STUDENTS

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## DEDICATION

This work is dedicated to my husband, Don B. Meador, who shared equally in the joys and frustrations of completing this project. His dedication to my personal and profession development has enabled me to reach beyond the constraints of my own realistic beliefs about my potential to the farthest reaches of my dreams.

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ABSTRACT

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This study investigated the effect of one particular creativity training method, synectics, on gifted and nongifted kindergarten students. Data were gathered from 109 students in three gifted and two nongifted kindergarten classes. One group of gifted and one group of nongifted kindergarten students received synectics training. Comparisons of changes in creativity, self-concept, and verbal skills during the research period were made for experimental versus control groups, gifted versus nongifted experimental groups, and highly creative versus average to below average creativity groups.

The collected data included the results of pretest and posttest administrations of the Torrance Test of Creative Thinking, the Martinek-Zaichkowsky Self-Concept Scale, and the Peabody Picture Vocabulary Test. These were analyzed through one-way analysis of variance. Student interviews were also conducted and other qualitative information was

gathered by tape recording the training sessions and keeping anecdotal records.

The major findings of the study reveal a significant growth in creativity by both the gifted and the nongifted experimental groups as a result of the training and nonsignificant changes in self-concept and verbal skills. There was no significant difference between the changes of the gifted and the nongifted experimental group on any of the measures. The study did, however, note that gifted students enter and participate in the training at a different level from the nongifted students. It provides rich descriptive data of the participatory differences between the two groups. The research also showed that the highly creative experimental students displayed less gain in creativity than the other experimental students.

Intra-group differences in creativity were also described in this study in which creative response levels differed according to whether the activity was figural, verbal or manipulative. The researcher established a response hierarchy for rating pupil products in order to make comparisons of responses possible.

The study revealed that kindergarten students have the ability to reason by analogy and benefit from synectics

activities which uses this type of thinking. It also points to the fact that the use of creativity training in the kindergarten classroom helps prevent the decline of creativity which is common as children enter school.

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# CHAPTER I

## INTRODUCTION

The preschool years are a critical period in the development of all children. Gallagher and Ramsbothan (1977) stated that these years "(provide) a foundation for learning and the base for constructive social and adaptive patterns of behavior" (p. 42). The experiences of children in the years prior to entrance into first grade largely determine how they feel about themselves and affect their attitudes toward school (Morrison, 1988). Clark (1988) emphasized this fact in her discussion of sensitive periods in child development and suggested that educators must "optimize learning" during the critical early years.

In providing appropriate learning opportunities for young children, it is essential to realize that the needs of gifted children may differ from those of others. Roeper (1977), reflecting on the work of Piaget, a noted theorist in child development, suggested that young gifted children differ from their nongifted peers. "The gifted child becomes an abstract thinker before the child is emotionally able to deal with this understanding" (p. 391). The National Association for the Education of Young Children has also pointed out that children are unique and

that their needs may vary individually. Based upon this premise, the association has made a strong recommendation for both developmentally and individually appropriate educational practices (Bredekamp, 1987).

## Statement of the Problem

While educational programs for older gifted children have been in existence for years, many states have largely ignored the needs of the young gifted child. Some, however, such as Louisiana and Texas, have recognized the fact that young gifted children have a right to an education which is commensurate with their needs and abilities. As state mandates are issued for preschool and kindergarten programs for the gifted, many systems are left without guidelines as to appropriate strategies for these special populations.

Many educators are currently focused on the development of thinking and/or process skills. They believe that in order for children to survive and make future contributions, they must be able to do more than merely recite facts. Creative thinking is important both to the thinking skills movement, and to aiding children in reaching their potential. This emphasis on future contributions of gifted children to society which Borland (1986) termed the "national-resources approach" (p. 165)

has provided one of the rationales for gifted education programs. Rogers (1959) stated that "The mainspring of creativity (is) . . . man's tendency to actualize himself, to become his potentialities" (p. 72). Maslow (1968) also asserted that creativity is one of the healthy ways in which people move toward self-actualization. Clark (1988) stated that "Creativity (is) The Highest Expression of Giftedness" (p. 45). Creativity is natural in young children and peaks during the early years (Chen, 1980); therefore, it is vital that developmentally appropriate creative strategies be studied.

Creativity research utilizing varied strategies has been conducted with elementary school children (Begy & Hicks, 1980; Carter & Torrance, 1979; Clague-Tweet, 1981), junior high school students (Seghini, 1979), high school students (Jarial, 1981) and college students (Parnes, 1988). These studies and others (Gordon, 1961; Osborn, 1979; Taylor, 1968; Torrance, 1962a) have verified that creativity can be developed through training. While many studies have validated the positive effect of training in the development of creativity in the age groups aforementioned, little research has been conducted with kindergarten children. No studies have been located by this researcher which compared the effects of creativity

training on gifted vs. nongifted preschool students. This may be due, in part, to the lack of developed age-appropriate creativity materials and strategies for young children.

Training for increasing metaphoric thinking may be utilized for the enhancement of creativity. There are indications that children are ready for metaphoric thinking at a young age and that exercises to encourage its development are appropriate for young children (Chen, 1980; Samples, 1977). Synectics, purposeful connection-making, is a strategy designed to promote metaphorical thinking.

## Purpose

The purpose of this study was to describe the effect of training in synectics on the creativity, self-concept, and verbal abilities of kindergarten gifted and nongifted students. Synectics was chosen because it has been proven to be effective with older students (Gordon & Poze, 1980; Springfield, 1986), and its potential value has also been suggested for kindergarten students (Meyer, 1978). Kindergarten students were chosen as subjects due to the paucity of creativity research for this age group.

## Research Questions

This study investigated the effects of synectics training on gifted and nongifted kindergarten students. The following research questions were addressed:

1. What changes in creativity, self-concept, and verbal skills will result from training kindergarten children in synectics?

2. How will the effect of synectics training on creativity, self-concept, and verbal skills differ between gifted and nongifted students?

3. How will changes in creativity among highly creative subjects involved in the training differ from changes in creativity among subjects with average or below-average creative abilities?

## Limitations of the Study

Several limitations of the study must be considered.

1. The subjects for this study were selected from an urban north Texas school system. The school districts' boundaries served as the geographic limitations of the study.

2. Three of the schools used in this study were designated by the researcher since they housed the only homogeneously grouped kindergarten gifted students in the district.

3. The school which housed the nongifted kindergarten subjects was designated for the researcher by the school district.

4. None of the groups for the gifted students were located on the same school campus.

5. The gifted and nongifted training groups were not located on the same campus.

6. The researcher was a participant-observer in the classrooms and conducted the synectics exercises with the designated groups.

7. The time period for collection of data and observation of subjects was 15 weeks.

8. The time period for synectics activities in the training groups was limited to 20 minutes per day, twice a week for 12 weeks.

9. The small size of the highly creative population affected the study; therefore, a cautious interpretation of the results and future implications for this group should be used.

## Definition of Terms

Definitions used for the terms in this study follow.

Creativity was defined in this study by each subject's creative index score on the figural form of the Torrance

Tests of Creativity. Underlying this instrument is the following definition:

> Creativity is the 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 them; and finally communicating the result. (Torrance, 1974, p. 8)

Highly creative subjects were designated in this study by a creative index score at or above 125 on the pretest results of the figural form of the Torrance Tests of Creative Thinking.

Creative constructs in this study included fluency, originality, the ability to produce abstract titles, elaboration, and the ability to resist premature closure. Each of these constructs receives a score on the figural form of the Torrance Tests of Creative Thinking and is defined individually.

Fluency measures the ability to produce many different ideas or examples.

Originality measures the ability to produce ideas which are unique or unusual.

Abstractness of titles measures the ability to produce titles which capture the essence of an idea.

Elaboration measures the ability to develop an idea and add detail to it.

Resistance to premature closure measures the ability to resist the completion of a task in the simplest and quickest manner.

Synectics is derived from the Greek word Synectikos which refers to "bringing forth together" and "bringing different things into unified connection" (Roukes, 1982, p. v). For this study, synectics refers to purposeful connection-making for learning and problem solving.

Synectics training refers to the classroom activities conducted in this study by the researcher with the training subjects.

Gifted students in this study were those who were designated by the school district in which the research was conducted. These students had previously been identified through screening and evaluation by the district.

Nongifted students for this study were those students who were not designated as gifted by the school district in which the research took place.

Self-concept refers to "the perceptions, feeling, and attitudes that a person has about himself or herself" (Marshall, 1989, p. 45). For purposes of this study, self-concept refers to the score achieved by each subject on the Martinek-Zaichkowsky Self-Concept Scale.

Verbal skill refers to the standard score for each subject determined by the Peabody Picture Vocabulary Test-Revised, Form L.

## Conclusion

Since opportunities for learning and personal development during the years of early childhood help to encourage lifelong individual growth, it is important to provide appropriate instruction for children of varying levels of ability. An understanding of the effect of various types of strategies which may be used with young children may help educators optimize learning during this critical period. Since it is possible that some strategies may be more appropriate for children at specific cognitive or ability levels, research which compares different types of learners is important.

Creativity is among those abilities which are developing and being exercised in early childhood.

Khatena (1971) stated that "children between the ages of five and six in some ways can and do think in creative directions with even more freedom than older children" (p. 386). These youngsters, who are not yet stifled by the mundane or encumbered by presuppositions (Levine, 1984), are able to look at things creatively and try out new ideas. They may even alter reality to their own needs as they experiment with life through play (Piaget & Inhelder, 1969). A look at creativity in preschool children can provide a window to the child's thinking and can suggest important elements of creativity which may be lost during childhood.

There are ample descriptions and definitions of creativity (Clark, 1988; Davis & Rimm, 1985; Torrance, 1962a); yet, Amabile's (1989) simple statement that language or actions by young children must meet the criteria of novelty and appropriateness in order to be considered creative seems quite appropriate for young children. In order to be novel, the words or act must be unique "within the child's repertoire of behavior" (p. 25). The criterion of appropriateness is met if the action is "pleasing or communicative or meaningful" (p. 25) to the child.

This definition comes to life through examples of child behavior. Torrance (1968) discussed the work of Andrews during 1930, at the University of Iowa Child Study Center. Andrews used a variety of methods to gain information about the creative and imaginative functioning of children from ages two to six. In terms of imaginative play, Andrews observed the following activities: "imitation, experimentation, transformation of objects, transformation of animals, acts of sympathy, dramatizations, imaginary playmates, fanciful explanations, fantastic stories, new uses of stories, constructions, new games, extensions of language, appropriate quotations, leadership with plan, and aesthetic appreciation" (p. 55).

## Assessment of Creativity

### Alternate Uses Tasks

Recognition of creativity in preschool children is possible and is largely referred to in the literature in terms of divergent thinking and associative fluency. Wallach and Kogan (1965) suggested that creativity can be measured by the total number of responses that the person can generate on a given task and the relative uniqueness of those responses. Based upon this premise, many researchers have utilized alternate uses tasks in which children are asked to tell all the uses for novel or familiar objects (Pellegrini, 1984-85; Sawyers, Moran & Fu, 1983). The

following example of this type of measurement is taken from a study conducted by Dansky and Silverman (1973).

> "You can use a _____ in lots of different ways. I would like you to tell me all of the things you could do with it, make with it, or use it for." Once the subject stopped responding, the experimenter would ask, "Could you do anything else with it?" The subject was permitted to continue responding until he could give no more ideas. (p. 40)

The results of studies of American (Moran, Milgram, Sawyers, & Fu, 1983), Israeli (Milgram, Moran, Sawyers, & Fu, 1987), and Indian (Mehrotra, 1987) preschoolers using alternate uses tasks and other measures have shown a marked order effect with popular answers generally occurring earlier and unique responses later in the sequence. In all three studies, the strength of this order effect was much greater for high than for low original subjects. Researchers also reported that 52% of the responses generated by Israeli preschoolers (Milgram et al., 1987) and 60.14% produced by the American children (Moran et al., 1983) were original. Comparison of this information with that gained from a study of older children by Milgram and Rabkin (1980) indicated that a smaller percentage of original responses was produced by the older subjects. In the latter study, 34% of the responses produced by subjects between 12 and 17 years of age and 26% of the responses of those between 9 and 12 years of age were original.

## Standardized Instruments

In addition to alternate uses tasks, several measurement instruments have been used for the assessment of creativity in preschool children. These include the Starkweather Originality Test (Starkweather, 1974), Thinking Creatively in Movement and Action (Torrance, 1981), the Multidimensional Stimulus Fluency Measure (Moran et al., 1983), and the figural forms of the Torrance Test of Creative Thinking (Torrance, 1962b, 1962c). A thorough discussion of these instruments is not within the scope of this review.

## Declines in Creativity

"Human childhood can be generalized as a highly creative, perhaps the most creative, phase in every human life history, a time phase shaped and framed by characteristics shared by all races and all peoples, primitive or sophisticated" (Cobb, 1977, p. 29). Unfortunately, the creativity which may be seen in preschoolers does not maintain a positive continuum of development throughout life. Clark (1988) acknowledged that creativity, as measured by test performance, varies by age groups, and Torrance (1962a) reported that a decline in it occurs when children enter kindergarten. He also noted creativity slumps between third and fourth grade and between seventh and eighth grade.

## Shmukler's Model

Shmukler (1982), who developed a model of elements of creativity in young children, suggested that three components contribute to creative production. An inner component, described at the input stage of this model, is closely related to originality. Shmukler stated that this inner imagination can be stimulated by new information and ideas. Elaboration or expressive imagination, the second component of the model, results from the child's desire for mastery and competence. The output component of this model involves creativity expressed through behavior and social competence.

Schmukler (1982-83) collected information for subjects when they were in nursery school, first grade and third grade during a longitudinal study of children in Johannesburg, South Africa. She reported this information in terms of the components of her model. Assessment of preschool imaginative predisposition was related to imaginative expression in third grade; preschool demonstration of the expressive component in play was related to later assessments of imagination and creativity; and social competence at the preschool level was related to third grade social effectiveness.

Johnson and Hatch (1990) also expressed the information obtained when they conducted a descriptive

study of four highly original young children in terms of Schmukler's model. It was determined that all four of the children displayed a higher level of inner imagination than the other children in their preschool class, yet, they expressed their creativity in varying ways. While one subject expressed creativity through elaborative drawing, another made three-dimensional arts and craft products. A male subject was especially adept at making object transformations such as creating rifles and walkie-talkies out of blocks. Elaborative storytelling and dramatic play provided avenues for another subject's expressive creativity. The subjects also differed in their level of social competence.

## Play

### Importance of Play

Play has been termed the "work" of children (Papilia & Olds, 1990; Parke & Ness, 1988), and its importance is recognized by early childhood experts (Fromberg, 1987; Morrison, 1988). During play "children become what they are not yet ready to be in real life; they pose tentative solutions for problems; (and) they translate experiences into action" (Cecil, Gray, Thornburg, & Ispa, 1985, p. 203). Through this medium, they can develop physically, socially, emotionally, and intellectually (Bjorklund, 1978).

The National Association for the Education of Young Children has long been a proponent of play in the early childhood classroom. This association and the National Association of Early Childhood Specialists in State Departments of Education (1991) issued a joint position statement concerning programs for children three through eight years of age. In this document, they state that "perhaps most important it is through play that children develop their imaginations and creativity" (p. 27).

## Relationship Between Play and Creativity

This relationship between play and creativity has been examined by numerous researchers (Feitelson & Ross, 1973; Pepler, 1986). Kogan (1983) clarifies that free-play as opposed to play governed by rules provides opportunities for children to demonstrate creative behavior. Games with rules and boundaries allow little flexibility while free-play, often termed make-believe, fantasy or symbolic, allows children to structure the environment, create alternate uses for objects and assume new roles or functions.

Free-play. During free-play, children are immersed in a risk-free environment where they need not fear evaluation or failure. Researchers have noted a link between free-play or opportunities for open-ended activities and associative fluency (Dansky & Silverman, 1973;

Sutton-Smith, 1967). Play with objects is often part of a free-play situation and is believed to be fundamental in the development of a young child's thinking and imagination (Hughes, 1987; Trostle & Yawkey, 1983). "Through the quality and quantity of the interaction between the youngster and objects, creative thought evolves, develops, and can be sustained and enhanced" (Trostle & Yawkey, 1983, p. 183).

Sutton-Smith (1967) investigated the relationship between free-play and creativity by interviewing kindergarten subjects through a game in which the investigator pretended to be blind. The subjects were asked to describe dolls, dishes, trucks, and blocks to the investigator and tell uses for them. While the subjects did not differ by gender on their descriptions of the toys, the males gave more uses for the trucks and blocks and the females gave more for the dolls and dishes. Sutton-Smith suggested that this is because these were the toys most often used by children of each gender during free-play. He surmised that during free-play with stimulus objects, children become familiar with the various attributes of objects and form associations which provide a basis for creating alternate uses for them.

Dansky and Silverman (1973) compared alternate uses task results for 4- to 6-year-old subjects exposed to free-

play with the stimulus objects to the scores of other experimental and control subjects. They found them to be significantly higher for the former.

In 1975, Dansky and Silverman varied their 1973 experiment by requesting alternate uses for objects which the subjects had not played with during a free-play treatment. They found that subjects in the free-play treatment group produced significantly more standard and nonstandard responses than subjects involved in imitation or intellectual tasks groups. This study indicated a generalized effect of the free-play treatment.

Hughes (1987) also reported that manipulative play with objects by her 4- and 5-year-old subjects facilitated creativity in the form of alternate uses for play items and other test material. The result of this experiment differed from those of Dansky and Silverman's (1975) study since the subjects involved in pretest manipulative play differed significantly from the other subjects only in the production of nonstandard answers.

Imagination and Make-believe. Imagination can come alive as transformations evolve in the play setting. Shmukler (1982-83) stated that

> Imaginative play is a part of a more general capacity for divergent thinking, lying at the cognitive/affective interface. Even if the overt expression of imagination decreases with age, the capacity for symbolising [sic] experience as

> manifest in play in young children, turns into other forms of imaginative expression such as fantasy, day dreaming and creative potential. (p. 232)

Make-believe is an important element in play which allows children to dream. Singer (1973) states that dreaming

> Makes it possible to examine the alternatives that inhere every moment as we organize our immediate experience. To be able to make-believe gives both the child and the adult a power over the environment and an opportunity to create one's own novelty and potential joy. (pp. 258-259)

Make-believe, an aspect of divergent thinking (Singer, 1973), has been linked to creativity in young adults by Schaefer and Anastasti (1968). They used a biographical inventory to study the correlates of creativity in adolescent boys. Information gained indicated that as young children the subjects displayed their creativity through the "creation of new games, mechanical or electronic objects, poems, stories, or art products" (p. 46). Compared to the controls, boys designated "creative-artistic" were more likely to have had imaginary companions during early childhood.

Imaginary friends, with whom children can talk and play, are part of the world of 15% to 30% of 3- to 10-year-olds (Papilia & Olds, 1990). Somers and Yawkey (1984) suggested that a belief in these friends is related to cognitive and creative thinking since children who have

them tend to be bright (Charlesworth, 1987) and creative (Jalongo, 1984). Elaborative character development is one of the ways in which having an imaginary companion allows children to develop creative thought processes.

Dansky (1980) reported that the degree of make-believe play varies among preschoolers and that opportunities for make-believe through free-play do not necessarily result in increased associative fluency. He examined the relationship between individual differences among children and experimental conditions. After observation of subject's free-play, the children were designated as players or non-players according to the amount of time they engaged in make-believe activities. Equal numbers of subjects from each of these categories were assigned to either the free-play, imitation, or convergent problem solving condition in which all were exposed to the same common objects. Association fluency, as indicated by an alternate-uses task using different objects, was significantly greater for players in the free-play condition than for any other group. This study lends support for the idea that fantasy or make-believe activities during play contributes to creativity.

Feitelson and Ross (1973) found a relationship between thematic play training and creativity in kindergarten subjects. In this study, thematic play involved a certain

play theme which was the "mainspring of the activity" (p. 204). The researchers found that thematic play does not develop spontaneously in all children and demonstrated the positive results of modelling for increasing its level in preschoolers.

Playful Attitude. The contribution of a playful attitude to creativity has been the topic of several researchers (Liebermann, 1977; Wallach & Kogan, 1965). Liebermann (1977) looked at the individual in terms of play disposition by studying the relationship of playfulness to divergent thinking in kindergarten children. The Playfulness Scale which she developed for this study measured physical spontaneity, manifest joy, sense of humor, social spontaneity, and cognitive spontaneity. In addition to the rating of each subject on this scale, Lieberman gained information through the Divergent Thinking Tasks and the Peabody Picture Vocabulary Test. The results of this study indicated a positive relationship between playfulness traits and ideational fluency, and between spontaneous flexibility and originality.

Freeman (1985) acknowledged the value of playfulness and the importance of its role in playful inquiry. She states that a playful attitude helps to prevent the creative person from taking matters too seriously and

allows him/her to remain flexible during the creative process.

## Creativity Training

Dacey (1989) suggested that preschool children between the ages of 0 and 5-years-old are in one of the peak periods during which creativity can be cultivated. Several studies have investigated this possibility by assessing the effect of creativity training on preschoolers (Kalmar, 1987; Kelly, 1989; Khatena, 1971).

Kalmar (1987) found that creativity training held positive results for disadvantaged 5- and 6-year-old children. Institutionalized Hungarian children were given opportunities for the exercise of creativity through planned sessions three times a week for three months. The lessons were based on various topics and included open-ended activities such as puppet-making, fancy dress making, and collage making. The results of this study showed that the experimental subjects performed significantly better than the control subjects on measures of creativity. It is significant that improvement through treatment was demonstrated not only in fluency, but also in flexibility and originality.

Khatena (1971) also worked with disadvantaged preschoolers when he investigated the use of nonverbal stimuli in training them to think more creatively.

Experimental subjects were trained in the use of "three creative thinking strategies, namely, breaking away from the obvious and commonplace, restructuring, and synthesis" (Khatena, unpublished manuscript, 1969, cited in Khatena, 1971, p. 384). One activity involved making common objects out of a square, and others utilized flannel geometric shapes for construction. The experimental subjects showed significant positive gains in creativity as measured by the figural form of the Torrance Tests of Creative Thinking.

Kelly (1989) exposed experimental kindergarten subjects to a creative arts program and assessed creativity through pretesting and posttesting with Thinking Creatively in Action and Movement. The experimental subjects demonstrated significantly greater improvement than the control subjects on fluency and originality.

While the aforementioned training programs mainly dealt with specific content or strategies, a more holistic experimental approach was used by Torrance and Fortson (1967). They investigated the effects of the Creative-Aesthetic Approach to School Readiness and Beginning Reading and Mathematics. This approach not only attempted to develop "the beginnings of intellectual skills, abilities, and attitudes important in school success and self-fulfillment" (p. 28), but also provided activities "planned to elicit maximum amounts of creative thinking,

problem solving, fluency of ideas and fluency in verbal expression, and to develop auditory and visual discrimination" (p. 28). Using pretests and posttests to assess verbal and figural elements of creativity, the researchers compared the scores of 5-year-old experimental subjects, exposed to the Creative-Aesthetic Approach, to the scores of control subjects. The results showed significant gains for the experimental subjects on verbal fluency, verbal originality, figural originality and total figural scores. This group excelled the controls on all scores of verbal creativity and originality.

The literature is rich with studies which have investigated various aspects of creativity in the very young. It suggests that creativity in preschoolers is positively affected by opportunities for free play and exploration and provides information regarding make-believe or fantasy play which appears to stimulate the imagination of these youngsters. Creativity appears to increase during the preschool years (Torrance, 1962a), and it is encouraging to note that some researchers have dispensed data about guiding preschoolers toward more creative production.

## Relationship of Language and Creativity

Several researchers (Pellegrini, 1984-85; Pinrantana, 1987) have indicated the connection between language skills

and creativity. Others (Geller, 1984; Vosniadou, Ortony, Reynolds, & Wilson, 1984), whose studies will be discussed in the section on synectics, have examined language in terms of children's renaming skills.

Preschoolers with developed language skills may have a creative advantage over their peers as demonstrated by Pinratana (1987). This researcher found a significant positive relationship for her 4-year-old subjects between expressive language scores measured by the Preschool Language Assessment Scales and originality scores obtained on the Starkweather Originality Test. She also found that there was no significant difference in either expressive language scores or originality scores between lower and middle socioeconomic status groups.

Researchers have experimented with the use of language for facilitating creativity in preschoolers (Harrington, 1984; Pellegrini, 1984-85). In an article on how exploration and play affect associative fluency, Pellegrini (1984-85) discussed the results of several of his studies. Through questions asked by an adult, the treatment subjects in his 1980 study were encouraged to explore various aspects of stimulus objects as they handled them. Pellegrini surmised that while responding to the open-ended questions by the researchers, the subjects verbally encoded various attributes of the objects. Subjects in this guided

exploration group gave significantly more creative uses for the stimulus objects than either control group subjects or subjects who played with the objects. In another study in 1981, Pellegrini found that preschoolers engaged in guided exploration of stimulus objects more than other experimental and control subjects demonstrated that they can readily transfer strategies to other objects. This was demonstrated as the subjects provided uses for alternate objects which they had not seen during treatment.

These results are supported by the work of Harrington (1984) who also studied the use of language to facilitate creative production. From his study, Harrington concluded that "verbal self-instruction may be an effective method for facilitating certain aspects of creativity in young children's play" (p. 144). These studies add a language dimension to the previously cited Sutton-Smith (1967) investigation that allowed children to become familiar with object attributes during free-play with them.

Shaklee and Amos (1985) trained kindergarten subjects in creative problem solving which has been shown to increase creative thinking in older students (Osborn, 1979). Language fluency was among those abilities measured by the researchers before and after the training. This was assessed by comparison of nominal data from recorded group brainstorming sessions. The post-training language fluency

scores for the experimental groups indicated an increase in this ability. The creative problem solving training also proved to be educationally significant for the children.

The research presented documents the importance of the relationship between language development and creativity. The studies indicate the existence of a reciprocal relationship whereby language facilitates creativity and creativity development through training facilitates language development.

## Relationship of Self-Concept and Creativity

Self-concept is another human characteristic which relates to creativity. An individual's self-concept affects how that person views the world. The manner in which a person interprets experiences is largely determined by a perception of self (F. Roebuck, personal communication, April, 1991). Since creativity is largely effected by an openness to experience and the ability to take risks, self-concept is of utmost importance. In the following paragraphs information on researchers' viewpoints as well as empirical studies which illuminate the relationship of creativity and self-concept will be presented.

The importance of self-confidence as it relates to creativity in very young children is reiterated in a paper by Freeman (1985) of the United Kingdom. The author

asserts that it takes considerable courage for a youngster to "keep hold of her ideas" (p. 102) and tolerate ambiguity. The child must also be confident enough to defer judgment and resist the criticism or others.

Tannenbaum (1991) alluded to the relationship between certain traits of creative individuals and high self-concept in his discussion of factors which affect giftedness. He referred to the inconsistent results of the research regarding the self-concept of the gifted. A variety of personal and demographic factors may have affected the results of this research. It appeared to him that gifted children in special classes have better self-concepts than gifted children in regular education classes. He also suggested a relationship between willingness to take risks, one of the important traits of creative individuals, and high self-concept. Tannenbaum stated that "high self-regard has to be actualized through risk-taking behavior" (p. 36).

Sisk (1972) discussed the importance of creativity to man by suggesting that "every mobilization of power rests with man and his creativity" (p. 229). She indicated that a person's creative power, which makes achievement possible, results from that person's inner strengths and the individual's perceptions of these strengths contributes

to the development of self-concept. She indicates the cyclic relationship among these variables.

> Strengths and the perceptions of strengths and self-concept are then closely related. If an individual views himself as a person with valuable strengths, he enhances his self concept. As his self-concept grows, he is free to discover new strengths, which in turn further develop and improve his self evaluation. (p. 229)

In her 1972 study, Sisk identified students who were both gifted and low in creativity. The age of these students was not indicated in the report of this research. While there was no formal self-concept assessment for the subjects, their classroom instructors did describe them as conforming, obedient, quiet and shy. In addition they were helpers and followers in the classroom. These characteristics are not normally found in descriptions of students who have high self-concepts. For 10 weeks, the subjects met in groups of 15 to participate in classes that were designed to provide them with success. Instructors for these classes provided praise and encouragement for the students as they participated in discussions or were actively involved in planned experiences. After the training, 75% of the classroom teachers of the low creatives noted changes in the students. They were described as more cheerful and enthusiastic about school. In addition, the children responded "at a higher level in their schoolwork" (p. 233). This study lends emphasis to

the manner in which personal development, through risk-free, open-ended activities which are characteristic of exercises in creativity, can lead to improved self-concept.

Dissertation work by Kurtines (1989) provided support for the idea that personal affective needs must be addressed before higher order skills, such as creativity, may fully develop. In her study, which involved six classes of preschoolers, the classroom instructors of the experimental groups used a commercially prepared set of activities and materials. Developing Understanding of Self and Others (DUSO) was used with these students 30 minutes a day for 10 weeks. The program is specifically designed to help children understand and develop healthy social and emotional behavior which includes self-concept. Although no training in creativity was given, the experimental subjects did demonstrate a significant improvement between pretest and posttest scores on Thinking Creatively in Movement and Action compared to no improvement on this measure for the control students. A significant improvement was also demonstrated by the experimental subjects on one of two self-concept measurements taken before and after the training. Pearson product moment correlations on the creativity and self-concept measures prior to training revealed a near significance ($p < .10$) relationship. After training, however, a significant

relationship ($p < .03$) was noted. The research indicates "a probable concomitant relationship between self-esteem and creativity" (p. 78). In light of her findings, Kurtines made a strong case for the importance of meeting the affective needs of young children and stated that self-esteem enhancement should precede creativity development.

Another study which explored the relationship between creativity and self-esteem was conducted with Puerto Ricon kindergarten children (Robles Torres, 1988). This study differed from the Kurtines research since it did not include any type of training. The subjects were assessed using the Torrance Tests of Creative Thinking, Figural A and the Coopersmith Self-Esteem Inventory. The results indicated no significant relationship between the measured variables.

Rampaul, Sigh, and Didyk's (1986) study of Native Indian children in a Northern Manitoba community in Canada also failed to show a significant relationship between creativity and self-concept. The subjects for this study were in grades three and four of a school in which 97% of the school population spoke Cree. The study did reveal significant positive correlations among self-concept, academic achievement and teachers expectations. It also revealed a significant positive correlation between teacher expectations and creativity.

Fishkin (1990a) measured the effects of participation in Odyssey of the Mind on creativity, creative self-concept, locus-of-control and general self-concept in elementary gifted children. Odyssey of the Mind is an extracurricular program which involves students in team efforts in creative problem solving. Both the figural and the verbal Torrance Tests of Creative Thinking indicated posttest declines for all groups except the Odyssey of the Mind high effort group. The enrichment program did, however, seem to be effective in increasing creative self-concept and attribution of responsibility for negative experiences.

A link between creativity and self-actualization has been discussed by several researchers and practitioners (Davis, 1982; Drews, 1972; Maslow, 1971; Rogers, 1961) . While self-concept is not specifically discussed, it seems inherent in the concept of self-actualization. Drews (1972) stated that self-actualization involves "high ethical concern for the good of others along with insight into, and acceptance of, the self" (p. 67).

Maslow (1954) described a hierarchy of human needs in which lower-level needs must be satisfied in order for an individual to develop fully and move toward self-actualization. He stated that physiological needs, safety needs, belongingness and love and esteem needs must be met

before an individual can move toward the satisfaction of cognitive and aesthetic needs. Self-actualization is found at the pinnacle of Maslow's hierarchy and is not reached by all humans. Maslow's thoughts suggest that creative endeavors, which seem inherent is the cognitive and aesthetic components of the hierarchy, cannot be attempted until a strong sense of self is established. In a discussion of the creative attitude, Maslow (1971) showed concern for this holistic development of the person as a means for facilitating creative growth. "My feeling is that the concept of creativeness and the concept of the healthy, self-actualizing, fully human person seem to be coming closer and closer together, and may perhaps turn out to be the same thing" (p. 57).

Many of Maslow's ideas regarding this relationship were presented in Vau's (1991) article which documented the psychoanalytic and humanistic positions on creativity. Vau also discussed what she termed an essential interrelationship: healthy self-esteem and productive creativity. The author suggested that the cornerstone of the creative individual is curiosity and a child requires self-confidence in order to follow that curiosity with exploration. Among those characteristics which Vau stated are shared by high self-esteem and productive creative individuals are "ego strength, . . . courage, openness to

experience, . . . the tendency to be flexible and exploring . . . and the ability to risk-take" (p. 158).

Rogers (1961) also discussed the relationship between creativity and self-actualization. "The mainspring of creativity appears to be . . . --man's tendency to actualize himself, to become his potentialities" (p. 350-351). He further explained the tendency as "the urge to expand, extend, develop, mature--the tendency to express and activate all the capacities of the organism, or the self" (p. 351). Rogers' ideas regarding the self-actualization process came largely from his experience as a psychotherapist. From this perspective, he wrote about "the good life" and the process of achieving this life which may result from becoming a more fully functioning individual. Rogers clearly stated that a person involved in the process of reaching for "the good life" is a creative person. His discussion of the creative person pointed out not only the creative person's "sensitive openness to his world" (p. 193) but also "his trust of his own ability to form new relationships with his environment" (p. 193).

The relevance of self-actualization to the creative development of the individual was also expressed by Davis (1982) in The Model AUTA. The model, presented in taxonomic form, defines the cognitive and affective stages

of development as a person becomes more creative. These steps are awareness, understanding, techniques, and self-actualization. Davis described self-actualization as the goal of the creative person in reaching the full development of talent.

The ideas presented by noteworthy scholars provide a theoretical base for the existence of a relationship between creativity and self-concept. While the empirical research on this relationship is inconclusive, there is enough data to indicate that further investigation is merited.

## Synectics

Since creative thinking is important to society, it is necessary to develop strategies which are conducive to its development. Various strategies such as creative problem-solving (Parnes, 1988), lateral thinking (De Bono, 1970) and synectics (Gordon, 1961) have been devised to facilitate growth in thinking and creativity. This study investigated the effect of one of those techniques, synectics, and its effect on kindergarten children.

The Greek word, synectics, means "the joining together of different and apparently irrelevant elements" (Gordon, 1961, p. 3). While synectics was originally designed to facilitate creative growth and production in adults, it has been used for educational purposes with children (Gray,

1988; Cohen, 1988; Pfingstag, 1986). An indication of its power with very young children was provided in a Title I study reported by Heuristics, Inc. in 1974 and 1975. A complete review of this investigation may be found later in this document. Prior to the discussion of empirical research studies a thorough review of synectics is presented.

## Synectics History

This section presents pertinent historical information about the development of the synectics strategy. It documents the development and study of the production of creative ideas by synectics founder, Gordon, and associate Poze. It also presents information on the work of Gordon's former colleague, Prince. Examples from history demonstrating the productive benefits of analogical thinking necessary for synectics are also provided.

Alexander (1965) discussed the varied background of Gordon, the originator of synectics. Gordon received education at the universities of California and Pennsylvania as well as Harvard and Boston Universities. He studied physics, history, biochemistry, psychology, and philosophy and tried numerous occupations. These include horse handling, pig raising, teaching, writing, inventing and schooner sailing. Gordon drove an ambulance during World War II and worked with the Harvard Underwater Sound

Laboratory in the development of an acoustic torpedo. He was intrigued by the higher than average productivity of a certain team of people working on this problem and managed an assignment to that group. In an attempt to find the key to productive innovation, Gordon recorded their team work sessions as well as his own ideas and thoughts as he worked privately on inventions .

Gordon formed an operating group for Arthur D. Little, Inc. in 1952, which was responsible for producing inventions and became a model of creativity and innovation. Gordon purposefully solicited people with varied backgrounds to comprise the group. It was "composed of a physicist with interest in psychology; an electromechanical engineer; an anthropologist with interest in electronics; a graphic artist with the added background of industrial engineering; and a sculptor with some background in chemistry" (Gordon, 1961, p. 25). The group's work sessions were also recorded and scrutiny of these helped provide insight into the process of innovation.

Gordon read and studied creativity and formulated his own theory on the subject, during the war and throughout his work with Arthur D. Little. This was largely derived from the information gleaned from listening to many hours of tape recorded sessions of groups attempting to solve a problem or invent a product.

Gordon and others formed Synectics, Inc. in 1960 and began serious efforts to operationalize his ideas. The company was organized to "provide training facilities and training personnel for those interest in learning his technique to stimulate creativity" (Stein, 1975, p. 173). Alexander (1965) stated that it was Prince who observed Gordon as he worked with various groups and developed a "flow chart" or synectics system which could be more easily taught to clients. Those clients have included Kimberly-Clark, Whirlpool, Johns Manville, Pillsbury, and Singer. Prince now heads Synectics, Inc., and Gordon works with his colleague Poze at Synectics Education Systems (SES).

Before becoming involved with synectics research, Prince was interested in the psychoanalytic work of Jung and Freud (Prince, 1951). He postulated that the unconscious or subconscious is a "storehouse of immense capacity" (p. 1) and that new ideas could be found in repressed thoughts. Prince stated that the conscious mind contains well organized logical information and tends to serve as a censor to seemingly irrelevant, new, or strange ideas which may emerge from the subconscious. Synectics procedures require a conscious effort to recognize these ideas and utilize them in creative production and learning. "The purpose of the methodology is to provide the individual with a repeatable procedure which will increase

the probability of his success and hasten his arrival at an innovative solution" (Prince, 1951, p. 4).

## Historical Examples of Synectics

There are numerous historical examples of discoveries and inventions which resulted from analogical connections. A small sample of those which were explained by Gordon (1974) will be discussed.

The Wright Brothers experienced difficulty with their perfection of the airplane when they were unable to turn their contraption. By comparing their invention to a buzzard which negotiated turns by dropping and twisting one wing, they found the answer to their dilemma. After experimentation, the Wright Brothers attached wires to the airplane wings which could be controlled from inside the craft. This enabled them to tilt the wings, turn the plane and then restore the wings to balance.

When Morse invented the telegraph, he had difficulty transmitting its signal over long distances. During a stagecoach trip from New York to Baltimore, he made an analogy between the power needed for his telegraph and the horse power required for the stagecoach to travel long distances. Just as relay stations on the trail exchanged fresh horses for tired ones, Morse set up stations which added more electrical power to his telegraph signal.

The idea behind Whitney's development of the cotton gin resulted from his watching a cat try to catch a chicken through a fence. Just as the cat extracted only feathers through the fence, the gin picks only the seeds from the cotton.

## Synectics Research

Research involving synectics, which has been conducted in various settings, has demonstrated the success of the technique as an aid to problem solving, writing, and learning new material. The studies which follow employed synectics strategies with adults and children.

The boxstep procedure was used by Gendrop (1989) when she tested the effect of synectics instruction on the divergent thinking skills of professional nurses. Significant pretest-posttest differences for the experimental subjects were expressed by gains in fluency, flexibility, originality and creative problem solving and supported the use of synectics in the education of nurses.

Instructors, such as high school teacher Foster (Gordon & Poze, 1980), have used synectics for making the strange familiar while others have made the familiar strange while using synectics in problem solving (Meador, 1991; Springfield, 1986). Several researchers (Evans, 1985; Heavelin, 1982; Stark, 1987) have been interested in the

effect of synectics with college students. They have used a variety of content domains for their studies.

Heavelin (1982) studied "The Use of Synectics as an Aid to Invention in College Composition." She found that training in synectics helped college freshman enrolled in a composition class develop the ability to think analogically but did not effect their divergent thinking. She also found that students developed more positive attitudes toward writing during the investigation. Heavelin followed an adaptation of Gordon's procedures which included presentation of situation, evocative questions, direct analogy, personal analogy, compressed conflict, resulting analogy, and application.

Synectics was also used at the college level by Stark (1987) in her home economics class on family and communication. She described an activity in which synectics was used to help undergraduate students understand family relationships. Through the use of analogies, some of the students were able to become more empathetic with characters from a movie which they had chosen to examine. Stark noted that not all of the students gained from the synectics exercise and acknowledged that it takes time to develop a class climate in which all students are comfortable with openly dealing with feelings and emotions.

climate without employing any particular creativity technique. While the results of this study are intriguing, serious concern must be expressed regarding the manner in which the techniques were presented to the subjects. Synectics and brainstorming were explained to the appropriate groups via written instructions which described the techniques and gave examples. It is questionable whether or not either of the techniques was practiced appropriately by the subgroups.

A study by Baade (1980) looked at the effects of synectics on individual levels of communication apprehension and ideation output. While it was not specifically stated in the abstract, the 42 subjects of the study were probably college students. The training resulted in "a clear trend toward lower levels of communication apprehension in all the Synectically trained groups" (p. 4283) and significant findings in mean scores of measures of ideation output. The mean score differences in levels of communication apprehension were not significant enough to meet the study's decision criteria.

Results from a study of college students indicated that synectically trained subjects scored higher gains in creative thinking than did the controls (Korth, 1973). The experimental subjects did not, however, show improvement in their ability to solve real-life problems after the thirty

hours of training nor did they show any type of personality change through measurement with the California Personality Inventory, the Tennessee Self-Concept Scale, and the Personal Orientation Inventory.

Synectics has also been effective at the high school (Gordon & Poze, 1980) and kindergarten--elementary school levels (Gordon & Poze, 1978). In addition, it has proven useful with students of varying learning needs and ability levels (Cohen, 1988; Pfingstag, 1986).

Gordon and Poze (1980) reported the efforts of biology teacher Foster, who worked with students at various grade levels. After attending a synectics workshop, Foster successfully utilized the strategies, which he learned from Gordon and Poze, with his classes. Foster noted that the aforementioned paradox technique enabled his students of various ability levels to focus on the core on the content. He also found that the use of connective analogues helped slow and average learners toward a better understanding and comprehension of the content. It enabled gifted students to reveal a "new crispness and organization to their recall of details" (p. 149).

Cohen (1988) further verified the fact that synectics can be helpful with slow learners through her efforts with learning disabled students. She used direct, personal and symbolic analogies in an exercise with her high school

seniors who were studying "The Rime of the Ancient Mariner." After the synectics excursion, individual students chose one of the previously discussed analogies and wrote a short essay which compared it to the book. Cohen stated that synectics led her students to a "deeper understanding" of the themes in the book.

Gray produced qualitative information about the effects of the synectics process, in another 1988 study. The author employed synectics in an attempt to generate higher order thinking skills in a heterogeneous 11th grade history class. Rich descriptive data and samples of student writing verify the positive results of using synectics to help students in their study of post-Civil War America and the treatment of minorities. Comments by student participants regarding the effect of the technique indicated that synectics helped them to "connect things together, personalize their learning, experience the feelings of people in history, and think in new ways" (pp. 72-73). This report calls for research to determine whether synectics will regularly help average students engage in higher-order thinking skills.

Synectics was used in an advanced English as a Second Language writing class and was described by Pfingstag (1986) in "Justice is a Nike T-Shirt." Students in the class compared an abstract idea to a concrete object

through the synectics process. Pfingstag's approach was more individualized than the techniques used in the other studies discussed. Each student selected abstract terms such as honesty, bravery and justice for which they were to write an extended definition essay. Prior to beginning to write, each student drew a concrete object from a grab bag. These included a man's tie, a tape dispenser, a Nike t-shirt, and other objects. The students then wrote information in chart form which described the concrete object. Next they compared the abstract concept to the concrete object using the information on the chart. The exercise culminated with the writing of the assigned essay. Pfingstag found that this activity helped students improve both observation and reasoning skills and she suggested that it is quite useful in the classroom.

In 1974-75, Gordon and Poze (1978) worked with the Lawrence Title I Project, which they called the Listening/Expressing Project. Synectics strategies were used with kindergarten through third grade students in this study. All the subjects in the project were culturally deprived and had poor learning skills. Their severe inability to comprehend led Gordon and Poze to surmise that these students could not listen well enough to comprehend. In the Listening/Expressing Project (LEP), Gordon & Poze (1975) trained two instructors and four aides who worked

with 100 students. They also informed support personnel, including classroom teachers and parents about the project and encouraged them to involve the students in connection-making activities outside of the Title I classes. Instruction was given for two months and students in grades 1 through 3 worked with the instructors 5 days a week for 40 minutes a day while kindergarten students worked 25 minutes per day. The results of this training were reported by Meyer (1978). Significant cognitive gains between pre and post training measurements were indicated for kindergarten students on the Peabody Picture Vocabulary Test, for first graders on the Stanford Early School Achievement Test and for second and third graders on the Stanford Achievement Test. The results of these tests were also compared with those obtained from the first through third grade students in 1973-74 when they received the same instruction except for the added synectics training. Significant achievement differences between the two years were demonstrated for first graders on the Stanford Early School Achievement Test in letter and sound. This was also demonstrated on word reading. Differences in reading, for second graders, comprehension and total reading scores were significantly higher than the previous year as were third graders' word study skills on the Stanford Achievement Test (Meyer, 1978). Another result of the project, improved

self-concept among the student participants, was demonstrated on the Inferred Self-Concept Scale which was completed by the instructor for a random sample of students. Through analogies, the students were forced to make connections with their culture and environment and this very "process of asking students to select analogues from their own experience implicitly honors each person" (Gordon & Poze, 1978, p. 88).

Title I sixth graders served as the subjects for Brown's (1981) examination of synectics on learning. Her experimental study involving 45 subjects in an experimental and 2 control groups used Synectics Education Systems' published materials. Brown used the Piers-Harris Children's Self-Concept Scale, McDeaniel Inferred Self-Concept Scale, Analytical Reading Inventory, Peabody Picture Vocabulary Test and SES Associates' Test of Synectics Proficiency to determine whether training would result in enhanced self-concept, improved reading skills and increases in students' vocabulary. Statistical analysis of pretest and posttest data indicated no significant differences in any of the measures. Some growth appeared to have taken place since the F values on the SES Associates' Test of Synectics Proficiency and the comprehension subtest (independent level) of Analytical Reading Inventory were close to significance.

Joyce and Weil (1986) included synectics in their book, Models of Teaching, and suggested that it should be part of the basic repertoire of strategies used by schools. They stated that the models in their book "achieved their primary goals and also had general educational benefits" (pg. 3).

Joyce, Showers, and Rolheiser-Bennet (1987) also attested to the value of synectics as they refer to the effect size of the strategy. These researchers examined the gains made by the educational strategy compared to traditional strategies in terms of standard deviation units. Their study of the research on synectics revealed average effect sizes of 1.5 for problem solving and idea generation. The strategy also helped students increase their ability to recall information gained from written passages by an effect size of 2.0.

Weaver and Prince (1990) discussed self-concept, synectics, and a young child's use of language. They indicated that in order to learn, children should be encouraged to experiment without fear of evaluation from self or others. They stongly suggested that discounts of children's interpretations or understanding of material or events can severely limit the child's learning by discouraging adventurous thinking. In addition, Weaver and Prince suggested that improved self-concept may result from

learning gains as the child makes his or her own connections. They discussed the connection made by a 3-year-old named Max who noticed the tank on the back of a scuba diver and referred to him as a fireman.

> He (Max) has done a splendid job of connection-making. His store of experience is limited (although vastly greater at age 3 than we probably imagine), and his discovery is a wonderful approximation. . . . His ability to observe, imagine, and connect in order to build then retrieve an idea that reduces his lack of understanding enhances his sense of competence, independence, and self-worth. (p. 381)

Synectics encourages this type of connection-making and trains individuals to value their own unique experiences.

## Synectics Process

Since the research has indicated the value of synectics as an aid to learning and problem solving, it is important to explore the mechanisms of the process. Gordon's work in synectics is based on the following assumptions:

> (i) that the creative process in human beginnings can be concretely described and, further, that sound description should be usable in teaching methodology to increase the creative output of both individuals and groups...;
>
> (ii) that the cultural phenomena of invention in the arts and in science are analogous and are characterized by the same fundamental psychic processes;
>
> (iii) that individual process in the creative enterprise enjoys a direct analogy in group process. (Gordon, 1961, p. 5)

Traditionalists may believe that dissection and analysis of the creative process is detrimental to its development (Joyce & Weil, 1986). Gordon (1961), however, opposed this "illumination as destructive" theory (p. 5) and stated that understanding can increase creative capacity. Joyce and Weil (1986) reiterated this belief and stated that knowledge of the creative process combined with the practice of aids to creativity can produce fruitful results in creative capacity and production.

Synectics involves metaphoric activities which elicit original thoughts (Joyce & Weil, 1986). It is very personal since it draws upon the past experiences and the knowledge base of each individual as analogies are made. Gordon (1961) discussed the following four types of analogies: personal; direct; symbolic; and fantasy.

Personal analogy requires that an individual take on the role of the problem's subject and personally make muscular or emotional identification with it. Muscular identification requires an attempt to take on the physical characteristics of the subject (Gordon & Poze, 1990). For example, a student who is attempting to grasp the concept of poultry incubation may be encouraged to become a small chick inside an egg and discuss the physical feeling of being cramped in a tiny space. An emotional identification

might result when the student is asked to state his or her feelings as the chick emerges from the shell.

Direct analogies are straightforward and require a comparison of "parallel facts, knowledge or technology" (Prince, 1967, p. 7). For example, a fish net is like a spider web because they catch things in the same manner (Gordon & Poze, 1990). When making a direct analogy, an individual searches his or her own storehouse of information to find something similar to the current subject.

A symbolic analogy, sometimes referred to as compressed conflict (Gordon, 1972a; Joyce & Weil, 1986), is a poetic response to the problem. "It is a compressed description of the function or elements of the problem" (Gordon, 1961, p. 4) as the individual sees it. In symbolic analogy, the "words fight each other" (Gordon, 1972a, p. 298) as shown by the phrases "tiredly aggressive" and "friendly foe" (Joyce & Weil, 1986, p. 167). Prince (1967) suggested that a mixture is "balanced confusion" and that receptivity is "involuntary willingness" (p. 8). Historical examples of symbolic analogies include Shakespeare's "captive victor" expression and Pasteur's idea of a "safe attack" which described his antitoxin research (Gordon, 1972a, p. 298).

The fourth type of analogy, fantasy analogy, was discussed by Gordon in his 1961 publication, Synectics, but was not mentioned by authors Prince (1951) or Joyce and Weil (1986). This form of analogy requires wishing and the exploration of fantasy. It allows the individual to imagine the ideal problem solution without the inhibitions which result from constraint by rules and logic. Parker (1989) suggested that fantasy analogies may be useful when other types of analogies have not been productive. She suggested that a fantasy analogy may result by asking "How would we in our wildest fantasies like for this to be done?" (p. 162).

Analogies are required for the basic synectics activities. Making the strange familiar and making the familiar strange serve different functions in the synectics process (Gordon, 1961; Prince, 1967).

Making the Strange Familiar

Making the strange familiar is based on the human distrust for strangeness and the need to make the unique understandable. In synectics, this is accomplished by making analogies. Vosniadou and Schommer(1988) also discussed the use of analogies and found that they enabled children "to transfer an explanatory structure from a familiar domain to an unfamiliar one" (p. 524). The familiar domain may be referred to as the source and the

unfamiliar one may be called a target system (Vosniadou, 1988). Poze (1991) refers to these as the subject and the analogue in an explanation of the synectics process which will be presented in material which follows. In order for information from the source to be useful, it must be mapped or matched with the target system (Vosniadou, 1988). While Williams (1989) did not refer to synectics, he did discuss "instructional metaphors" (p. 80) and their power in helping students to understand the unknown by comparison to something which they understand.

Gordon (1972a) considered making the strange familiar an important part of the learning process as it requires the learner to bring "a strange concept into a familiar context" (p. 296). This process is illustrated by Gordon through an example of a student trying to learn about a fish's heart. The student listened to his professor's explanation of how the heart acted as a pump and then placed the unfamiliar fish's heart within the familiar context of a swimming pool; a learning connection resulted. The student was not only able to understand how the blood in the heart recirculates, but also how the liver and lungs cleanse it as the filter on the swimming pool pump cleans the water.

Although neither Gordon nor Prince refer to child development, synectics assumptions regarding making the

strange familiar parallel Piaget's philosophy of cognitive development. Piaget believed that information is organized by humans into structures called schemas. The information stored in these schemas is organized around common features and information is taken into them through the process of assimilation. Through the process of accommodation, schemas may be altered or adjusted. Piaget also felt that the child constructs his/her own knowledge by acting upon the environment (Osborn & Osborn, 1983). These ideas are reiterated by synectics experts in the following statements.

> All learning is in a sense a result of some action (experiment) plus some connecting to what is already known to form a new piece of knowledge, an idea, a concept. (Weaver & Prince, 1990, p. 382)

> Learning is a combination of focusing, connection-making, and application. To learn, students must respond to subject matter by focusing on important points, internalizing those points, expressing their comprehension, and sometimes creatively applying what they have learned. Effective internalization takes place when students connect the subject matter to something they already know about. (Gordon & Poze, 1980, p. 147)

Gordon and Poze (1983) offered suggestions for instructors regarding how to make content material personally meaningful to students through synectics. In The Teacher's Guide to the SES Student Sampler, a model is recommended which asks the following four questions:

1. WHAT IS THE SUBJECT MATTER FOR THE ASSIGNMENT? (Briefly describe the material you want your students to comprehend.)

2. WHAT CATEGORY IS THE SUBJECT? (Is it a person? An invention? A concept?)

3. WHAT IS THE FOCUS OF YOUR ASSIGNMENT? (For instance for a concept describe an example; for a person describe an important event; for an invention describe a special feature.)

4. WHAT IS YOUR APPLICATION QUESTION? (Remember to ask the students to explain the reasons for their answer.)(p. 67)

Making the Familiar Strange

The other synectics activity, making the familiar strange, involves a conscious effort to view things from a new perspective. While the above mentioned activity of making the strange familiar called for connection making, making the familiar strange requires connection breaking as the familiar is viewed in a strange context (Gordon, 1972a). Prince (1967) called this the "pursuit of strangeness" (p. 5) and likened it to the view of a child who makes the world strange by bending over and viewing if from between his or her legs. Making the familiar strange is perceived as an activity that can generate inventions, product improvements and innovative solutions to problems.

Roukes (1982, 1988), who works with the synectics process in art and design, stated that synectics makes it possible to visualize the links between two seemingly

different elements. By doing so, new ideas and insights are realized and a creative spark is generated.

In 1961, Gordon suggested an outline for a synectics activity, called an excursion, which could be followed for problem solving. The process begins with the following phases:

Phase 1: Problem as Given

Phase 2: Making the Strange Familiar

Phase 3: Problem as Understood (p. 158)

Gordon noted the difference between the problem as given and the problem as understood. In the former, the statement of the problem is given to those who are trying to solve it and may or may not clearly present all elements of the problem situation. The problem as understood results from analysis of the information given and examination of its various components by the problem solving group.

Phase 4: Operational Mechanisms

In phase 4, analogies are used to change the problem as understood from its original rigid state into another conceptual form which may open possible avenues for solution exploration.

Phase 5: The Familiar Made Strange

Phase 6: Psychological States

Phase 7: States Integrated with Problem

Presumably by phase 6, the problem solvers have attained a psychological state which is most conducive to creativity. They may then become detached from the problem and "liberated from its old rigid form" (p. 159).

Phase 8: Viewpoint

Phase 9: Solution or Research Target

Through the process of synectics, various analogies are compared with the problem and this causes it to be seen from a different viewpoint. When one of these viewpoints becomes effective in guiding the problem solvers to a new and possible insight, the viewpoint is said to be "actual" (p. 159). Finally, the viewpoint is tested and may result in either the problem solution or the subject of new research.

During problem solving or invention efforts, people often have immediate solutions which need to be shared. Prince suggested that these be "purged" after the problem is given. At this point, the expert could explain why the ideas were not possible, and this would enable participants to understand the problem more completely. It is possible also that an idea may be productive at this early point.

Prince discussed the fact that analogies must be force-fitted to the problem in order to produce the needed strain which may result in a productive new viewpoint. Obvious analogical connections may not yield new insight.

Springfield (1986) used a flow chart, similar to the abovementioned one, with her fourth grade students. She recommended the use of this strategy with gifted students and discussed how the process helps increase their chances of innovative breakthroughs as problem-solvers in society.

Current information indicates that separately both Prince and Gordon have simplified the synectics process (Poze, 1991; Weaver & Prince, 1990). Weaver and Prince, who discussed applying synectics in the classroom, suggested the following three steps: "first, put the problem temporarily out of mind . . . second, deliberately focus on apparent irrelevancy . . . third, force-fit the irrelevant material together with the problem and allow your mind to invent a way of connecting them" (p. 384).

Gordon and Poze now also work with four boxsteps in the synectics process (Poze, 1991). This method has been previously applied by this author (Meador, 1991) to the following mousetrap problem, which was presented in Strange and Familiar, Book VI (Gordon, 1972b) and will be used to illustrate the procedure. The step and procedural information are being quoted from Poze (1991). The mousetrap problem in based upon the assumption that a home is infested with a large number of mice. Conventional spring-loaded mousetraps are functional; however, when they catch one mouse, the noise scares the others away. The

other mice, therefore, do not go near the additional traps. The task is to produce a trap which will allow a large number of mice to be caught in a short period of time.

| Boxstep | Procedure | Example |
|---|---|---|
| Step 1--Paradox | State the specific conflict within the problem | At the same time that a trap catches mice, it scares mice away |
| Step 2--Analogue | Select something that fits both parts of the paradox | Spider web--it catches several things without scaring others away |
| Step 3--Unique Activity | Describe the special way the analogue works/acts | The spider web is sticky |
| Step 4--Equivalent | Express the problem in unique activity terms | Instead of making the trap spring and make a noise, put glue or something sticky on it so that it is silent, but catches the mouse |

Poze (personal communication, June, 1991) stated that paradox should not be used with students below sixth grade, since conceptually they do not understand that compressed conflict is one thing and that something can have both characteristics.

## Analogical Thinking

Since synectics requires the use of analogies, it is important to understand how they contribute to learning. While some authors (Sternberg, 1977; White & Alexander, 1988) refer to analogies and analogical reasoning, others (Lutzer, 1991; Vosniadou, 1988) discuss the same types of phrases and comparisons in terms of metaphoric thinking. Sternberg stated that "We reason analogically whenever we make a decision about something new in our experience by drawing a parallel to something old in our experience" (p. 99). A metaphor serves this function as indicated by this definition offered by Lutzer (1991): "Cognitively, a metaphor involves a merging of categories into a single utterance. A metaphor describes one idea in terms of another" (p. 69). Khatena (1984) suggested that metaphor is among those figures of speech which include simile, personification and allusion which can be used in making analogies. This is supported by information found in Webster's New Collegiate Dictionary (1959). In it the word metaphor is described as "A figure of speech in which a word or phrase literally denoting one kind of object or idea is used in place of another by way of suggesting a likeness of analogy between them" (p. 528). To summarize, it is apparent that whether the researcher is referring to analogy or metaphor, he/she is concerned with the

development of knowledge resulting from the comparison of two seemingly different things or ideas.

Billow (1981) suggested that metaphors may be based on similarity analogy or proportional analogy. Similarity analogy exists in what was previously described as direct analogy and involves matching such as that required in the statement "My principal is a real bear" (Meador, 1991). The proportional analogy has two sets of things in which the pairs similarly relate internally. The latter type of analogy is commonly seen in the form A:B::C:D.

There is some dispute in the literature regarding the age of onset of children's understanding of metaphors. In order to think analogically, a preschooler is required to make comparisons across conceptual categories. Piaget (1962) felt that preschoolers could not use and understand metaphors since they were not cognitively able to form the needed categories. Gallagher (1978) in Gallagher & Wright (1979) further interpreted Piaget's views in a description of three hierarchical levels of analogical reasoning. With reference to analogy problems of the A:B::C:D variety, 5- to 7-year-old children can arrange things into pairs but do not recognize higher-order relationships. Although 8- to 11-year-old children can form complete analogies, they may change their response when they are challenged with regard

to their answers. By age 11, children can form the analogies and explain their rationale for their answers.

Malgady (1981) noted a change with age in the evaluation of figurative language which requires metaphoric thinking. In a study of kindergarten, third, and sixth graders, this researcher asked subjects to interpret similes such as "The butterfly is like a rainbow" (p. 868). The sentences were presented in pairs and the subjects indicated their preferences as to which of the two was better at describing one thing as another. The results indicated that kindergarten children's appreciation of figurative language may be based on nonverbal creativity. It is tied more closely to verbal creativity and verbal IQ in older students.

The research findings by Gallagher and Wright (1979) supported Piaget's idea that analogical reasoning increases with age. They found that the percentage of symmetrical explanations for analogy solutions increased with age for their subjects in grades 4 to 6. Symmetrical explanations were those which showed the student's understanding of the higher-order linkage of A:B to C:D.

Alexander, Haensly, and Crimmins-Jeanes (1986) examined the effect of age and analogy training in their investigation with average 4th graders, gifted 8th graders, and average 10th graders. The older students performed

better on the analogy tasks than the younger fourth grade students. Prior to the training, the 8th graders showed verbal reasoning performance similar to that of the 10th graders. After training, however, the performance of the gifted eighth graders was significantly better than that of the average 10th graders who received the same instruction.

Other researchers suggest that young children have the ability to understand higher-order analogical relationships. In 1977, Gentner investigated the abilities of 4- to 7-year-old children and college students to perform a spatial analogies tasks. By asking questions such as "If this [pictured] mountain had a knee, where would it be?" (p. 1034), the researcher determined that young children were able to analogically map the human body onto other domains. There was no difference between the younger and the older subjects with regard to the spatial analogy tasks.

Experiments by Holyoak, Junn, and Billman (1984) produced results which indicated that young children have the ability to use analogies in problem-solving. These researcher worked with preschool and kindergarten children as well as fifth and sixth graders. After reading stories which presented a problem and a creative solution to the subjects, the researchers asked the children to solve a similar problem using manipulatives. The solutions were

analyzed with regard to their similarity to the story problem solutions. Members of both age groups demonstrated analogical thinking by matching a story problem to the problem offered by the researchers. The results for the younger group indicated that their analogical problem-solving ability was more fragile that the abilities of the older children. These younger subjects had some difficulty with the required matching when the perceptual and functional similarities between the source and the target were not obvious.

Vosniadou and Schommer (1988) also used stories in their research with 5- and 7-year-olds. They were interested in how explanatory analogies can help children acquire information from expository text. The students were asked to recall unfamiliar information related to them in stories. Some of the students heard stories which contained explanatory analogies while others heard story renditions without analogies. The results indicated that the analogies were an aid to recall and that the analogy condition had a stronger effect for older than for younger children.

Renaming, which is basic to metaphoric thinking (Geller, 1984), is common practice in young children (Holyoak, Junn, & Billman, 1984). While children play, they often give pretend names to objects such as calling a

dish "a hat" or a stick "a horse." At other times, they may rename things for what appears to be explanatory purposes. Weaver and Prince (1990) reported an episode in which a 3-year-old referred to a scuba diver as a fireman.

Mendelsohn, Robinson, Gardner, and Winner (1984) questioned whether renaming by preschoolers demonstrated intentional category violations. If these violations, such as calling a bat an ear of corn, are unintentional, then they are not metaphorical and should be termed mistakes. It is possible, however, for these statements to qualify as metaphorical usage. The researchers state that in order to do so, "a word which is usually applied to one referent must be applied to another (and novel) referent" (p. 188). The metaphor must not only cross normal category boundaries, but also be made between two referents with some similarity. For example, metaphorical thinking may be used when a child calls a box a building; however, it may not be used when a child labels a stick a ball. In an investigation with 4- and 5-year-old children, the researchers asked subjects to match a stimulus with either a conventional, visual, or unrelated choice. For example, consider a red apple as the stimulus item. The conventional choice would be a member of the same category of objects such as a banana; the visual choice would be similar to the stimulus in color or shape, such as a red

ball; and the unrelated choice, which bears no similarity to the stimulus, might be a fork. When the preschoolers answers were compared to those given by adults, the researchers determined a similarity in classification. Both age groups sorted things conventionally and across conventional categories. It is interesting to note that the preschoolers found it easier to explain their classifications of associative matches than for taxonomically based matches. As a result of this investigation, the authors make a strong statement regarding young children's metaphorical thinking abilities. "We can now assert with considerable confidence that preschooler's renamings are genuine perceptual metaphors" (p. 192).

Work completed by Cometa and Eson (1978) is in contrast to the above mentioned studies which support the young child's understanding of metaphors. They suggested that children in Piaget's preoperational stage do not understand metaphors "in a manner acceptable to adults" (p. 657). These researchers used a total of 60 subjects from kindergarten, first, third, fourth, and eighth grade. Through the use of Piagetian tasks they determined each subject's stage of cognitive development and then examined their ability to interpret common and rare metaphors found in adult speech. As a result of their findings, the

researchers state that children must enter the stage of concrete operations before they have the ability to adequately explain metaphors. This differs from merely making a metaphor.

Vosniadou, Ortony, Reynolds and Wilson (1984) suggest that part of the inconsistency in research results pertaining to the ability of young children to use metaphorical thinking represented by the preceding studies may be partly due to methodological research problems. They suggest the following three problems: a subject's lack of background information necessary to interpret the metaphor; "the absence of any reasonable linguistic or nonlinguistic context" (p. 1589) in metaphor presentation; child's inability to explain metaphors which may not be an indication of lack of understanding.

The research adds support to hierarchical nature of the levels of analogical reasoning which were proposed by Piaget (cited in Gallagher & Wright, 1979). Some of it disputes his claim, however, that preschool children are not able to use this type of reasoning and makes it clear that at least under some circumstances very young children do use this skill (Billow, 1981; Holyoak, Junn, & Billman, 1984; Vosniadou & Schommer, 1988). Holyoak, Junn, and Billman asserted that "analogical problem-solving may in

fact provide a basic mechanism for cognitive development" (p. 2052).

Studies (Nippold & Sullivan, 1987; White & Alexander, 1988; White & Caropreso, 1989) have shown that analogical reasoning is related to vocabulary knowledge and development. Partridge (1988) advances the idea that metaphor interpretation should be taught in school language programs since language is metaphorical.

A study of 4- to 6-year-olds indicated that vocabulary knowledge significantly effected the subjects analogical reasoning. Children whose vocabulary knowledge was well-above average scored significantly higher in analogical reasoning than others with less ability in this area. These finding are supported by Nippold and Sullivan (1987) who determined that receptive vocabulary development was related to certain types of analogical reasoning.

White and Caropreso (1989) were concerned with how training in analogical reasoning would effect low socioeconomic status preschool children. The subjects, which were 4- and 5-year-olds enrolled in a Head Start program, were randomly assigned to either the trained, play or control group. During pretesting, the researchers noted that it was difficult for the subjects to supply verbal information regarding their solution choices on the Test of Analogical Reasoning in Children. The quality of the

posttest responses of the trained group appeared to be better as they gave more detailed and explicit explanations. In addition, the posttest trained group produced significantly more higher-order problem solutions than the other two groups.

## Summary

The literature describes how creativity is exhibited by young children and discusses various attempts to measure the ability. The importance of allowing young children opportunities for free-play, make-believe and the development of a playful attitude has been shown through many studies.

Indications of the positive effect of creativity training has been demonstrated by the research. In particular, training in synectics has been shown to be conducive to the development of important creative skills and attitudes. Since analogical thinking is required in synectics, research exploring this ability in young children provides important basic information relevant to the use of the strategy with this age group.

The research has established a viable link between creativity and self-concept and between creativity and verbal skills. The studies exploring these relationships provide support for continuing research regarding these connections.

# CHAPTER III

## METHODS AND PROCEDURES

The purpose of this research was to study the effect of training in synectics on the creativity, self-concept, and verbal abilities of kindergarten gifted and nongifted students. The study was intended to produce a descriptive analysis of the differences between gifted and nongifted students involved in synectics training. It also proposed to provide information regarding the effect of the training on highly creative students as compared to those demonstrating average or below average creative abilities. The study was descriptive in nature; however, test data were also gained through the use of valid and reliable instruments in order to triangulate the information. The study utilized a pretest--posttest design in order to answer the following research questions:

1. What changes in creativity, self-concept, and verbal skills will result from training kindergarten children in synectics?

2. How will the effect of synectics training on creativity, self-concept, and verbal skills differ between gifted and nongifted students?

3. How will changes in creativity among highly creative subjects involved in the training differ from changes in creativity among subjects with average or below average creative abilities?

Hypotheses with regard to these research questions were made.

1. Subjects engaged in synectics training will show more improvement in creativity scores than subjects not engaged in the training.

2. Subjects engaged in synectics training will exhibit greater improvement in self-concept than subjects not engaged in the training.

3. Subjects engaged in synectics training will exhibit more positive growth in verbal skills than subjects not engaged in the training.

4. Gifted subjects engaged in synectics training will exhibit more change in the dependent variables than all other subjects.

5. Subjects who are highly creative will show less change in creativity as a result of the training than those who are not highly creative.

## Subjects and Sampling Procedure

### Population

The population for this study was all of the kindergarten students in an urban north central Texas school district serving approximately 40,000 students. This district was used since it grouped gifted kindergarten students homogeneously. This was necessary in order to secure an adequate sample size and make training logistically possible.

### Sample

The sample consisted of five groups. A visual representation of this information may be found in Appendix A. Three classes of gifted kindergarten students and two classes of nongifted kindergarten students were used. One class of gifted students and one class of nongifted students served as the experimental groups. Each of the three kindergarten classes of gifted students was housed at a different magnet elementary school. These schools served both the gifted students for the district and the neighborhood children, the majority of whom were disadvantaged. Due to the fact that the kindergarten gifted classes were not located on the same campus, one training and two comparison groups of gifted students were used for this research. Fishkin (1990b) suggested that the

comparisons made in a pretest--posttest design are strengthened by adding the third comparison group. The training classroom of 23 gifted students was selected by the Coordinator for the Gifted. There were 23 and 20 students in the two comparison groups. The three classes of gifted students were of similar demographic composition. The nongifted kindergarten classes at these three schools consisted of disadvantaged students and were not used in the research due to contrasting demographic variables.

Both the training and the comparison classes of nongifted kindergarten students came from one campus which was not the campus for any of the gifted groups. The Director of Research for the school district selected this campus since the student population had demographic similarity to the gifted population. The training and comparison classrooms were randomly selected from the kindergarten classes in that school. There were 20 students in the training class and 23 students in the comparison class.

Since the gifted kindergarten students were identified by the district in the Spring of the year preceding their kindergarten entrance, the classes were in place at the initiation of the school year and made it possible to begin the research in September. The gifted students were

identified for these classes through a two-stage selection process. During the screening phase, student information was gathered with a parent questionnaire, student interview and testing instruments. The Kaufman Brief Intelligence Test (Kaufman & Kaufman, 1990) and the Einstein Readiness Test (Gottesman & Cerullo, 1988) were administered to students, and they were also asked to read a short written passage. Students who qualified for the selection process took the intelligence quotient subtest of the Kaufman Assessment Battery for Children (Kaufman & Kaufman, 1983), a portion of the Williams Test of Divergent Thinking (Williams, 1980) and a pre-literacy test in which they were asked to tell a story in order. Twenty-two students were selected for each of the three schools which housed the gifted programs.

Since the research was conducted in an educational setting with the approval and supervision of the Department of Research for the school district, it was not necessary to obtain parental consent for student participation. A copy of the letter of acceptance from the school district may be found in the Appendix B. Parents of students in the training groups were, however, notified by letter that an additional instructional person would be in their child's

classroom. A copy of this letter may also be found in the Appendix B.

## Procedures for Collection of Data

In an effort to secure both qualitative and quantitative data, various data collection methods were used in this study. These will be explained in the paragraphs which follow.

### Quantitative Data Collection

#### Standardized Instruments Used

Three instruments, the figural form of the Torrance Test of Creative Thinking (Torrance, 1962b, 1962c), the Martinek-Zaichkowsky Self-Concept Scale (Martinek & Zaichkowsky, 1971), and the Peabody Picture Vocabulary Test-Revised (Dunn & Dunn, 1981a), were used to collect quantitative information about the subjects. These instruments were chosen because of their appropriateness for young children and the specific information which they could provide.

Torrance Test of Creative Thinking. The figural form of the Torrance Tests of Creative Thinking (Torrance, 1962b, 1962c) was used in this research in order to gain information about the creativity of all the subjects. Form A was given initially and Form B was administered at the end of the data collection period. The test was chosen

because it is nonverbal and culture-free. It provides data for individual students in the form of a creative index and gives specific information regarding the components of creative thought demonstrated on the test. Although this test is normed for kindergarten through adult subjects, some creativity experts (G. Lewis, personal communication, July, 1991; T. Safter, personal communication, March, 1991) recommended the use of Thinking Creatively in Movement and Action (Torrance, 1981), specifically designed for young children, for this research. Torrance (personal communication, July, 1991), however, suggested that the figural test would more accurately measure changes in subjects which might result from the type of training used in this research. The test, which is composed of three parts, requires the students to draw lines onto the stimulus forms and write titles for the pictures in two sections. The administration of each section is supposed to take 10 minutes. In order to facilitate the use of the test with younger students, Kaufman (personal communication, August, 1991) of Scholastic Testing Service, which markets the tests, suggested that the examiners write the titles for the students and that the time limitations for the three sections of the test be less restrictive. A maximum of 10 minutes was allowed per section, for these

young students; however, if students completed a section and were no longer incubating upon their ideas, they were allowed to move ahead to the next part.

Adequate test-retest reliability as well as alternate forms reliability has been demonstrasted for the Torrance Test of Creative Thinking (Torrance, 1962b, 1962c) through numerous studies (Torrance & Ball, 1984). Content and construct validity was based upon Torrance and his associates' analysis of lives of indisputably eminent creative people. They studied not only their personalities, but also the nature of creative performances and theories concerning the functioning of the mind. The new streamlined scoring of the figural forms of the Torrance Tests of Creative Thinking (Torrance & Ball, 1984) was used in this study. With this method, it is possible to keep the scoring reliability above the .90 level for all test areas. These include fluency, originality, abstractness of titles, elaboration, resistance to premature closure and 13 creative strengths. A sample of the scoring form may be found in the Appendix C.

Martinek-Zaichkowsky Self-Concept Scale. The global self-concept of all subjects in the sample was measured with the one form of the Martinek-Zaichkowsky Self-Concept Scale (Martinek & Zaichkowsky, 1971) before and after the

synectics training of two groups. Sweetland and Keyser (1983) stated that the scale "identifies children with low self-esteem, and evaluates the impact of the educational process on a child's self-perception" (p. 72). In addition to a global score, the test provides information on the following five factors: satisfaction and happiness; home and family relationships and circumstances; ability in games, recreation, and sports; behavioral, personal, and social characteristics in school; and personality traits and emotional tendencies. This nonverbal, culture-free instrument uses 25 pairs of pictures depicting children engaged in various types of activities. In each picture pair, one picture illustrates a happy or successful child and the other shows the opposite. Each student is told to mark the picture which is most like him or her. The scale was designed for students in grades 1 through 8; however, the authors noted that it could be used with kindergarten students (Martinek & Zaichkowsky, 1977). The scale was administered to small groups of students, and they were questioned about the sample item before beginning work. Students were told to ask the examiner if they did not understand any of the pictures. While the students worked, the examiner monitored their progress and asked individual students to explain various sets of pictures.

The scale has adequate internal consistency for this research as demonstrated by an overall Hoyt Estimate of Reliability of .88. Concurrent validity was partially demonstrated through a comparison with the Piers-Harris Children's Self-Concept Scale (Piers, 1969) which revealed a correlation of .49.

Peabody Picture Vocabulary Test. In order to obtain an estimate of each subject's verbal skills, the Peabody Picture Vocabulary Test-Revised, Form L (Dunn & Dunn, 1981a), a measure receptive or hearing vocabulary, was individually administered to subjects in all five classrooms before and after the training of the two groups. The test measures standard English vocabulary and estimates verbal ability. Since it requires the subjects to point to the appropriate picture among four after hearing a stimulus word, it is appropriate for very young children. The test items are arranged in increasing difficulty and the number of items given is determined individually for each student. The starting point for the test items is established by the chronological age of the student. A basal score is ascertained and the testing ends when a ceiling level has been established. Age-based norms are provided in the manual.

The Peabody Picture Vocabulary Test (Dunn & Dunn, 1981a) has adequate validity and reliability for this research. Coefficients of internal consistency split half reliabilities on Form L for the ages of the children in this study ranged from .73 to .77 (Dunn & Dunn, 1981b). The test has a strong correlation to other vocabulary tests as well as vocabulary subtests of individual intelligence and psycholinguistic tests. The overall median value of .71 was based upon 55 correlations.

Testing Procedure

Because of the difficulty of testing young children, every effort was made to establish the appropriate testing environment and procedures for this age group. A team of evaluators, which included an early childhood specialist, a diagnostician, the district Coordinator of the Gifted, two elementary counselors, the classroom teachers, and the researcher administered all of the aforementioned instruments. The early childhood specialist was trained by the researcher in the administration of the Peabody Picture Vocabulary Test (Dunn & Dunn, 1981a). The other members of the team had previously administered this test to other students. All of the team was trained by the researcher in the administration of the Torrance Test of Creative Thinking (Torrance, 1962b, 1962c) and the Martinek-

Zaichkowsky Self-Concept Scale (Martinek & Zaichkowsky, 1971). The Torrance Test of Creative Thinking and the Martinek-Zaichkowsky Self-Concept Scale were given on separate school days in order to reduce possible frustration with pencil and paper activities. The students were divided into small groups of five or six for these two tests, and a member of the evaluation team worked with each group. The Peabody Picture Vocabulary Test and the student interviews, a means for gaining qualitative data which will be described later, were conducted with individuals as time permitted each day after the small group tests. It was necessary to return to some of the classes an additional day in order to complete the individually administered measures.

## Qualitative Data Collection

The qualitative techniques used were designed to gather the maximum amount of descriptive data from individual students as well as small groups. Quantitative data was gathered during pretesting, posttesting, and the training sessions.

### Student Interview

Each subject was interviewed individually at the beginning and the end of the training period. A sample of the interview form may be found in Appendix C. The members

of the evaluation team who conducted the interviews were instructed by the researcher regarding the appropriate method for conducting the student interviews, and the classroom teacher did not participate in conducting the interviews. In order to gather descriptive information, each student was asked what the examiner could write to tell about the child. Students were encouraged to answer; however, examples and suggestions were not offered when they did not respond. The question was repeated in order to gather a maximum of 10 responses. This questioning procedure was used in previous research examining the self-concept of young children (Keller, Ford, & Meacham, 1978).

The second question was adapted from the work of Wallach and Kogan (1965) and was intended to gather additional information regarding the creativity of the subjects. Each student was shown an unusual object and asked to suggest what the object could be or how it could be used. The three objects which were used in this study were made by students in the mechanical engineering laboratory at Rice University. One of the objects was a heavy, metal cylinder approximately 10 inches in length. Another object was a metal rectangle 2 x 5 inches which had one small hole near each corner. The third object was a short, fat, metal cylinder with one large hole through the

middle and several small holes which went approximately 1/2 inch into the cylinder. One object, chosen at random, was shown to each of the students. Since it was possible that any one of the items might have produced more creative responses from the groups, care was taken to insure that an approximately equal number of students in each classroom responded to each object. Each of the three members of the testing team who were conducting the pretest interviews chose one object and was given a group of students to interview. Prior to the posttesting, the researcher randomly selected one of the two remaining objects which the student had not previously seen, and this object was shown to the student for the later interview.

Participant Observations

Descriptive data were also obtained by tape recording the training sessions conducted with the two classrooms of experimental students. The tapes from the sessions were transcribed by the researcher and analyzed.

The synectics training, used in this research, provided opportunities for the students to display their ideas in a variety of forms. They responded verbally during some of the activities and often drew pictures, which they then orally described. Some of the activities required the manipulation of objects and data regarding

these sessions was obtained when the students orally described what they had done with the objects.

Careful anecdotal records were kept by the researcher as a participant-observer in the experimental classrooms. Information obtained through conversations about the students with the classroom teacher was also recorded by the researcher.

## Training

Identical synectics sessions were conducted in the gifted training classroom and the nongifted training classroom. The sessions were held twice a week for 12 weeks. Small groups of 8 to 10 children met for 20 minutes during each session. Each session was repeated in the classroom until all the experimental students had participated. The basic format for the sessions was extracted from Strange and Familiar, Book I (Gordon & Poze, 1990), which includes the exercises previously used by Gordon and Poze (1975) with kindergarten students. Various changes and modifications to these activities were made by this researcher and original activities based upon the synectics process were also included. Several synectics activities involving art were also developed by the researcher based on information provided by Roukes (1982) in Art Synectics. Many of the researchers' original

activities were discussed with synectics experts (J. McIntyre, personal communication, June 1991; A. Norbett, personal communication, June, 1991; D. Taylor, personal communication, June, 1991; T. Poze, personal communication, June,1991, & October, 1991), in order to assure that all aspects of the training utilized the synectics process. Many of these had been previously piloted in an exploratory study by the researcher (Meador, 1989b).

## Design and Analysis

Data obtained from this research were analyzed in order to describe the effect of synectics training on subject's creativity, self-concept, and verbal skills. The data was also analyzed to determine the difference in the effect on various groups within this descriptive study. The information gained was organized according to seven groups. These included the gifted experimental group, the nongifted experimental group, the two gifted control groups, and the nongifted control group which were established by the researcher design. The other two groups, which included the highly creative experimental group and the group of experimental students who are average or below average on their pretest creativity scores, were determined statistically from the results of the Torrance Test of Creative Thinking (Torrance, 1962b,

1962c). Those students who scored 125 or above on the pretest formed the highly creative group, and all the other students were part of the average to below average group.

Quantitative Data Analysis

Gain scores derived from the analysis of pretest and posttest scores on the Peabody Picture Vocabulary Test (Dunn and Dunn, 1981a), Torrance Test of Creative Thinking (Torrance, 1962b, 1962c) and the Martinek-Zaichkowsky Self-Concept Scale (Martinek & Zaichkowsky, 1971) were statistically analyzed through one-way analysis of variance. The .05 level of significance was used in the evaluation of the hypotheses.

The Torrance Test of Creative Thinking (Torrance, 1962b, 1972c) was also analyzed to check for variation in scores on the individual creative constructs. One-way analysis of variance was computed for fluency, originality, abstractness of titles, elaboration, resistance to closure, and creative strengths. These constructs were previously described in Chapter I. The experimental group was compared to the control group and the gifted experimental group was compared to the nongifted experimental group.

The researcher was the sole scorer for the three standardized instruments. Since scoring the Peabody Picture Vocabulary Test (Dunn & Dunn, 1981a) and the

Martinek-Zaichkowsky Self-Concept Scale (Martinek & Zaichkowsky, 1971) merely require a count of the test items and mathematical calculation of the score, it was not necessary to establish validity and reliability of scoring.

This was, however, required for the Torrance Test of Creative Thinking (Torrance, 1962b, 1962c). It was necessary to establish the quality of the researcher's scoring and confirm that it met the standards established for this test. The creative index scores derived by the researcher for six tests were compared against those of an expert scorer who had been trained by Torrance. The Kendall W Coefficient of Concordance, calculated for these scores, was .91. This reached the .1035 level of significance. Although the Kendall Coefficient indicated satisfactory agreement between the researcher and the expert, the small number of cases used resulted in the lack of significance at the .05 level. The correlation was, therefore, also calculated through computation of Pearson's R which yielded a correlation coefficient of .99 which was significant at .01. It was concluded that the researcher's scoring was valid and met established standards for the test.

It was also necessary to control for researcher bias and make sure that the same type of judgment was used on

both the pretests and the posttests of the Torrance Test of Creative Thinking (Torrance, 1962b, 1962c). In order to establish reliability, five pretests were chosen at random from the 109 which were given in September. The researcher rescored these tests in February and compared the scores with those for the same tests when she had scored them in September. The Kendall W Coefficient of Concordance calculated for these was .95. Again, due to the small number of cases, this was not significant at the .05 level ($p$ = .1074). Recheck with Pearson's R of .97 did, however, result in significance at .01. It was concluded that the researcher's intra-rater reliability was stable across the 6 month interval.

## Qualitative Data Analysis

### Interview Analysis

The individual student responses to the interview questions asked before and after the 12 weeks of training were coded by the researcher and statistically analyzed. This was to determine whether there were any changes in the responses of the groups as a result of the training. Coding for responses to the self-concept question, in which students were asked to tell about themselves, is explained in Table 1. The categories used are similar to those used by Keller, Ford, and Meacham during their 1978 study.

The data were analyzed by computing Goodness of Fit Chi Square using the total group pretest scores as the expected frequencies. The posttest scores were calculated against these for the groups. Categories 8, 10, and 11 were collapsed into one category in order to avoid cells having expected frequencies of less than 5.

Table 1

Categories Used for Coding Student's Self-Concept Interview Answers

| Category | Positive | Negative |
|---|---|---|
| Ability | 1 | 12 |
| Preferences | 2 | 11 |
| Physical Attributes | 3 | 10 |
| Family and Social Relations | 4 | 9 |
| Superficial | 5 | |
| Global | 6 | 8 |
| Possessions | 7 | |

During the interviews, conducted pre- and post-training, each student was given an opportunity to display creative thinking. Each child was asked to give a maximum of ten responses describing the use of a novel object. Student responses were coded, by the researcher, according

to the categories shown on Table 2. The results of the pretest and posttest creativity question were calculated in the same manner as the results from the self-concept question.

Table 2

Categories Used for Coding Student's Creativity Interview Responses

| Category | Explanation | Example |
|---|---|---|
| Closure | student gave no answers | |
| Global Whole | object used as a single entity | a weight |
| Use | object functioned as a part of something | wheel of a car |
| Description | information about the object | it's heavy |
| Scenario Use | described how the object could be instrumental in a chain of events | when the rain falls, and the water builds up, object can be used to put in the hole to keep the water out of the house |
| Item Change | something that could be done with or to the object | paint it |

Analysis of Classroom Data and Notes

The transcripts of the training sessions were analyzed in order to obtain descriptive data regarding the students and the effect of the training. The analysis depended, in part, upon the type of activity or discussion which was conducted during the training session; however, all of the transcripts were specifically examined for changes in creativity, self-concept, and verbal skills.

It is difficult to compare student's responses from various sessions; therefore, five of the sessions were analyzed in terms of a response hierarchy. Each of the experimental students present during the individual sessions was given a score of 1 to 4 or 5 for the activity. A description of the hierarchy for the various products follows.

Transcripts of sessions 1 and 24, in which the students responded verbally to questions about the similarities between two pictures, were analyzed according to type of answer. Each answer on the transcript of these two sessions was coded according to the following hierarchy: (1) incomplete--the response did not indicate a true similarity; (2) visual--the response indicated a visual similarity: (3) functional--the response indicated something that both objects or animals could do; and

(4) other--a response which did not fit in categories 1, 2, or 3. The number of responses given in each category was divided by the total number of responses given by all the students during that session. The results provided information regarding the percentage of responses given in each category. Sessions 1 and 24 were then compared to see what changes resulted from the training.

Session 20, which required students to make analogical connections, was analyzed according to a response hierarchy. The students gave oral responses during this session. Individual students were rated according to fluency of original ideas using five categories: (1) no ideas, (2) repeated another student's idea, (3) gave one original idea, (4) gave two or three original ideas, and (5) gave more than three original ideas. A percentage score for each category was obtained by dividing the number of students achieving each score by the total number of students who participated in the activity. The results for the gifted experimental group were compared with those for the nongifted experimental group.

The visual representations of ideas drawn by the students were analyzed in terms of fluency of ideas. The activity in session 6 involved creating and drawing a robot, while the pupil product for session 23 was an

unusual bike. Since the number of ideas presented in each picture was indicative of the creative quality of the product, the fluency score is synonymous with student creativity on these two products. A precedent for this assumption was established by the early work of Wallach and Kogan (1965) who suggested that creativity can be measured by the total number of responses that a person can generate on a given task and the relative uniqueness of those responses. A marked order effect with popular answers generally occurring earlier and unique responses later in the sequence was found by Moran et al. (1983) and Mehrotra (1987). Since the more novel responses are expressed later, fluency of ideas is a logical measure of creativity. In order to score the pictures, the number of different ideas represented in a picture was counted for each individual student. Since many of the pictures were difficult to decipher, the transcription of the children's oral descriptions of the products proved valuable in the analysis of ideas. Fluency levels were used to create a hierarchy for the products. Two examples of figural products and their scores may be found in the Appendix D.

The drawing, which each student made during sessions 6 and 23, was rated according to the following hierarchy: (1) no ideas given which related to the assignment,

(2) 1--2 ideas shown, (3) 3--4 ideas given, (4) 5--6 ideas illustrated, and (5) more than 6 ideas given. The number of students in each category was divided by the total number of students who completed the activity in order to gain a percentage score for each level of the hierarchy. These were compared for sessions 6 and 23 in order to determine the effect of the training on this type of activity.

It was not possible to score the pupil products completed during the training sessions which required manipulation of objects. In general the products were assessed according to the type of combination of objects produced and ranged from very simple, obvious connections to complex representations of abstract ideas.

## Summary

The subjects of this research were 109 students from five classrooms in an urban north Texas school district. Three of the classrooms served identified gifted children and the other two served nongifted students. Twelve weeks of training in synectics was conducted in one classroom of gifted and one classroom of nongifted students. A description of all subjects was obtained before and after the training through various quantitative and qualitative data gathering techniques. Posttest data were not

available for three of the control subjects. It was the purpose of the study to determine the effect of the synectics training on the subject's creativity, self-concept, and verbal skills and to compare these effects among gifted and nongifted kindergarten students. The effect of the training on highly creative students was also investigated.

# CHAPTER IV

## FINDINGS

This chapter presents the findings of the study examining the effect of synectics training on gifted and nongifted kindergarten students. The results of this research are reported to answer the three research questions which formed the basis for this study.

1. What changes in creativity, self-concept, and verbal skills will result from training kindergarten children in synectics?

2. How will the effect of synectics training on creativity, self-concept, and verbal skills differ between gifted and nongifted students?

3. How will changes in creativity among highly creative subjects involved in the training differ from changes in creativity among subjects with average or below average creative abilities.

The sample consisted of 109 students who were enrolled in five kindergarten classes in one school district. The results of the study were reported for the following groups:

1. Gifted experimental group
2. Nongifted experimental group

3. Gifted control group 1
4. Gifted control group 2
5. Nongifted control group

In order to report the findings pertaining to the third research question regarding creativity, the experimental students were also studied as members of two additional groups. Students who scored 125 or above on the pretest administration of the Torrance Test of Creative Thinking (Torrance, 1962b) were designated members of the highly creative group, and the remaining experimental subjects were members of the average to below average creativity group.

Posttest data were not gathered for 2 students who moved from the district during the data collection period and one student who was absent during posttesting. All three of the groups of gifted students attended morning kindergarten classes, and both of the nongifted groups attended afternoon classes. Students in one of the gifted classes and one of the nongifted classes received synectics training. The students in the sample ranged in age from 61 months to 77 months with a mean age of 68.5 months for the five groups. The mean age for each of the groups was as follows: gifted experimental--67.9 months, nongifted experimental--69.8 months, gifted control 1--68.7, gifted control 2--68.4 months, and nongifted control--67.8 months.

There was no significant difference between the mean ages of the students in the groups.

In order to describe the effect of the synectics training, each of the 24 sessions conducted by the researcher with the training groups was tape recorded. Anecdotal records and observations by the researcher and the classroom teachers were written for the two groups which received training. Pupil products, in figural, verbal and manipulative forms, were analyzed according to the procedures described in Chapter III. Quantitative information was also collected for all of the subjects before and after the training of the one gifted and one nongifted group. Standardized instruments were used to assess the following: creativity--figural forms of Torrance Test of Creative Thinking (Torrance, 1962b, 1962c), self-concept--Martinek-Zaichkowsky Self-Concept Scale (Martinek & Zaichkowsky, 1971); and verbal skills--Peabody Picture Vocabulary Test (Dunn & Dunn, 1981a). An interview was conducted with each student to gain further information on self-concept and creativity.

## Results

### Research Questions

Descriptive observational information addressing the research questions is provided for the training groups. Statistical information pertaining to the research

questions and hypotheses for all five classrooms of students on the three standardized measures and interviews are also discussed. Statistical results were evaluated at the .05 level of significance.

Effect of the Training on Dependent Variables

Research question 1 asked what changes in creativity, self-concept, and verbal skills would result from training kindergarten children in synectics. Figure 1 provides overall information regarding the mean gain scores for the experimental and control groups on the standardized assessment tools used in the study. A one-way analysis of variance on each measure revealed that there was no significant difference between the two groups in measured self-concept or verbal skills. The results of the analysis of the creativity test were, however, significant at the .0001 level. The results of each of these assessments will be discussed in detail.

Creativity. Hypothesis 1, subjects engaged in synectics training will show more improvement in creativity scores than subjects not engaged in the training, is related to the research question being addressed in this section. This hypothesis is supported by the statistical information derived from the standardized creativity test and the qualitative information gathered by the researcher which will be discussed later. Table 3 provides

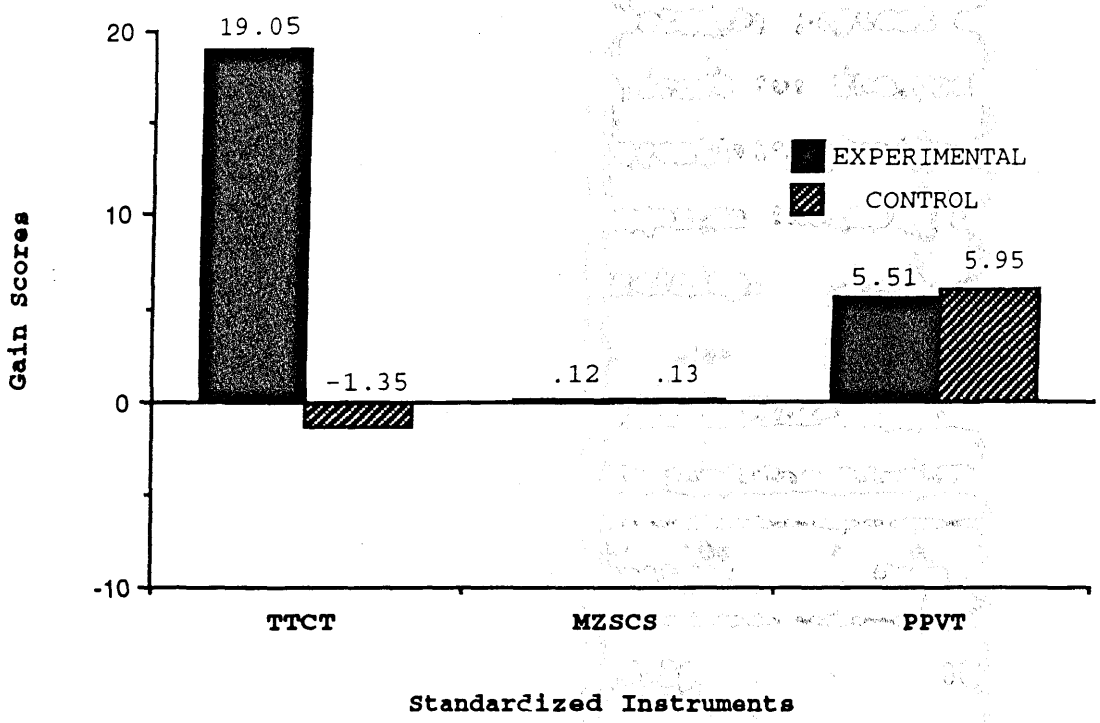


Figure 1. Comparison of Mean Gain Scores for Experimental and Control Groups on the Torrance Test of Creative Thinking (TTCT), Martinek-Zaichkowsky Self-Concept Scale (MZSCS), and the Peabody Picture Vocabulary Test (PPVT)

information regarding the mean gain scores of all groups of subjects on the Torrance Test of Creative Thinking (Torrance, 1962b, 1962c).

The mean for the Torrance Test of Creative Thinking (Torrance, 1962b, 1962c) is 100 and the standard deviation is 20 (Torrance & Ball, 1984). The statistical information

found in Table 3 indicates that the experimental groups made significant increases of approximately one standard deviation in creativity as indicated by pretest and posttest scores. The mean gain score for the control groups indicates a decrease in creativity during the research period. The data document an increase in creativity as a result of the training.

Table 3

Mean Pretest, Posttest and Gain Scores for Experimental and Control Groups on the Torrance Test of Creative Thinking

| Group | Pretest | Posttest | Gain Score |
|---|---|---|---|
| Experimental | 100.16 | 119.21 | 19.05 |
| Control | 107.31 | 105.41 | - 1.34 |

Note. There was no significant difference between the groups on the pretest; however, the difference in the mean posttests was significant at the .05 level. The difference in the gain scores was significant at the .0001 level.

In order to gain more specific information about the components of creative growth tested by the Torrance Test of Creative Thinking (Torrance, 1962b, 1962c), a one-way analysis of variance was computed for each creative construct measured by the test. These included fluency,

originality, abstractness of titles, elaboration, resistance to closure, and creative strengths, which were previously defined in Chapter I. A significant difference ($p < .05$), ranging from .0001 to .0438, was found for each construct when the experimental group was compared to the control group. This was to be expected in light of the large difference between the overall mean scores for the groups. The most significant differences were found for fluency and creative strengths.

Information obtained from the pretest and posttest creativity interview question was coded, according to the categories discussed in Chapter III, and compiled for the entire group, the experimental group, and the control group. Table 4 provides specific information regarding the number of students who gave various categorical responses.

Goodness of Fit Chi Square, computed with this information for the experimental versus the control groups, was 190.396 which is significant at the .0001 level. The information in Table 4 indicates the specific changes which took place within each group.

A careful analysis of creative products completed by students during the training exercises helped to elaborate upon the changes demonstrated by the two experimental groups on the creativity test. The products analyzed were in various product forms since the students either drew

Table 4

Creativity Interview Data for Entire Group, Experimental Group and Control Group

| Category | Total Group | | Experimental | | Comparison | |
|---|---|---|---|---|---|---|
| | Pre | Post | Pre | Post | Pre | Post |
| Closure | 8 | 6 | 5 | 3 | 3 | 3 |
| Global Whole | 73 | 147 | 18 | 65 | 65 | 73 |
| Use | 238 | 204 | 74 | 99 | 164 | 105 |
| Description | 37 | 41 | 27 | 17 | 10 | 24 |
| Scenario Use | 6 | 5 | 2 | 4 | 4 | 1 |
| Item Change | 42 | 124 | 7 | 59 | 35 | 65 |

pictures, manipulated objects or gave verbal responses during the activities.

The pictures drawn by students in the 6th and 23rd sessions were compared as a measure of creative growth. During the sixth session, the students drew a robot which would help catch the Gingerbread Boy. They created this robot by borrowing unique physical abilities from animals which the group had studied. Session 23 required students to create an unusual bike which would help to get a college student home for Thanksgiving. Criteria for this assignment were established by the children.

Figure 2 documents the changes in creative products between the two sessions. The data are presented in

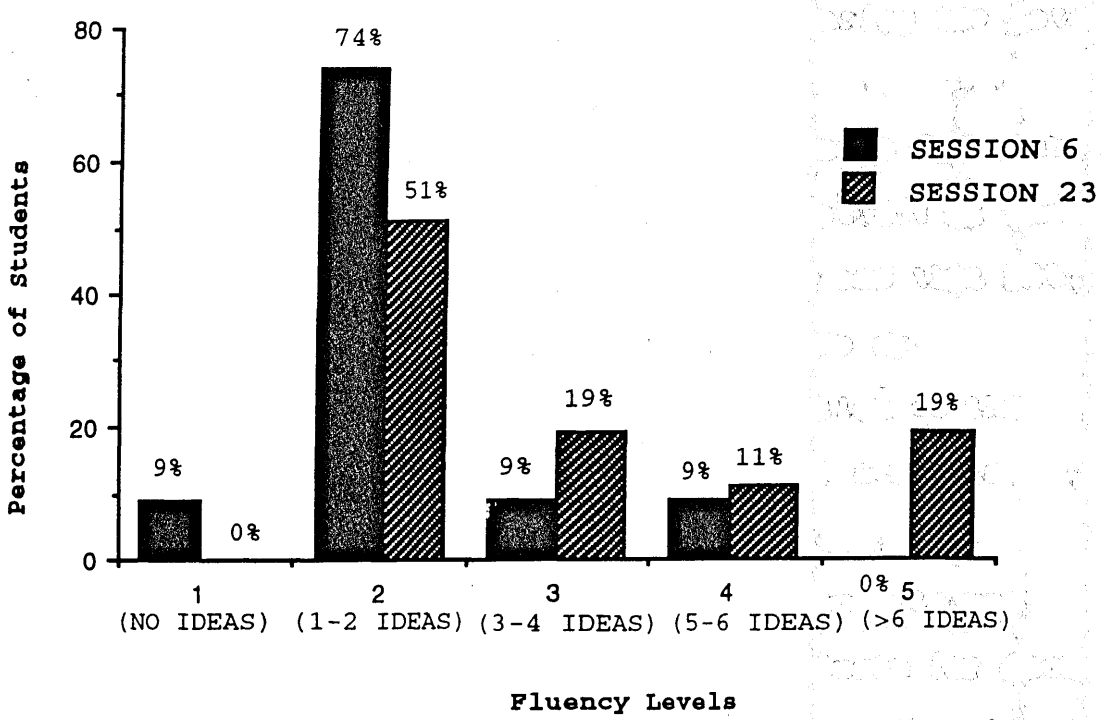


Figure 2. Comparison of Percentage of Experimental Students at Fluency Levels During Session 6 and Session 23

percentages calculated by dividing the number of students at each level by the number of students who completed both products. A few students were absent during each of the sessions. The increase in fluency is apparent from the

information found on the graph. It may be noted that no students were unable to produce ideas during the 23rd session. A comparison of the percentage changes between the two sessions illustrates that while the majority of the responses remained at fluency level 2, 31% more student products reached levels three through five during the later session.

A perusal of the scores on the two products for each individual experimental subject indicates that 45% of them demonstrated an increase in fluency of ideas and that 94% of the student scores either remained the same or increased. This provides authentic verification of the increase in creativity among the experimental students during the research period.

A more general analysis of the visual products was conducted by juxtaposing the two session products for each individual student. Creating an environment in the picture was the exception during session 6; however, almost all of the drawings produced in session 23 illustrated an environment. In addition, most of the pictures in the later session covered the entire page while those in session 6 were smaller and less elaborative. The overall visual quality of the drawing was better on the second effort.

Comments by the instructor of the nongifted experimental group, made during approximately the 10th week of training, also indicated an increase in the creativity of these students as a result of the training. The teacher, comparing the training students with those in her classes during previous years, noted that it was easier for her to get these students to participate in activities which required creative expression.

The statistical information presented which compared the creativity scores of experimental and control students leads to an acceptance of hypothesis 1. There was significant positive growth in the creativity scores of the experimental students as a result of the training. All of the quantitative data also supports the hypothesis.

Self-Concept. The second research hypothesis stated that subjects engaged in synectics training will exhibit greater improvement in self-concept than subjects not engaged in the training. Table 5 provides information relating to this hypothesis.

A one-way analysis of variance performed on each set of pretest, posttest, and gain scores revealed no significant difference between the experimental and control groups; therefore, the statistical data requires rejection of Hypothesis 2. This indicates that the training did not

Table 5

Mean Pretest, Posttest and Gain Scores for Experimental and Control Groups on the Martinek-Zaichkowsky Self-Concept Scale

| Group | Pretest | Posttest | Gain Score |
|---|---|---|---|
| Experimental | 24.05 | 24.16 | .12 |
| Control | 23.95 | 24.06 | .13 |

affect self-concept as measured by the Martinek-Zaichkowsky Self-Concept Scale (Martinek & Zaichkowsky, 1971).

Student responses to the self-concept interview question were coded as discussed in Chapter III. Table 6 lists the number of pretest and posttest responses given in each category by the groups. A Goodness of Fit Chi-Square (186.995), computed on this information for experimental versus control groups, was significant at the .0001 level.

Qualitative information pertaining to the self-concept research hypothesis is more difficult to analyze than the aforementioned student information on creativity. It is difficult to observe overall changes in self-concept for a group of students. Scrutiny of the test and interview results, the transcripts of the training sessions, and the researcher's anecdotal records, however, indicate positive changes in individual students. These changes can be

Table 6

Self-Concept Interview Data for Entire Group, Experimental Group and Control Group

| Category | Total Group | | Experimental | | Comparison | |
|---|---|---|---|---|---|---|
| | Pre | Post | Pre | Post | Pre | Post |
| Ability (Positive) | 50 | 72 | 20 | 42 | 30 | 28 |
| Ability (Negative) | 4 | 2 | 1 | 1 | 3 | 0 |
| Preference (Positive) | 158 | 201 | 43 | 85 | 115 | 120 |
| Physical Attributes (Positive) | 32 | 9 | 6 | 5 | 26 | 4 |
| Physical Attributes (Negative) | 1 | 0 | 1 | 1 | 5 | 1 |
| Family and Social Relations (Positive) | 15 | 5 | 1 | 0 | 0 | 0 |
| Superficial | 89 | 120 | 30 | 54 | 59 | 66 |
| Global (Positive) | 83 | 74 | 45 | 28 | 38 | 46 |
| Global (Negative) | 6 | 6 | 1 | 2 | 5 | 4 |
| Possessions | 22 | 33 | 6 | 14 | 16 | 18 |

realistically documented for approximately eight of the 43 experimental students. Two of these students will be discussed herein.

A change in self-concept was observed for Boy 103. Identical pretest and posttest scores of 19 out of 25 possible points on the Martinek-Zaichkowsky Self-Concept Scale (Martinek & Zaichkowsky, 1971) do not indicate any positive growth in self-concept for this student. Perusal of the self-concept interview, however, was revealing and indicated a positive change in Boy 103. During the pretest interview, Boy 103 gave only four responses when he was asked to tell about himself. Three of these responses were negative and dealt with family relations, physical attributes, and abilities. The two positive responses indicated things that Boy 103 likes to do. During the posttest interview, Boy 103 was more fluent and gave 9 responses. Only one of these, dealing with family relations, was negative. Five of the responses indicated positive things about family and social relations, two indicated things which the child likes to do and one answer was global in nature.

The following descriptive examples support the positive results of the posttest interview and indicate how the boy's self-concept improved within the setting of the training exercises. Boy 103 was extremely apprehensive

during the pretesting sessions. When he discovered that there were people in the classroom which he did not know and that pencil and paper activities were to be conducted, he cried. With careful attention and continual support and encouragement by personnel conducting the testing, the boy was able to complete all the required exercises. While taking several of the tests, he perseverated saying "Momma, Momma, Momma" quietly without seeming to be aware that he was speaking. This boy was very hesitant about participating in the individual interview and tried to rush through it while keeping an eye on the rest of the class. During approximately the first three training sessions, Boy 103 was apprehensive about joining the group and spent a great deal of time looking over his shoulder at the classroom teacher and asking the researcher when he would be finished. Even though he was working with a group of his classmates, he expressed considerable concern over what the rest of the class was doing and the fact that he was not taking part. In actuality, no activity was missed since the groups were rotated between the classroom teacher and the researcher in order that all might take part in every activity. During the first session in which the students gave similarities for pairs of animals, Boy 103 displayed a lack of involvement by repeating answers previously given by other students. For example, he stated

that dogs and cats are similar because they chase. Two other students had given this answer immediately preceding his response.

The above description may be contrasted with the actions of this boy at the end of the training. During the later training sessions Boy 103 seemed to enjoy the activities, participated without concern for other classroom activities and brought considerable humor and enthusiasm with his answers. This is exemplified by a conversation in Session 20 during which Boy 103 and Boy 120 discussed how to help an invisible dog, following some children, make his presence known to them.

> Boy 103: "I think he should keep on going until he gets there and break in the door and scratch on the door and then no one could see him, but he could say that he was there."
>
> Boy 120: "I got another idea, he could just go to the door and break it down and say 'ruf'."
>
> (Two other children briefly discuss solutions)
>
> Boy 103: "I think he could go back in time and be born again."
>
> Boy 120: "That's like what I said on the wizard." (previously discussed)
>
> Researcher: "Yes, it was just said a little differently. What could we do so this dog could be noticed?"
>
> Boy 103: "He could make a time machine."

This conversation illustrates how Boy 103 became more assertive and shows that he was confident enough to give a fantasy response to the problem.

Changes in this boy were also apparent during posttesting, which did not appear to frighten him. He completed all of the activities with confidence and was eager to participate in the final interview.

An improvement in self-concept was also demonstrated by Girl 210 who only spoke when called upon the for first 15 sessions. When the researcher asked for her ideas during the first 8 weeks of the training, her response was always brief and quietly spoken. If she chose to give an answer other than saying she didn't know, it was always a repeat of another student's response. During approximately the fourth or fifth week of the training, Girl 219 began to hug the researcher when she came into the classroom. Shortly thereafter, she began to show her the school work she was completing or a picture she had drawn. Later, she also began to periodically talk briefly to the researcher in a barely audible voice, prior to the sessions. During the 16th session, Girl 219 raised her hand and gave a short answer. The researcher was not able to hear the girl's response; however, the session continued without the researcher stopping to question her. During the next session, the girl also raised her hand and gave an answer

which could be heard but was not understood. Thereafter, she contributed to the discussions and usually gave short responses which could be understood by members of the group.

These observed changes coincide with Girl 219's scores on the Martinek-Zaichkowsky Self-Concept Scale. She scored 20 on the pretest and 24 of 25 possible on the posttest which shows a gain score of 4 points. Her posttest interview may also indicate positive growth in self-concept since she was willing to give more answers during the later session. Girl 219's fluency score rose from 2 to 5 and all responses given during both interviews were positive; therefore, the training was effecting in building self-concept in Girl 219.

Even though changes in a few individual students can be qualitatively documented, there is not sufficient evidence to support Hypothesis 2. It is, therefore, rejected.

Verbal Skills. Hypothesis 3 stated that subjects engaged in synectics training will exhibit more positive growth in verbal skills than subjects not engaged in the training. Table 7 details the statistical information gained from the Peabody Picture Vocabulary Test (Dunn & Dunn, 1981a) and related to this hypothesis.

Table 7

Mean Pretest, Posttest and Gain Scores for Experimental and Control Groups on the Peabody Picture Vocabulary Test

| Group | Pretest | Posttest | Gain Score |
|---|---|---|---|
| Experimental | 102.95 | 108.47 | 5.51 |
| Control | 100.95 | 106.69 | 5.95 |

The majority of the students in both groups showed positive growth on the Peabody Picture Vocabulary Test. One-way analysis of variances revealed no significance between the pretest scores, the posttest scores, or the mean gain scores of the two groups. The figures do not support the hypothesis which required significance at the .05 level.

Qualitative information, which is pertinent to this hypothesis, was gained by perusal of the tape transcripts of the training sessions. This made it possible to describe changes in the verbal skills of the experimental groups during the research period which may not have been evaluated by the standardized assessment.

Identical first and last training activities were used with the two experimental groups. The activity used involved a discussion of similarities between pairs of animals which were displayed through hand-drawn pictures.

This activity was used since the ability to note similarities between things is basic to analogizing (Gentner, 1977) which is important for success in synectics.

Similarities which referred to things that both animals could do were mentioned by the students in session with largely single word answers such as responses indicating that both animals could run, jump, eat, and so forth. These types of similarities described during the last session were more elaborative. These included statements that the dog and cat can both "put their tail around you," "get exercise by chasing," and "lick theirselves (sic) with a tongue." Single word comments describing visual similarities, such as those indicating that both animals have tails, eyes, and ears, were offered by individuals during the first session. The describers, which were common in the first session, tended to come as strings of words from a single person such as "they both have whiskers and they both have mouths and noses and eyes" during the last session. When single idea describers were offered in the last session, they were more likely to be accompanied by elaboration such as "noses to smell with". Repetition of answers given by other students was more common in the first than in the last session. Students in the final session also had a greater tendency to discuss

and argue about the answers given by others. One such discussion ensued regarding whether or not dogs have whiskers.

Individual student growth in verbal skills is also documented by the transcripts. An increase in the amount of verbal responses of Girl 219 has been discussed previously in the section on change in self-concept. It is debatable whether the changes reported for Girl 219 were the result of improved self-concept, improved verbal skills or a combination of the two. Verbal change is, however, apparent and supported for this child by a gain score of 18 on the Peabody Picture Vocabulary Test (Dunn & Dunn, 1981a)

Approximately five other individual experimental students obviously exhibited a change in their verbal participation during the 12 week research period. This discussion of changes in Girl 119 and Boy 102 will serve as an example. Girl 119 offered few responses to questions posed at the beginning of the research activities, however, after approximately Session 18, her level of response increased and her answers became more elaborative. This is illustrated by the dialogue which follows. In the first discussion, during Session 5, Girl 119 is describing her picture of a robot designed to catch the Gingerbread Boy.

Girl 119: "It's a porcupine, so it can stick."

Researcher: "What does that do to the Gingerbread Boy?"

Girl 119: "It makes some of it fall off."

When other students were questioned after their drawings, most of them responded with more lengthy and elaborative explanations. The researcher's comments written immediately after the training session state that "Girl 119 was never really involved and doesn't seem to know the purpose of what she drew." The discussion which follows indicates a higher level of verbal participation exhibited during Session 18. In this session, two other students, who had worked together, were describing something which they had made through the manipulation of two objects and Girl 119 became enthusiastically involved.

Researcher: "Boy 122, would you please tell us what objects you used?"

Boy 122: "A ruler and a turn table."

Researcher: "(name), what did you make?"

Girl 109: "A turning bridge, so when somebody gets on here, (demonstrating) they can just turn it and get off and just walk over here."

Girl 119: (interrupting) "Maybe I could make one for our playhouse 'cause (sic) our a (sic) playhouse is breaking down and we are goin' (sic) to throw it away pretty soon and we could make something in our backyard and be funny."

Girl 109: (undaunted) "And this is for when little kids can come out here and just get on one of these

(demonstrating) and then turn it and have a ride and the ruler is so they can hold onto."

The third narration, which demonstrates the excitement of Girl 119 during Session 23, is her description of a special bicycle she designed to help a boy get home from college.

Girl 119: "Mine was finished the very firstest (sic). This is where they carry the food (demonstrating) and this is where the handles come out and this you can open up and . . . the seat and that's where the bag is and that's the game."

Researcher: "A game?"

Girl 119: (disgusted) Game!"

Researcher: "What's all this pink stuff in here?"

Girl 119: "That's all the clothes and there's his spare tires."

These observed changes in verbal skills appear to be mainly is terms of fluency. Verbal changes for this student are not supported by her Peabody Picture Vocabulary Tests (Dunn & Dunn, 1981a) gain scores which indicated a decreased of 7 points on the posttest. Her fluency on the interview questions increased by a mere 2 responses on the post interview.

Boy 102 also displayed the effect of the training on verbal skills; yet, his gain score on the Peabody Picture Vocabulary Test (Dunn & Dunn, 1981a) was only six points. A more authentic picture is presented in the transcripts of the sessions. During approximately the first eight weeks, Boy 102 had very little to say during the sessions and

responded only when called upon. Later in the training, however, he became much more verbose and began to volunteer answers and contribute to the discussions. Below he describes a contraption he made during a forced association activity with kitchen objects. Boy 102 had a bottle and a piece of string with which to work.

> Boy 102: "First we made an electrical bottle and then we made this thing so you can pull it down to break."
>
> Researcher: "A bottle breaker? Show us how you made the electrical bottle."
>
> Boy 102: "We put the string through the hole."
>
> Researcher: "That string doesn't represent just string. What else might it represent?"
>
> Boy 102: "Wire."
>
> Researcher: "It could represent wire and he puts it in the bottle and what do you do with this end?"
>
> Boy 102: You'll see! Electricity goes through it and then it and then if someone's trying to break it just like this (demonstrating), then, a, then it's going to come up and go through all the lines and it's going to go inside their hand. Electricity will."
>
> Researcher: "Is it kind of like a burglar proof bottle?"
>
> Boy 102: "Yes!"

These examples of changes in verbal skills among individual experimental students mainly display more fluency responses to the training activities and more elaborative speech. Since these changes can be concretely

documented for only a handful of students, Hypothesis 3 must be rejected.

Differences in the Effect of Training Between Experimental Groups

Research question 2 explored how the effect of the synectics training on creativity, self-concept and verbal skills differed between gifted and nongifted students. The hypothesis which relates to this question stated that gifted subjects engaged in synectics training will exhibit more changes in the dependent variables than all other subjects. Figure 3 compares the mean gain scores for each of the two experimental groups on the three standardized instruments used before and after the training. An analysis of variance on the gain scores for the three instruments revealed that the slight difference in scores between the groups is insignificant at the .05 level.

Creativity. Data, in terms of pupil products, strongly support the similarity of change in creativity between the two groups. A comparison of similar pupil products from Session 6 and Session 20 supports the similarity in gain scores on the Torrance Test of Creative Thinking (Torrance, 1962b, 1962c). An analysis revealed that approximately the same percentage of students in both groups were more fluent on the second product. The product analysis disclosed that 44% of the gifted experimental and

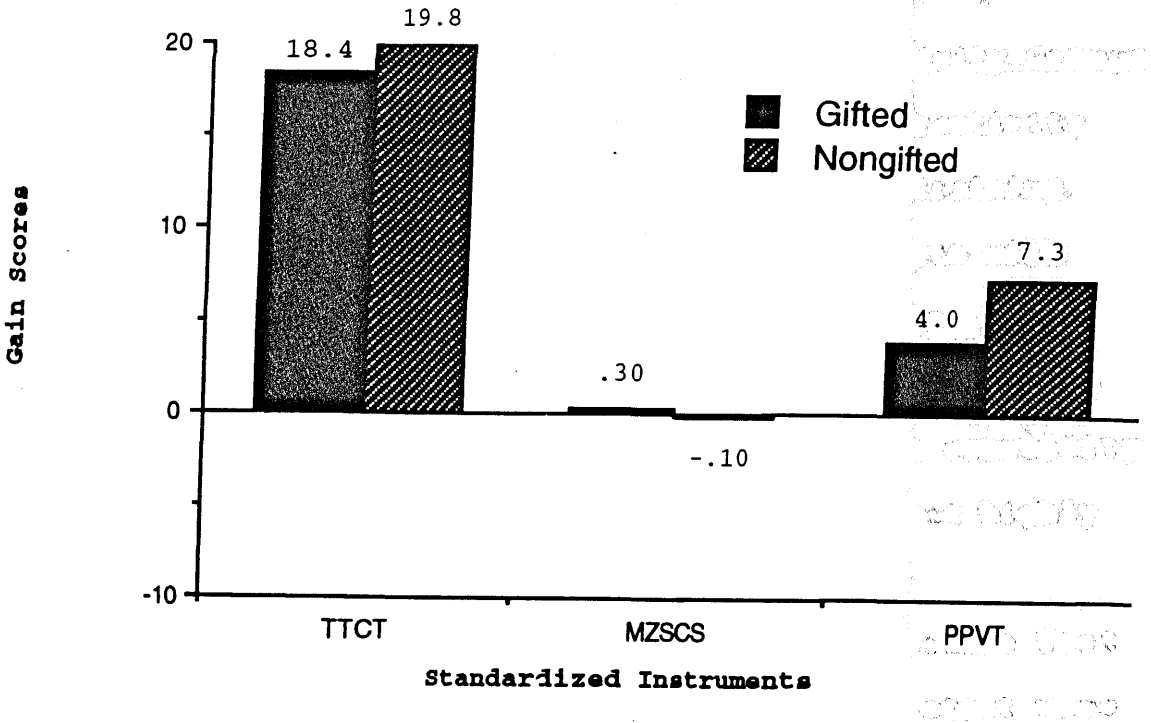


Figure 3. Comparison of Mean Gain Scores of Gifted and Nongifted Experimental Groups on the Torrance Test of Creative Thinking (TTCT), Martinek-Zaichkowsky Self-Concept Scale (MZSCS) and the Peabody Picture Vocabulary Test (PPVT)

47% of the nongifted experimental subjects were more fluent during the later session.

Self-Concept and Verbal Skills. The qualitative data verify the fact that the changes which occurred in the students were similar for both the gifted and nongifted

experimental groups. Documentation of growth in self-concept and verbal skills can be found for approximately the same number of students in each group.

Differences in Effect of Training Between Creativity Groups

Research question 3 asked how changes in creativity among highly creative subjects involved in the training differed from changes in creativity among subjects with average or below average creative abilities. The hypothesis relating to this question stated that subjects who are highly creative will show less change in creativity as a result of the training than those who are not highly creative.

Students who scored 125 or above on the Torrance Test of Creative Thinking (Torrance, 1962b, 1962c) pretest were designated highly creative. The mean gain score for the five highly creative experimental students is 5.6 and may be compared with a mean gain score of 20.95 for the other experimental subjects in this study. A one-way analysis of variance conducted on these results yielded an F Probability of .0584 showing nonsignificance at the .05 level. The hypothesis is, therefore, rejected. The difference in scores does, however, indicate that the highly creative experimental students did not change as much in creativity as the average to below average subjects.

One blatant exception to the statement above is a highly creative student whose scores on the Torrance Test of Creative Thinking (Torrance, 1962b, 1962c) are not entirely indicative of her creative powers. This is demonstrated by the fact that her scores on one of the test's constructs during the pretesting and two constructs during posttesting were evaluated at the ceiling level of 200. This child improved her creativity score by 28 points from pretest to posttest and is certainly the exception to the data reported for the highly creative students. This student completed elaborative figural products displaying multiple ideas. One of these drawings may be found in the Appendix D. The student was an ardent participant in creative verbal exchanges and gave numerous lengthy responses during discussions. Her subtle wit and humor also predominated the sessions. The child was not particularly interested in the activities which required manipulation of objects. Additional information about this student was obtained by the researcher from the child's father while both were assisting with computer instruction for the students. The father described many home activities, such as work with computer animation and drawing, which he and his daughter enjoy. A later discussion with the student revealed that the mother is also involved in creative endeavors and enjoys fabric

painting and making cloth appliques. The student described an assortment of things she likes to do, including paint, play on the computer, and make voices for her stuffed doll. During an earlier discussion with the researcher, the child demonstrated that she could talk like Laura, a character in one of the Roger Rabbit movie adventures. During that portrayal, she slunk, seductively across the room, pretending to hold a long cigarette and then she spoke in a sultry voice. Her characterization was quite accurate.

The other highly creative experimental students, although enthusiastic about the activities, did not seem to thrive as much on the treatment as the above described girl. Their smaller gain scores on the Torrance Test of Creative Thinking (1962b, 1962c) also indicate this difference.

## Additional Findings

As the researcher began to work with the descriptive data collected in the study, it became apparent that considerable important information, which did not relate specifically to any of the original research questions, had been produced. This section presents information on other types of changes recognized in the experimental students.

### General Changes in Experimental Students

General changes were noted in the experimental subjects during the training period. It was previously

mentioned that identical activities were used in the first and last training sessions. Information in the verbal skills section herein describes the activity which asked the students to discuss similarities between pairs of animals. In order to accurately compare the student answers on the activity, the responses were categorized to indicate whether the similarity given was visual, functional, other, or incomplete. For purposes of this discussion the dog and cat picture pair will be used as an example. Answers categorized as "other" included responses such as "nice to pet" and "are human's friends." "Incomplete" answers made no comprehensible connection between the pair or were not related to the question. More answers describing visual similarities were given by students in both groups during both sessions. Figure 4 was compiled to reveal the percentage of student answers in each category in the combined experimental groups and to indicate the general effect of the training.

Positive growth for some of the categories is revealed in Figure 4. Although 6% of the answers given during Session 1 were incomplete, none of the answers were incomplete during Session 24. It is debatable whether or not the 8% increase, from 45% to 53%, in visual answers indicates positive or negative growth. Some may feel that this is positive since the students who gave incomplete

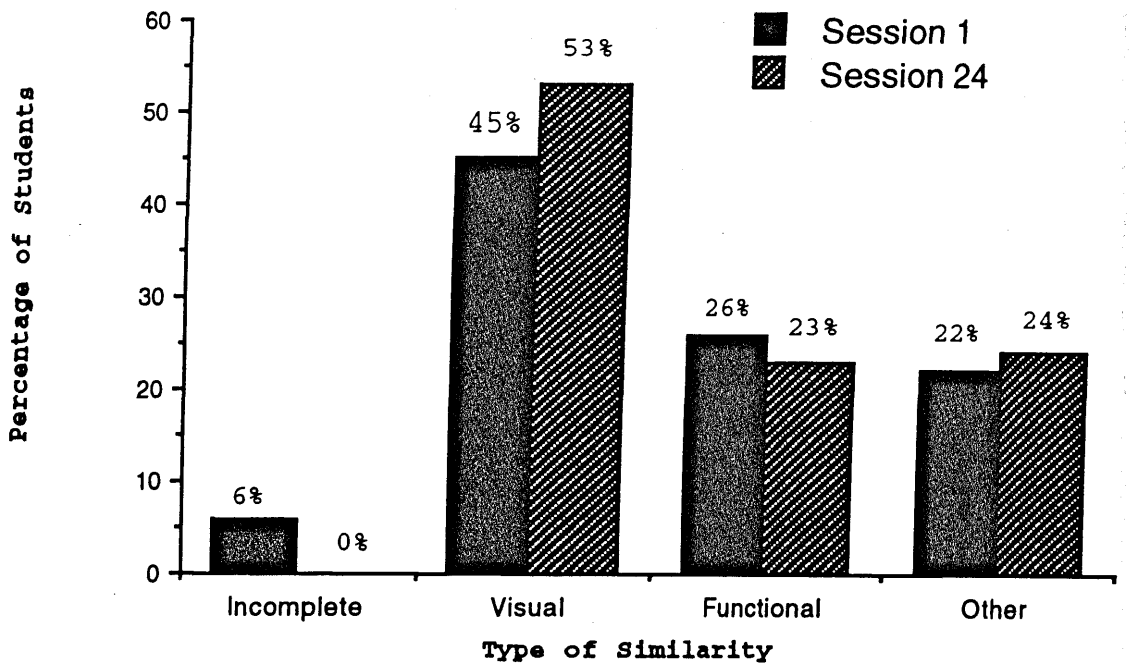


Figure 4. Comparison of Percentage of Responses of Experimental Students by Similarity Type in Session 1 and Session 24

answers during the first session may have given visual answers in the last. Others may feel that the 8% gain score is indicative of the predominance of students who are still noting concrete similarities and have not moved to a more abstract level of comparative thinking.

In order to explain differences in the changes between the gifted and the nongifted experimental students

which are exemplified by the exercises, the percentage of answers in each category for the separate groups are shown in Figures 5 and 6. An examination of these figures indicates that the nongifted students achieved slightly greater growth between the two sessions. They showed a larger growth in percentage of visual and functional answers than the gifted students. The difference between the percentage of answers at each level given by the two groups is also worth mentioning. A larger percentage of visual answers was given by the nongifted group during both sessions. A larger percentage of functional and other answers was offered by the gifted group during both sessions. It appears that while the gain scores in the categories were more impressive for the nongifted group, the level of answers within the hierarchy is superior for the gifted group. One should note, however, that the percentage of answers at each level for the nongifted experimental group was closer to those given by the gifted experimental during the last session than during the first.

While the figures seem to indicate little change in the types of responses offered by the students, the numbers do not tell the whole story. Scrutiny of transcripts of the training sessions reveals a change in the quality of

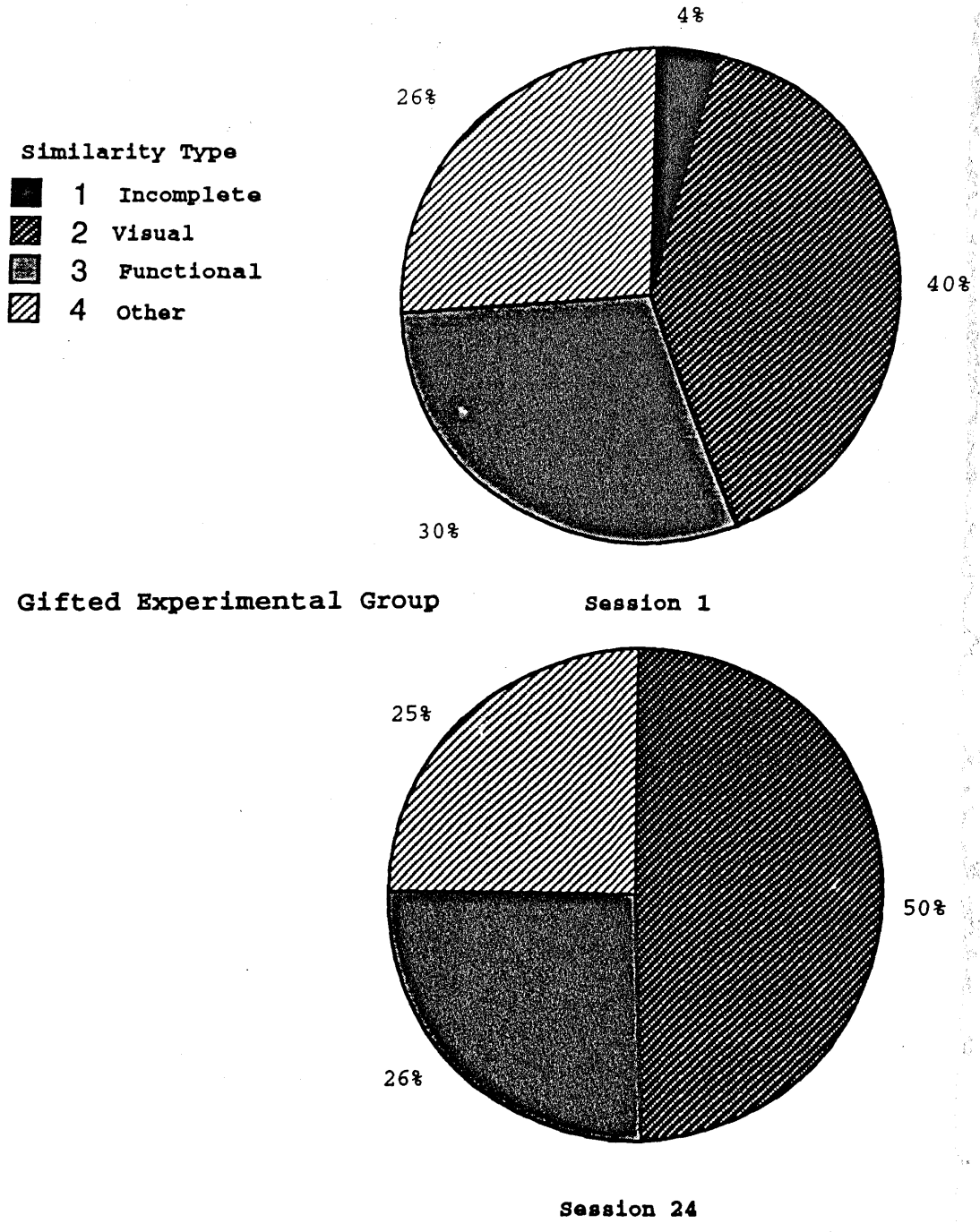


Figure 5. Percentage of Responses of Gifted Experimental Students by Similarity Type in Session 1 and Session 24

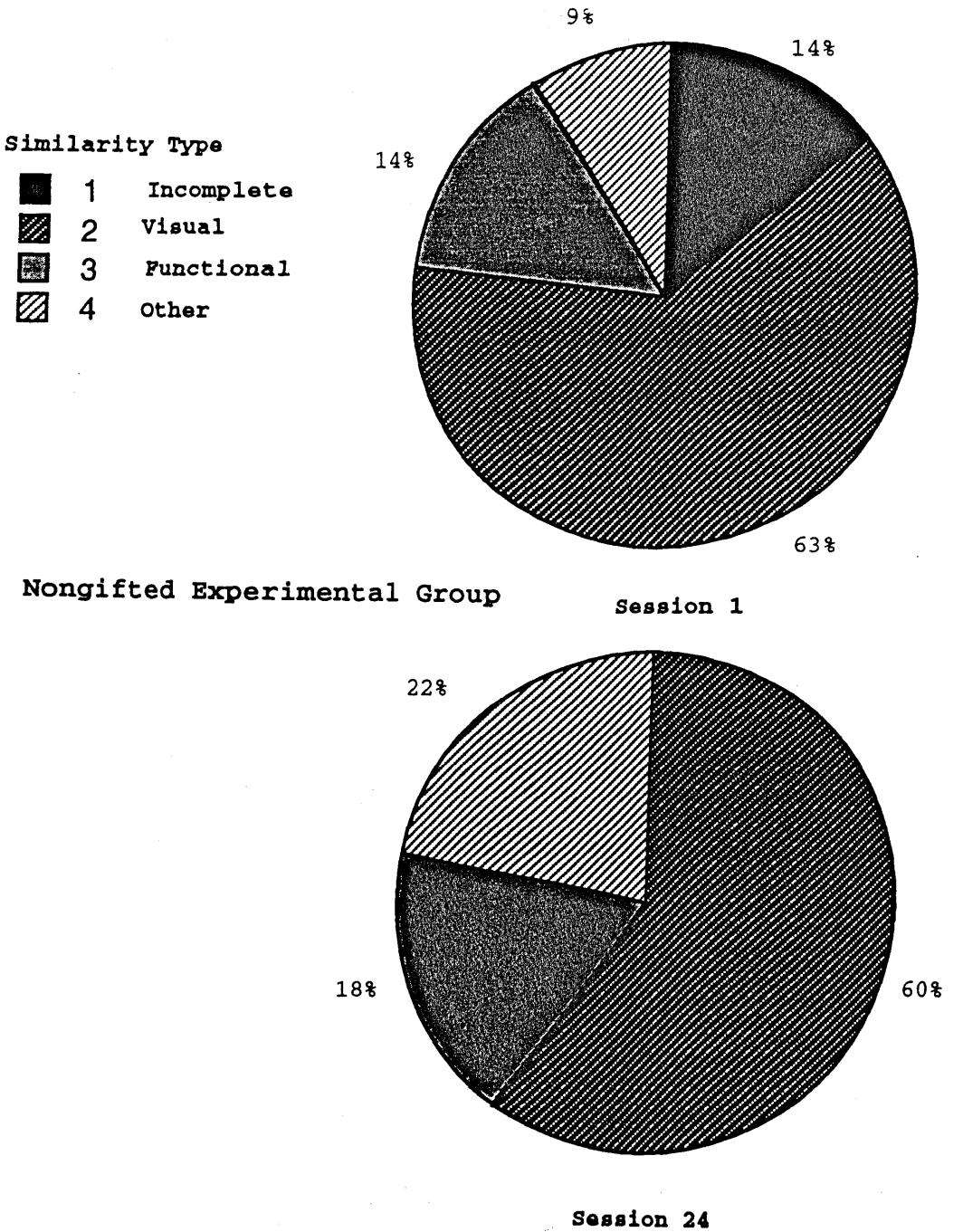


Figure 6. Percentage of Responses of Nongifted Experimental Students by Similarity Type in Session 1 and Session 24

student answers, as previously discussed, and the mental stretch required to note the similarities.

Differences Between Experimental Groups

The analysis of additional quantitative data also provided ample information regarding the ways in which kindergarten students differ in their responses to the training. A discussion of this data follows.

Verbal Skills. Disparities between the responses of gifted and nongifted students to the training exercises indicated some basic differences in the two populations. Many of these variations appear in terms of vocabulary and verbal skills. Students in the gifted group have a larger vocabulary than those in the nongifted group. This was readily apparent during an exercise in which the students described the emotions felt by a character in a story. Table 8 lists the words two groups of students which were given to describe the character. A comparison of the responses given by the two groups revealed that the nongifted students used eight different words, two of which were not used by the gifted group. The gifted students used 19 different terms, 13 of which were not used by the nongifted group.

Vocabulary differences were also apparent when students were asked the meaning of terms during the

Table 8

Descriptive Words Used by Experimental groups

| Gifted Group | | Nongifted | |
|---|---|---|---|
| Happy | *Embarrassed | Happy | *Bored |
| Mad | *Lonely | Mad | *Curious |
| Sad | *Terrible | Sad | |
| Scared | *Sleepy | Scared | |
| Surprised | *Excited | Surprised | |
| Glad | *Brave | Glad | |
| *Bad | *Good | | |
| *Hungry | *Thankful | | |
| *Proud | *Little happy and little sad | | |
| *Tired | | | |

Note. The asterisk indicates terms which were not used by the other group.

explanations of some of the training exercises. Many terms such as similarity and unique which were explained by the gifted students could not be defined by the nongifted students.

Knowledge Level. While the training exercises were planned so that they required little or no prior information about the animals or objects used in the sessions, some differences between the basic knowledge, comprehension and application levels of the groups were

noted. For example, during discussions of the uniqueness of individual animals, students in the nongifted group responded that a snow rabbit was unique because it hopped and upon probing by the researcher also stated that it was white. Students in the gifted group also responded that the rabbit hopped; however, upon further questioning, they stated that the rabbit was camouflaged. Students in the nongifted group described functionally unique features for familiar animals such as a turtle and a skunk, but tended to describe visual features of less familiar animals such as the koala. Many more unique descriptions, such as a statement that a koala is a marsupial, were given by gifted students.

Ability to Manipulate Objects. During other activities which involved the use and manipulation of kitchen objects, there was little or no difference in the level of response of knowledge base of the two groups. All of the students manipulated and played with the objects in a similar manner and seemed to delight in the exploration and discovery of how the objects functioned. An insignificantly larger number of gifted than nongifted students knew the names for some of the objects such as a sifter and a fondue pot.

Creativity. It was previously discussed that the rate of change in creativity for both experimental groups, indicated by gain scores on the Torrance Test of Creative

Thinking (Torrance, 1962b, 1962c), was approximately the same. It can be noted; however, from the observations of the training exercises that although the rate of change was similar, the gifted group was somewhat more creative than the nongifted group. This information is reiterated by the information found in Table 9 which gives scores, achieved on the Torrance Test of Creative Thinking (Torrance, 1962b, 1962c), for both groups. A one-way analysis of variance conducted on the pretest scores yielded an F Probability of .0553 which was not significant. The analysis for the posttest scores was also not significant, yielding an F Probability of .0562. It was noted earlier that there was not significant difference between the gain scores of the two groups.

A careful analysis of Session 10 and Session 20, both of which involved problem solving, reveals that students in the gifted group were more fluent and gave more novel solutions to the problem than students in the nongifted group. During session 10, the students were asked to suggest ways in which Shirley, a skunk who was the main character of a previously read story, might make friends after she had alienated the other animals with her scent. The most common answers were solutions in which the odor could be washed or removed from the skunk. Students in the

Table 9

Mean Pretest, Posttest and Gain Scores for Gifted and Nongifted Experimental Groups on Torrance Test of Creative Thinking

| Group | Pretest | Posttest | Gain Score |
|---|---|---|---|
| Gifted Experimental | 106.39 | 124.83 | 18.43 |
| Nongifted Experimental | 93.00 | 112.75 | 19.75 |

nongifted group tended to repeat previously mentioned ways of washing off the scent, while those in the gifted group tended to expand on the answers given by their classmates. The gifted students mentioned a variety of means for this removal such as taking a shower, diving in a river and cutting off the part of the skunk which smells. A larger number of creative answers was given by the gifted students; however, two novel answers were also given by nongifted students. Novel answers given by the gifted students included making a poster to advertise a party Shirley was giving, having Shirley say she was sorry, finding Shirley a blue jay to play with since the other animals don't like blue jays either, finding another skunk for her to play with and showing the other animals things to play with at Shirley's house. Answers by the nongifted group included baking something for the animals to eat and

giving a million dollars to those who would be Shirley's friend.

The same type of differences in novelty of responses and fluency between the answers of the two groups was noted during Session 20. A greater number of different responses was offered by students in the gifted group to the question of how an invisible dog might be noticed by people. The nongifted group suggested the following three problem solutions: the dog could bark, he could be painted to give him color, and someone could put water on him. Nine different solutions were offered by students in the gifted training group. These included having the dog make shadows, getting an invisible man to see the invisible dog, letting someone observe the dog splashing in water, and putting shampoo on him so he could be seen. These students also suggested that the dog could bark, rub a person's leg, or draw a picture of himself. Other gifted students thought that someone would notice the "doggy smell" or see the footprints left by the animal. More responses than those mentioned were offered by both groups; however, all other answers were some form of those previously listed.

An activity, adapted from a suggestion in Roukes' Art Synectics, in which the training students created preposterous hybrids by combining two different animals to create a new one, offered students a chance to display

creative characteristics. The drawings and narrative descriptions of them completed by the students indicate various levels of creative responses. Each students' description of the hybrid was tape recorded and later transcribed by the researcher. Some students drew separate pictures of the two animals they had chosen to use, while others drew elaborative combinations. A numeric analysis of the responses for the gifted and nongifted groups will be discussed together for purposes of explanation of this session. Ten of the 43 students (23%) made no attempt to combine the animals. The majority of the remainder of the students who satisfactorily completed the activity merely formed simple combinations such as creating a pig-bear by putting a bear face on a pig and a fish-rabbit made from placing a rabbit's tail on a fish. Ten of the students (23%) completed more elaborative drawings by sketching an environment in their pictures. Two of the students (5%) broke the boundaries of the assignment by combining multiple animals rather than just the two originally chosen. One student combined three animals, a pig, a frog, and a duck. Another borrowed characteristics from numerous creatures. He picture is best described by in her own words.

> Girl 110: " . . . I putted (sic) a turtle shell on a stegosaurus and a frog's spots on a stegosaurus and a cat's head on a stegosaurus and

a duck's beak on a stegosaurus and some bird's feet on a stegosaurus and a bird's wings on a stegosaurus and dog's ears on it and a cat's bow."

Researcher: "Do you want to call it anything?"

Girl 110: "I'm going to call it silliosaurus!"

Another dimension of thinking was demonstrated by four of the 43 experimental students, 9%, who gave descriptions of how their hybrid would function. A student who combined an elephant and a boy stated that they both could blow water out of the trunk. Another illustrated a turtleasaurus by drawing a turtle shell on the back of a stegosaurus instead of the animal's original dinosaur plates. The student acknowledged that this would allow the turtleasaurus to protect itself. A ""half a sheep and half a lion," was drawn by a young boy who explained that " . . . when its real snowing (sic), the fur can keep it warm to have muscles." Even though the answer does not make complete sense, it is apparent that the boy had thought about functional possibilities for his hybrid. A more humorous hybrid resulted from a student's combination of a bear and a cow. The student discussed this hybrid and stated that she " . . . was thinking if you took a bear and put cow horns and cow hair and then put the utter, then I thought it would look pretty silly. I would call it a bear that could make milk."

Two students (5%) drew hybrids which were based upon their prior experiences. One student drew a log-frog and indicated that he had heard about this creature while listening to a "Barnie" tape about camping. The other student's simplistic drawing, which combined a fish and a squirrel, did not immediately reveal the analogical thinking used for his hybrid; however, his explanation of the creature was enlightening.

Researcher: "What did you draw?"

Student: "A fish. A catfish."

Researcher: "Where did you get the idea?"

Student: "My Dad caught one one time."

Researcher: (confused) "And what did you combine?"

Student: "Wait! A squirrel-fish, a squirrel and a fish."

A connection had been made between the student's past experience of knowing his father caught a catfish to the present activity in which he must create a type of fish. His product took the analogical form of Living Thing A: Name A::Preposterous Hybrid B: Name B. It can be argued that name of "squirrel-fish" was simplistic and could easily have been made without the analogy. The fact that the student mentioned the analogical connection to the catfish, however, indicates the type of thinking he employed.

There were too few students who gave names for their hybrid to make it possible to say much about their verbal creativity. From those given, however, a few different response levels may be noted. The responses included simple combination of the name of the two animals such as giraffe-stegosaurus or pig-bear. Some titles such a long-necked cat, which was created from a giraffe and a cat, and beak-dog, a hybrid of a dog and a bird, were descriptive. Others were formed through a combination of abbreviated animal names such as a turtleasaurus. The title of silliosaurus was at a somewhat higher level of verbal creativity than the others given since the descriptive word "silly", applied to the name, was not derived from an attribute of any one animal.

Ability to Display Creativity in Various Forms. The training exercises provided outlets for the display of creative skills in three different forms. While some of the training sessions required the students to prepare a product by drawing, others encouraged the presentation of ideas in oral form. Several other activities required the students to manipulate common objects to demonstrate their ideas. A comparison of activities in each of the three forms is revealing. In order to be consistent with the analysis of the aforementioned picture products produced in Session 6 and Session 23, The oral responses given in

Session 20, a problem solving excursion, were also analyzed for fluency. The categories of student response level include Level 1, which indicates no problem-solving ideas were given. Level 2 indicates that the student had contributed an idea which was a repetition of a previously mentioned solution. Level 3 was achieved by students who gave one new idea, Level 4 was scored for two or three ideas, and Level 5 indicates that more than three ideas were given. Figure 7 indicates the percentage of gifted students who scored at each level on the verbal activity, and Figure 8 indicates the percentages for the nongifted experimental students. A comparison between the gifted and nongifted group of the level percentages divulges that the gifted students were more fluent than the nongifted students in their verbal problem solutions. Evidence of lack or oral participation for many nongifted students is provided by the fact that 53% of them shared no verbal solutions while all of the gifted students provided solutions.

These results can be compared with those obtained from the same type of analysis of the picture products made during session 23 and shown for the gifted experimental students on Figure 7 and the nongifted experimental students Figure 8.

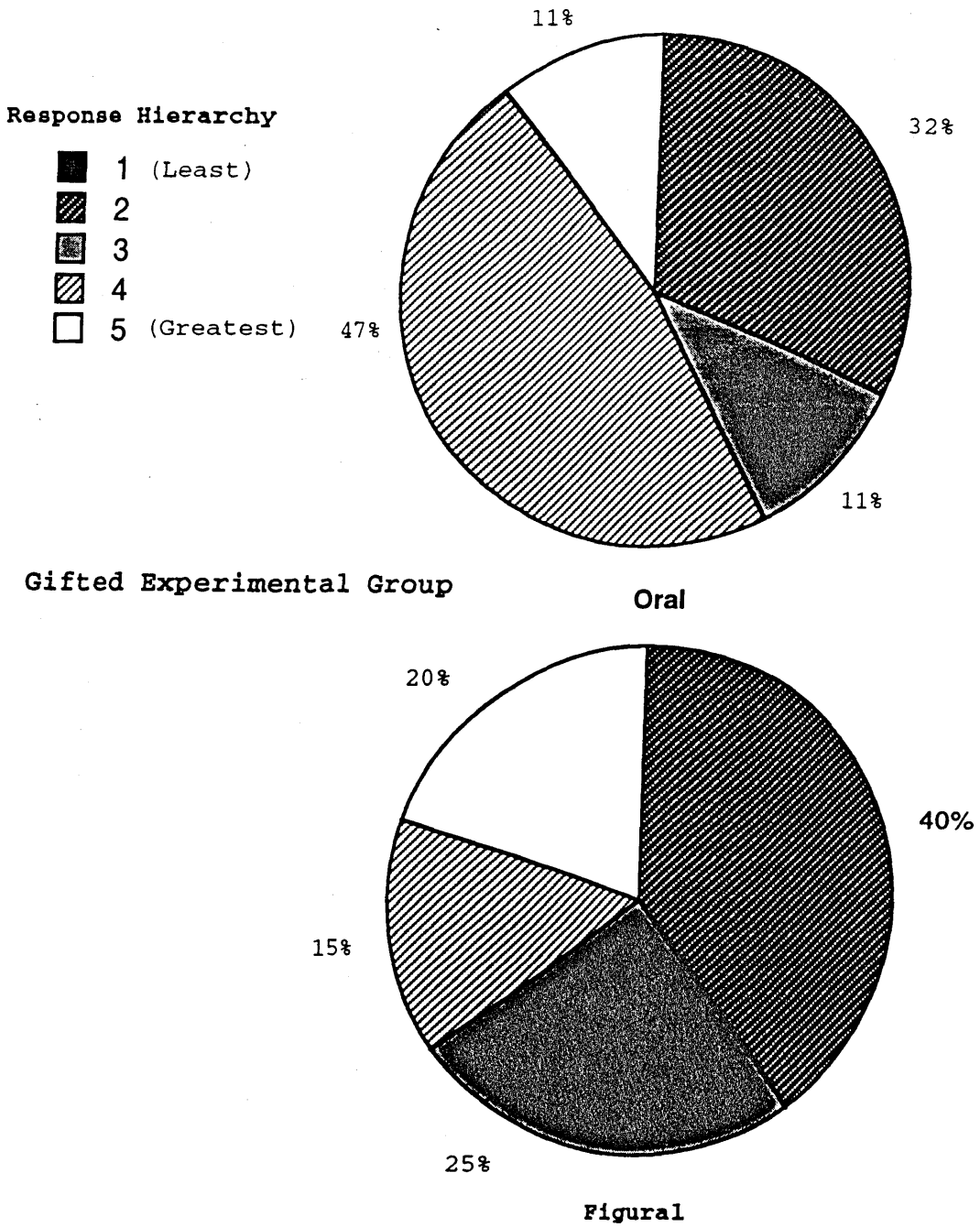


Figure 7. Comparison of Percentage of Gifted Experimental Students Scoring at Various Levels on Oral Products from Session 20 and Figural Products from Session 23

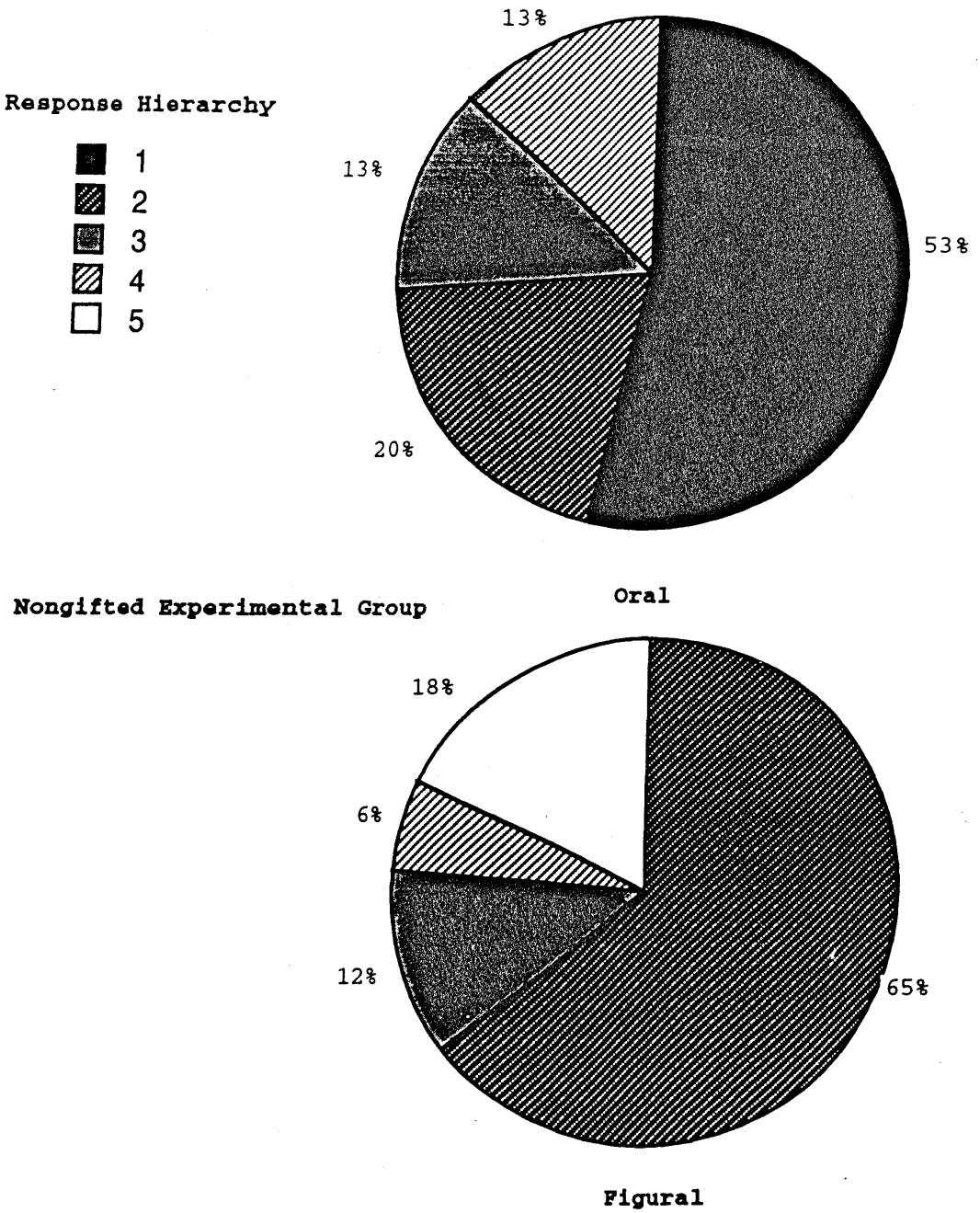


Figure 8. Comparison of Percentage of Nongifted Experimental Students Scoring at Various Levels on Oral Products from Session 20 and Figural Products from Session 23

A comparison of the information on Figure 8 discloses that the nongifted experimental subjects were more fluent on the drawing than on the verbal exercise. While 53% of them shared no verbal solutions during Session 20, all of them presented problem solutions during the drawing exercise. Figure 8 illustrates that while 13% of the nongifted students scored a 4 or a 5 on the verbal activity, 24% of them rated this on the figural product. This demonstrates that the nongifted students were more successful in expressing their ideas through drawing than through verbal response.

In contrast, it may deduced that the gifted students did not display an overt tendency to express more ideas through either the verbal or the figural mode; yet 58% did score a 4 or 5 on the verbal analysis compared with 35% who rated this on the figural product. This information is found in Figure 7.

It was not feasible to analyze the solutions completed by students on the manipulative exercise in the same manner as the other products. Due to the nature of the assignments, students were not able to display fluency. It can be stated, however, that five students who had not previously shown much creativity, became excited about the manipulative project and produced creative results. It may

be concluded from this information, that the level of creative response for some students varied according to the mode of expression allowed.

Ability to Make Analogical Connections. Another notable difference between the problem solving responses of the two groups during Session 20 has to do with the analogies suggested by the students during synectics excursions. The format for the synectics excursions used in this training was adapted from the original form developed by Gordon (1961). Changes with regard to the compressed conflict section of the excursion were suggested by Kaufman (1991).

It is common in synectics problem solving exercises, called excursions, for students to compare the problem given to similar problems with which they are more familiar. This sets up an analogy in the form Problem A: Solution A::Problem B: Solution B (Holyoak, Junn, & Billman, 1984). Basic direct analogies were offered by the researcher since it is sometimes difficult for excursion participants to think of comparative problems. This shortened the time required for the excursion and allowed the young children to concentrate their efforts on problem solving. In other words, the researcher presented Problem A and also provided Problem B for comparative purposes rather than asking the students to create their own Problem

B. It was hoped that as students derived solutions to the more familiar Problem B, they would be able to adapt and apply them to Problem A. The following narration from an excursion exercise in which the students attempted to help make the invisible dog noticeable will be used as an example. It illustrates the use of analogies by the nongifted experimental subjects during Session 20. These students had been discussing how an adult trying to locate a small child in a group of tall people was similar to the dog's problem.

Researcher: "What's something you could do in a crowd of big people to let your mom or your dad know where you are?"

Girl 204: "Be by them."

Researcher: "What if you are lost from them and you are in a crowd of big people. How do you let them know?"

Girl 204: "By getting up on the state and saying."

Researcher: " . . . what do you do up there? Do you yell at them?"

Unknown Child: (name not discernible on tape) "Holler at them."

Unknown Child #2: "Rub, rub, rub (pause) rub, rub, ruf."

Boy 205: (ignoring the barding) "A search party."

Boy 214: "You could scream out for them."

Boy 215: "A dog, Nothing-At-All (the dog's name) could bark!"

It is evident that Boy 205 was indeed thinking about what might be done if he were lost in a crowd. The search party he suggested might be appropriate for finding a child; however, it did not tie to the real problem in which the dog wanted people to know he was around. The other responses did lead to the analogical problem solution in which Solution B, " . . . scream out for them" led to Solution A, "a dog . . . could bark!"

Solution finding was, of course, the desired end to the excursion, and it was hoped that Solution B would lead directly to Solution A; yet, the discussion of Problem B also served to distance the students from the one they are attempting to solve. An illustration of this distancing which led to a solution is given below. Problem B was initially stated as a painting to be placed on a blank piece of paper.

> Researcher: "Sometimes in art they give you just a blank piece of paper . . . (and) there is nothing on it. How is that like the problem the dog had?"
>
> Girl 110: "You can't see anything."
>
> Girl 108: "You couldn't see anything."
>
> Researcher: "There's nothing on that piece of paper is there?"
>
> Girl 110: "There's nothing, and it hasn't been used yet."
>
> Researcher: "Is that like the dog?"

Boy 104: "You can see it because you can see the color on the piece of paper."

Researcher: "Now you may be thinking of an idea."

Boy 104: "See, what I mean blank, but there's still some color."

(students begin to get off the answer trail)

Boy 101: The paper and the dog is different is that the dog is an animal and the paper isn't."

Boy 104: "I know another difference, the dog isn't a square piece of paper."

Girl 109: "I know a similarity."

Boy 101: "The dog has fleas and the paper doesn't"

Girl 109: "Because you can't see anything. It's just plain. You can't see anything."

Researcher: (trying to direct student thinking to the problem) "Let's think about the picture waiting to be drawn. How is the picture that's waiting to be drawn on the paper like the dog that nobody can see?"

Girl 109: "I know. They could put that stuff on it that could make him turn into a dog or something."

Girl 108: "You could paint the dog!"

The researcher's comments written after the session read "hallelujah" at this point. It is obvious that the tactic used did distance these students from the problem while still allowing them to deal with the subject. The solution resolution, which seems to have little to do with most of the discussion, did finally arrive.

The two group discussions indicate the similarity in the way that the gifted and nongifted students used analogical connections to reach a solution. They do not, however, illustrate the fact that only five nongifted children utilized analogical thinking for problem solving. Many more of the gifted students utilized this connection-making process.

Students were given an opportunity to demonstrate their ability to understand compressed conflicts during the "help the dog" exercise discussed above. As the students described how they might feel if they were lost in a crowd, the researcher wrote their descriptive words in two columns, as suggested by Kaufman (1991). One column listed positive and the other negative descriptive words. The researcher then chose one word from each column and put them together to describe compressed conflicts, words which fight each other, which are used in Gordon's (1961) basic excursion process. The researcher asked the students to suggest examples of a time when they might have felt both emotions at the same moment. Complete examples were made when a described single experience demonstrated both words. Members of the nongifted experimental group gave complete and incomplete descriptions of the times when they were both mad and surprised.

Researcher: "Can you think of a time when you were both mad and surprised at the same time?"

Girl 204: "When I was at my grandmas . . . My grandma that we were going to go on a trip to the valley and I didn't want to go there because my dog would bite me."

Researcher: "So that made you mad. Surprised was what, (pause) That you were going?"

Girl 204: "Yes." . . .

Boy 215: "My little (pause); When I was at my house, this is my little brother and me. (describing the setting for the episode) My dad gave my little brother a spanking with a paddle that had his name on it and it says 'good boy paddle' and it's made out of wood."

Researcher: "Why did that make you mad?"

Boy 215: "It didn't make me mad. It made my little brother mad."

Researcher: "Was your little brother surprised he got a spanking too?"

Boy 215: "I was surprised I didn't get a spanking too."

Researcher: "So your brother was mad and you were surprised."

Girl 204 stated the only complete example during her group's discussion. A total of four incomplete answers was given including the above written one given by Boy 215. Although Boy 215 clearly understood the two emotions of mad and surprised, his example did not demonstrate that they were felt by one person at one time. Girl 202, who participated in another small group session, gave a

complete example. Her response was the only one offered by the members of her small group.

> Researcher: "Can you describe a time when you were happy and mad at the same time?"
>
> Girl 202: "You see one time my sister. You see she, I spilled my soup one time for dinner and my sister helped my mom to clean off the carpet and you see my mom was mad and my mom was happy because my sister helped her."

Similar types of connections were made by students in the gifted group which discussed episodes during which they were both happy and scared.

> Girl 115: "See, like you're, you got the most important part, but, but you're scared because you are standing up in front of the whole audience."
>
> Researcher: "Like part of a play or something?"
>
> Girl 115: "I'm Mrs. Clause." . . .
>
> Girl 105: "When we dressed up in those costumes I was happy and scared. I was happy that we dressed up in those costumes, but I was kind of scared . . ."
>
> Girl 121: "(researcher's name, researcher's name), I can swim under water."
>
> Researcher: "And how did that make you feel?"
>
> Girl 121: "Happy!"
>
> Researcher: "Happy and did you have more than one emotion?"
>
> Girl 121: "Just happy."
>
> Researcher: "Let's try two words."
>
> Boy 111: "Researcher, when I could swim, I was happy, but I was afraid I would drown."

> Girl 119: "When we were just starting school, I was happy and scared."
>
> Researcher: "So starting school gave you those feelings?"
>
> Girl 117: "I agree with Girl 119 'cause (sic) I was crying the night before school 'cause (sic) I didn't want to go to school because I thought they would all be strangers, but now look at me, every single one is my friend."

The connections made by Girl 115, Girl 105, Girl 119, and Boy 111 are examples of the 11 complete examples given by students in the gifted experimental group. The incomplete swimming example given by Girl 121 represents other incomplete examples suggested by the students and describes a time during which she felt only one of the emotions. Her example led to a complete one made by Boy 111.

The example, stated by Girl 117, does not directly discuss a time when she felt both emotions at the same time and is therefore incomplete. She did, however, build upon the complete answer of Girl 119 which may imply her understanding of compressed conflict.

Students who shared no examples of compressed conflict during the excursion also suggested no solutions for problems. Most students who gave incomplete examples of compressed conflict also did not use connection-making for solution finding. Girl 117, whose incomplete example is documented above, ignored a solution connection being

explored by the group in during the invisible dog excursion.

> Researcher: "What are some things that you do in the middle of a crowd so your mother can find you?"
>
> Girl 119: "You could run out. Try and run out and find her."
>
> Girl 105: "You can shout out."
>
> Researcher: "What could the dog do?"
>
> Girl 117: "He could smell, he could smell the way to the kids."
>
> Researcher: "That would help him find the kids, but how would it help the kids find him?

## Summary

Synectics training did effect both gifted and nongifted kindergarten students in this study of students in a large urban north central Texas school district. The findings resulted from both quantitative and qualitative data gathered.

A significant difference between the experimental and the control groups was noted for creativity as measured by the figural forms of Torrance Test of Creative Thinking (Torrance, 1962b, 1962c). The positive growth was also documented qualitatively through the analysis of tape transcripts of the training sessions and comments made by the classroom teachers.

No significant difference was found in the self-concept of experimental and control students as measured by the

Martinek-Zaichkowsky Self-Concept Scale (Martinek & Zaichkowsky, 1971).

No significant difference between experimental and control groups was found on the Peabody Picture Vocabulary Test (Dunn & Dunn, 1981a). Positive growth in terms of language fluency and elaboration was observed during the training sessions.

No significant difference, measured at the .05 level, was found between highly creative experimental subjects and the other experimental students. The difference was, however, near significance at .058.

Synectics training is appropriate for both the gifted and the nongifted experimental students in the study. Individual students within both groups responded to the training at various levels.

The experimental students exhibited different preferred modes of creative expression. These included drawing, manipulating objects and giving oral responses.

# CHAPTER V

## DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents a discussion of the findings of the study examining the effect of synectics training on gifted and nongifted kindergarten students. Conclusions are drawn with respect to the statistical and descriptive analyses presented in Chapter IV. Actionable suggestions are made for instructors and proposals for future research are listed.

## Discussion

A discussion of the previously presented findings will be organized according to the sections used in Chapter IV. This should simplify the interpretation of the findings.

### Research Questions

Three specific research questions were addressed in the study. Each of these will be discussed.

#### Effect of the Training on Dependent Variables

Research question 1 asked how synectics training would effect the creativity, self-concept, and verbal skills of gifted and nongifted kindergarten students.

Creativity. The findings pertaining to the question of how the training effected the creativity of the kindergarten students revealed a significant increase in

the display of creative ability for the experimental students as compared to the control subjects. Descriptive information relating to pupil products and verbal interactions, as well as the results from the creativity interview question, supported the change which was measured by the Torrance Test of Creativity (Torrance, 1962b, 1962c). The results of this study coincide with the research of others (Kalmar, 1987; Kelly, 1989; Khatena, 1971) who found that creativity training resulted in measurable creative growth in young children.

It might have been possible that the change in creativity among the experimental children occurred due to their increased facility with a pencil and improvement in their fine motor skills during the research period. This, however, was not the case, since the control subjects would have enjoyed this same advantage; yet, their creativity scores did not improve at the rate demonstrated by the experimental students. In actuality, the scores of the gifted control students lowered from pretest to posttest, showing a mean gain score of - 5.38 for one group and - 4.81 for the other. The nongifted control students demonstrated a mean growth of 5.45. All three groups had significantly lower gain scores than the mean gain scores for the experimental groups; therefore, the increase of approximately one standard deviation from pretest to

posttest by the experimental group resulted from the training experience.

The difference between the change in scores from pretest to posttest by the gifted control groups versus the nongifted control group on the Torrance Test of Creative Thinking (Torrance, 1962b, 1962c) was approximately 1/2 standard deviation. This difference is not statistically significant; however, it will be discussed. It may be speculated that the nongifted children may have previously had less opportunity for drawing and creative thinking, while these activities may have been encouraged during the preschool years for the gifted. School for the nongifted students may have provided them with a chance for these experiences and thus helped them to display slightly more creativity on the posttest.

The negative gain scores, observed in the gifted control groups, may be explained by the fact that a decline in creativity begins at about the time that children enter school (Torrance, 1980) and continues as students become more conforming and schools pressure them for the right answer (Von Oech, 1983). It is possible that the gifted students have more school "savvy" than the nongifted students and their greater awareness of school pressures and/or pressures from home or self to succeed infringes upon their creative abilities.

It is also surmised that regression to the mean may have contributed to the rise in the posttest creativity scores of the nongifted control group. Slavin (1984) discussed the fact that individuals with extremely low scores on one measure may have a tendency to improve their scores on that measure at a later time. There were 15 out of 23 students in the nongifted control group who scored below the mean on the Torrance Test of Creative Thinking pretest (Torrance, 1962b). This is in contrast to five of 22 students in Gifted Control 1 and two of 21 students in Gifted Control 2 who initially scored below the mean. Since more nongifted than gifted experimental students scored low on the pretest, there was a greater opportunity for them to increase on the posttest. It is also possible that since many more gifted than nongifted experimental subjects scored well above the mean on the pretest, they would have a tendency to regress toward the mean. This might account for their negative gain scores.

Another possible reason for a decline in creativity scores for some subjects is that students may not have been as interested in the Torrance Test of Creative Thinking (Torrance, 1962c) during the posttesting as they were during the initial session in which it was something novel. Safter (personal communication, March, 1991) suggested that there is a tendency for many students to achieve lower

scores on a second testing due to their lack of creative motivation to complete the similar activity. This is also supported by a study in which the scores of highly creative junior high school students decreased after training (Meador, 1989a). Research by Fishkin (1989) resulted in her conclusion that high levels of creative performance are only likely in highly motivated children. Adams (1974) called this "lack of challenge," which may be present on a second testing using the same measure, a "villain" which can prevent a person from doing their best.

The validity of test results for young children has often been questioned and certainly care should be taken with any interpretation of an assessment (Wiebe, personal communication, September, 1990). The similarity in the mean scores for the two experimental groups, however, seem to indicate an accurate assessment of change. The similarity of mean scores between the two gifted control groups also supports the test results.

The analysis computed for the creative constructs of the Torrance Test of Creative Thinking (Torrance, 1962b, 1962c) also revealed the power of the training for increasing creativity. As was previously mentioned, a one-way analysis was conducted for each of the constructs, fluency, originality, abstractness of titles, elaboration, resistance to closure, and creative strengths, for the

experimental versus the control groups. This was significant ($p < .05$) for each measure. The most significant difference was found for fluency and creative strengths. While the mean gain score of 4.21 for the experimental group and .841 for the control groups for change in creative strengths was significant, the actual growth was small. The fluency gain scores of 16.02 for the experimental group and -.889 for the control groups do, however, indicate the power of synectics training for this construct.

The gain in fluency is necessary for the large growth, exhibited by the experimental group, to occur. In order for a student to gain points on the other constructs, there must first be a large enough number of responses made on which a student can display these creative abilities.

Information which was gained from the pretest and posttest interviews also helps explain the growth in creativity exhibited by the experimental group. Student responses to the question of what an unusual object could be or how it may be used were categorized for analysis. Table 4 in Chapter IV detailed the number of student responses given for each category during pretesting and posttesting. Changes in the answers given by the control group may be attributed to school effect since they had just entered kindergarten on the pretesting date and had

been in school for 3 months at posttesting. The control group exhibited a gain score of - 59 in the use category indicating that they could not think of as many things to do with the object during posttesting. A large gain score of 30 points occurred in the item change category as control students thought of more things they could do to the object, such as wash it or paint it. The other changes were not large enough to warrant discussion. It appears that being in school adversely effected the ability of the students to look at the object from various perspectives in order to determine possibilities for its use.

Different changes were noted through close examination of the results for the experimental group creativity interviews. These students exhibited large positive growth in the categories of global whole (+ 47), use (+ 25), and item change (+ 52). Negligible changes were found in the other categories. Synectics training helped students learn to view things from a new perspective in order that possibilities became more apparent. This enabled the experimental group to break the boundaries of the obvious and see the interview object as a variety of different things with multiple uses. The training, which encouraged transformation and adaptation, also helped children to detemine how they might change the object.

The hypothesis which stated that subjects engaged in synectics training show more improvement in creativity scores than subjects not engaged in the training has been supported by the findings of this study.

Self-Concept. Theory, discussed by Maslow (1954), Rogers (1961) and Tannenbaum (1991), supports the idea that there is a link between creativity and self-concept. Prior to the beginning of the study, the researcher surmised that this proposed relationship between the two would make it possible for training in creativity to impact both self-concept and creativity. The findings of this research with regard to self-concept, however, did not display this result.

An analysis of the results of the Martinek-Zaichkowsky Self-Concept Scale (Martinek & Zaichkowsky, 1971) showed no significant difference in the gain scores of the experimental and control groups; therefore, the hypothesis stating that subjects engaged in synectics training exhibit greater improvement in self-concept than subjects not engaged in the training was rejected. A discussion of the Martinek-Zaichkowsky Self-Concept Scale and the measurement of creative self-concept may partially explain these results.

The Martinek-Zaichkowsky Self-Concept Scale (Martinek & Zaichkowsky, 1971) is a 25 item test on which 60% of all

the students in the study scored a perfect pretest score and 15% scored 24. It is difficult for students to grow significantly when the base score is already so high. The researcher did not anticipate the ceiling effect of the test due to the fact that it is designed with children in first grade and above.

It is, of course, possible that young children have a particularly positive attitude about themselves and that the standardized test results gained in this study are a true assessment. Kindergarten may already provide positive support for self-concept.

Fishkin (1990b) commented about the possibility that a self-concept scale may not show the types of changes which actually occur during creativity training. She suggested that training may have been "effective in changing student feelings about themselves as creative persons" (p. 3). This type of creative self-concept was also studied by Harrington and Anderson (1981) in their research with college students. Since the Martinek-Zaichkowsky Self-Concept Scale (Martinek & Zaichkowsky, 1971) contains no items which demonstrate a child being creative, it is impossible to check for this type of change with this instrument. Fishkin (personal communication, 1991) suggested the use of a creative self-concept scale for measuring the effect of creativity training on self-

concept. Unfortunately, no such scale is available for use with the young children in the current study.

Changes in self-concept were exhibited by the students through their posttest, as compared to pretest, self-concept interview responses. As was previously mentioned the changes in the responses between the experimental and the control groups reached significance ($p$ = .0001) for the Goodness of Fit Chi Square which was computed. Information was presented in Table 6 of Chapter IV regarding the changes in categories which were made by the students. The control group exhibited more change in the negative responses than the experimental group; however, the responses, which ranged from 0 to 5, are not cause for concern. Both groups gave more responses in the categories of preference, positive family and social relations, superficial, and possessions on the posttest interview. The gain score for each category was, however, higher for the experimental group. While the experimental group gave more posttest reponses regarding their abilities, the comparison group gave less. The experimental group gave fewer global answers on the posttest, while the control group gave more. Both groups discussed their pysical attributes less in the posttest session.

It was previously mentioned that the pretesting was completed in September, soon after students had entered

school, and the posttesting took place in December of the same year. The researcher expected, therefore, that changes in self-concept would appear due to the effect of being in school. This was not, however, exhibited when the pretest and posttest responses of the control groups were examined in detail. Although there were slight fluctuations in the counts for the categories, no large changes (more than 8 points) appeared for any category. The experimental group, however, did make larger changes in their responses which can be attributed to the training. After the training, the experimental students were either more willing to discuss or more aware of their own positive abilities. The experimental students also discussed more things they liked or preferred. They gave fewer global and more superficial answers on the posttest.

The changes in these responses are directly related to the synectics training. Synectics encourages students to express their ideas and become risk takers. Since the members of the group listen and piggy-back on answers given by other students, individuals begin to value their own ideas.

The quantitative data collected in this study support a change in the way the experimental subjects felt as creative persons. An increased willingness to participate in the training sessions and increases in the amount of

discussion and language fluency during the final sessions all point to this change. The experimental students became comfortable with the fact that all their responses were accepted and valued and that they were a part of a risk-free environment. These feelings may not have been carried with the students outside the boundaries of the training environment. Passi and Lalitha (1975) stated that "the development of one's self-concept depends on the permissiveness of the environment to his creative behavior" (p. 52). As the students moved from the nurturing creative environment of the training sessions into the rest of their world, they may have entered a setting which was more restrictive of growth in creative self-concept. This researcher believes that positive creative self-concept will be transformed into positive global self-concept in the proper environment.

The analysis of the transcribed information given for two individual students, previously discussed in Chapter IV, further represents the fact that positive growth did take place for at least some of the students. It was earlier noted that this change can be documented for eight students.

Due to the stablility of self-concept, it is hard to change, and the 12 week research period may not have been long enough for student change to be manifested on the

Martinek-Zaichkowsky Self-Concept Scale (Martinek & Zaichkowsky, 1971). A clear trend toward positive growth in self-concept is, however, born out by the behaviors of the students and the results of the self-concept interview.

Verbal Skills. The hypothesis that subjects engaged in synectics training exhibit more positive growth in verbal skills than subjects not engaged in the training is not supported by the statistical findings of the research; however, the changes in the experimental subjects, which are described by the researcher, do indicate some truth to this statement. There was no significant difference in the mean scores of the experimental versus the control groups on the Peabody Picture Vocabulary Test (Dunn & Dunn, 1981a) which measured verbal skills; yet previous descriptions of changes in verbal fluency and elaboration, taken from session transcripts, indicate some type of change. Research by Brown (1981), utilizing synectics training for sixth graders also showed no significance between pretest and posttest scores on the Peabody Picture Vocabulary Test. It is highly probable that the Peabody Picture Vocabulary Test did not measure the type of verbal skills which were effected by the training. This test is a measure of vocabulary and the training apparently did not significantly effect this verbal skill. The affirmative verbal changes noted from analysis of the session

transcripts were more in terms of quality and quantity as described by changes in verbal fluency and elaboration. Research by Shaklee and Amos (1985) also described a change in language fluency as a result of creativity training. The Peabody Picture Vocabulary Test does not assess these constructs.

The current research is antithetical to Gordon and Poze's research using synectics training with kindergartners during the Listening/Expressing Project (1975). Their study demonstrated a significant gain for students on the Peabody Picture Vocabulary Test (Dunn & Dunn, 1981). This discrepancy between the two studies may be the result of a difference between the type of students involved in the training. The Listening/Expressing Project worked with students who were culturally deprived and had poor learning skills, while the current study worked with more advantaged children.

Differences in Effect of Training Between Experimental Groups

Research question 2 asked how the effect of synectics training on creativity, self-concept, and verbal skills differs between gifted and nongifted students.

The hypothesis which stated that gifted subjects engaged in synectics training will exhibit more change in the dependent variables than all other subjects was not

supported by the research. The previously discussed changes in creativity, self-concept and verbal skills, measured by the standardized assessment tools, for the gifted experimental students did not vary significantly from the changes demonstrated by the nongifted experimental group.

A thorough discussion of differences in the qualitative data obtained in this study for the two experimental groups was presented in Chapter IV, and it was indicated that the level of response varied between these two groups. The degree of change is difficult to assess through descriptive information and product analysis since the base level for creativity and verbal skills was higher for gifted students than for nongifted.

Diffferences in Effect of Training Between Creativity Groups

Research question 3 asked how changes in creativity among highly creative subjects involved in the training differ from changes in creativity among subjects with average or below average creative abilities.

The aforementioned research by Meador (1989a) supports the finding in this study that the highly creative experimental subjects did not show as much growth in creativity as the other experimental students. The mean gain score of 4.6 for the five highly creative experimental

subjects was lower than the mean gain score of 20.9 achieved by the other experimental subjects. These results, however, do not confirm the hypothesis that subjects who are highly creative will show less change in creativity as a result of the training than those who are not highly creative since the difference in gain scores for the two groups was not significant at the .05 level. The F probability for this comparison was .058 making it significant at the .10 level. The ceiling effect contributed to the lack of improvement in creativity scores demonstrated by most of the highly creative subjects. The growth potential for subjects at or near the maximum possible score on a test is restricted (Slavin, 1984). All of the highly creative students scored more than one standard deviation above the mean on the pretest and many achieved individual construct scores two, three or more standard deviations above the mean. It is quite difficult for students in this high range to demonstrate improved scores on a creativity measure.

The previous discussion of regression to the mean as well as information provided by Lynch (1976) is applicable to high creatives who may tend to regress toward the mean on the posttest. Fishkin (1991) found similar results in her study with middle school children when she measured both figural and verbal creativity with the figural form

and the verbal form of the Torrance Test of Creative Thinking. The pretest mean verbal and figural elaboration scores of Fishkin's subjects were approximately 1 1/2 standard deviations above the mean. These students had significantly lower posttest creativity scores on both verbal and figural elaboration.

The results for the highly creative students may be an indication of the effect of conformity which is necessary in school. This may also be an example of Torrance's statement that it seemed to him "that the more creative a person is, the harder society tries to discourage his/her creative behavior" (Torrance, 1980, p. 150).

The antithesis of the results for the other highly creative students is the creativity gain score of one highly creative child, Girl 110, whose posttest score showed an increase of 28 points on the Torrance Test of Creative Thinking (Torrance, 1962b, 1962c). As was previously discussed in Chapter IV, she achieved a ceiling score on one of the pretest's constructs and two posttest constructs; therefore, her scores may not be truly indicative of her total creative ability. It is, perhaps, possible to explain the difference between this highly creative child and the others based upon the previously described positive home support and family experiences which nurture her creativity. This, however, is

inconclusive since the researcher did not have an opportunity to gain this type of information from the other highly creative subjects and they may also enjoy this type of home environment.

## Additional Information

### General Changes in Experimental Subjects

Caution should be exercised in interpreting the results described in Chapter IV under General Changes. This section discussed the first and last sessions in which the experimental students gave similarities for pairs of animals. The positive change in level of student response which was apparent in the last session may not necessarily have resulted from the training. The kindergarten curriculum in the school district includes lessons on similarities and differences; therefore, all students received reinforcement from their classroom teacher which may have influenced the results of the final research activity.

### Differences Between Experimental Groups

Ability to Display Creativity in Various Forms. The activities used in the synectics training provided opportunities for figural, verbal and manipulative responses by the experimental students. Discussion of the finding that a high level of response, indicated by a score of 4 or 5 on pupil products, varied according to the type

of pupil product expression follows. This level of response was achieved on at least one of the various products by only 26 students of the 43 experimental students. The finding that 16 of these students responded at this level on only one type of activity, figural, verbal, or manipulative demonstrates that creative abilities may not be manifested by students on all types of work.

The finding that nine of the experimental subjects achieved high scores solely on the manipulative product exercise is important, and this information, in combination with the results of the verbal and figural activities, may be indicative of a possible creative hierarchy. For purposes of this discussion, one must speculate that the manipulative activities require thinking based upon the concrete; the figural activities require a higher level of abstraction; and the verbal activities may require more sophisticated thinking for young children. If this position is taken, the findings referred to in Figures 7 and 8 show the importance of various types of creative assessment activities. While approximately the same number of creative gifted students were recognized with the figural or oral products of this study, a mere 22% of the nongifted students were recognized in this manner. On the other hand a much larger percentage (67%) of nongifted

students displayed high creativity on the manipulative activity. Support for this finding is also given by the fact that five of the six nongifted experimental students who scored well on the manipulative activities did not score in the highly creative range on the figural Torrance Test of Creative Thinking (Torrance, 1962b, 1962c). The sixth student also achieved a high score on the figural products and was in the highly creative range on the standardized measurement. This contrasts with the fact that all but one of the nine gifted experimental students who achieved high scores on the manipulative products also rated in the highly creative range on the creativity test. It is possible that a manipulative test would have missed identifying three of the students who showed creative strengths on the figural activities.

Research by Johnson and Hatch (1990) also demonstrated this phenomena when they found that the four highly creative children in their study displayed creative results through different avenues such as storytelling, drawing, object transformation, and three-dimensional arts and craft products. The current study indicated that 2 of the 5 highly creative experimental subjects manifested their creativity solely on the figural activities. This is also the media for creativity expression on the Torrance Test of Creative Thinking (Torrance, 1962b, 1962c).

Ability to Make Analogical Connections. The current study confirmed the fact that analogical reasoning is used by young students. Voisniadou also reached this conclusion in her 1988 study.

The additional finding that gifted and nongifted children differ in their use analogical connections for problem solving may be evidence of the varying level of abstraction used by the two groups. It was earlier noted that relatively few nongifted students gave any problem solutions. The bulk of these few was based upon analogical connections in the form Problem A: Solution A::Problem B: Solution B. These solutions indicated a direct relationship between the solution discussed by the group for Problem A and the solution offered by the students for the immediate Problem B. On the other hand, it is important to recognize that the gifted experimental students made direct analogical connections between Solution A and their solutions for Problem B, yet went on to add other solutions. The gifted students may have achieved a higher level of abstraction and may be capable of making their own analogical connections rather than following only those offered during group discussion (Lewis, personal communication, January, 1992). Khatena (1973) also observed a difference in the level of abstraction used by his subjects who worked with analogies.

He differentiated subject's analogical responses into simple and complex image patterns. A more complex level of analogical connection may have led experimental students of the current study to the solutions which seemed less related to the direct analogy discussed by the group.

## Conclusions

This study validates the fact that creativity training significantly increases creativity which has previously been shown by empirical evidence from other research. It is an important addition to the relatively small body of research studies which have explored the effect of training on very young children, since most of the previous work has involved older subjects.

The current study confirms that training in synectics, which is seldom used with young children, is an effective strategy for use in kindergarten. It gives evidence that modification by the researcher of the basic synectics strategies was appropriate for young students. This research demonstrates young children's ability to reason by analogy, which is part of the synectics process; additionally, the study found that the analogical connection level varies from concrete to the more abstract in children, and that some gifted children exhibit a higher level of reasoning by analogy than nongifted children.

The comparable positive effect of the training for both gifted and nongifted subjects reiterates the fact that regardless of a person's initial level of creativity, training can be productive. This finding addresses the current discussion by some educators who believe that "what's good for gifted is good for everyone." Synectics training is good for everyone. It must be noted, however, that the gifted students in this study participated in the training at a different level than the nongifted subjects. This occurred on all the activities except those involving manipulation of objects. While activity responses of the two groups at the beginning of each session were often similar, some of the gifted students resisted closure in the sessions and continued responding beyond the level reached by the nongifted students.

The literature on highly creative students indicated that these subjects would demonstrate less change in creativity than the other experimental subjects. This fact is corroborated by the current study. The significant positive change in creativity, evidenced by one highly creative girl, is an important finding, since it varied from the norm for highly creative children. Her creative growth may be indicative of the existence of extraneous factors which, if understood, could lead to the knowledge

of how to more effectively structure the environment for high creatives.

Experimental students within both the gifted and nongifted group in the current study differed in their response level to different types of activities involving figural, verbal or manipulative products. This indicates a preferred mode of creative expression for individuals and verifies that creative abilities may not be demonstrated across all expressive media. It may, in addition, be indicative of a hierarchy of creative development from concrete to abstract or simply reveal an individual preference for one type of activity more than another.

No significant difference in self-concept or verbal skills between the experimental and the control groups was substantiated on the self-concept or verbal skills assessment. Descriptive data did, however, indicate positive changes in individual students in both of these areas. Changes in verbal skills, in terms of language fluency and elaboration were documented descriptively. Growth in individual students with regard to risk taking and session participation suggests a positive change in creative self-concept.

## Implications for Teachers

The findings of the present study verify the importance of implementing creativity training in the

kindergarten classroom. Due to the natural decline in creativity when students enter school, it is imperative that instructors take steps to prevent this loss. The following recommendations for the classroom teacher may be derived from the current study:

1. Instructors should gain a clear understanding of the importance of creativity and learn about the concrete results of creativity training.

2. Creativity training, in part, should be content based in order to be integrated with existing curriculum. It is recognized that the kindergarten day is already filled with curricular requirements which leaves little time for the implementation of pure creativity training.

3. Teachers should seek instruction in the various types of creativity training which may be implemented in the classroom. It is essential that instructors learn to use appropriate brainstorming activities which ask questions for which there are no correct answers.

4. Classroom activities should involve different avenues for creative expression. These may include figural, verbal, manipulative and movement expressions.

5. Synectics in a viable strategy option for encouraging creative growth in the kindergarten classroom. Following are specific suggestions regarding the implementation of this type of training in kindergarten.

a. The training must involve the comparison of things by noting similarities and differences which take the student past the concrete and stretches each child toward a more abstract level of thinking.

b. Problem solving activities which require analogical thinking in the form Problem A: Solution A::Problem B: Solution B will provide students with opportunities to practice both critical and creative thinking. A synectics excursion is one applicable activity for this purpose.

c. Content based synectics activities may be developed for all subjects. It is detrimental to creative growth if the instructor solely encourages creative thinking on work in the art forms. Synectics should initially be integrated into the existing writing and reading curriculum which is an easy avenue for success.

## Implications for Further Research

The findings of this study necessitate the continued investigation of creativity training with young children as well as the comparison of gifted and nongifted subjects. The recommendation made below specifically address research with young students; however, the same types of studies are needed with older subjects.

1. Important information about synectics training could be gained by retesting the experimental students in

the current research. The proposed study would consist of the administration of creativity tests conducted six months and 12 months after the completion of the current training. This type of study would provide needed information regarding the longevity of the effect of creativity training.

2. It is proposed that the current study should be replicated using either two classes of gifted or two classes of nongifted experimental subjects and two similar control groups. Upon completion of the training, one teacher should be trained to encourage creative behavior in the regular classroom. A comparison of the groups six months later would suggest the effect of creative nurturance for sustaining the training results.

3. Research, utilizing the design and methodology of the current study, is proposed in order that modifications to the synectics training may be made. An augmentation to the training should be the use of self-concept building strategies within the regular synectics activities. The classroom teacher should be instructed on the importance of recognizing and encouraging creative thinking across all content areas and be asked to encourage these behaviors when they occur outside of the training environment. The study should measure creativity, with the figural form of the Torrance Test of Creative Thinking

(Torrance, 1962b, 1962c), global self-concept, and creative self-concept utilizing a measurement scale developed for young children. The development of a creative self-concept scale for early childhood students is inherent in this project.

4. Research comparing the effect of different types of creativity training is proposed in order to learn the best method for use with young children. This type of research has often been employed with older children and models for the study may be found in the literature. It is suggested that synectics, creative problem solving, using the materials from the Primary Future Problem Solving Program (available from Future Problem Solving Program, 315 West Huron, Suite 140B, Ann Arbor, MI), and lateral thinking, using the Just Think series (available from Thomas Geale Publication, Inc., Box 370540, Montara, CA 94037) be used in the proposed study.

5. It is proposed that a study be conducted to investigate the existence of a preferred mode of creative expression for individuals. A large number of students of various economic and intellectual levels should each be given opportunities for creative expression through drawing, manipulating objects, movement and verbal responses. Each expressive product should be rated according to level of creativity and the results of each of

the four types of activities compared. Analysis of these results and correlation of them with the economic and intellectual level of the student should reveal important information about creative expression. This should also provide information regarding the possible existence of a hierarchy of creative expression.

6. The current study reveals the importance of measuring creativity through a variety of expressive forms. It is, therefore, proposed that the development of a product portfolio prototype is needed for assessment of creativity in young children. Other portfolios and authentic gifted student assessment procedures are currently available and may be used to establish a format to the suggested assessment procedure. The proposed portfolio, however, would be developed solely for the assessment of creativity in all children and could be utilized as a tool for measuring further creativity research with young children. It is proposed that this project would develop figural, verbal, manipulative, and movement activities which would measure creativity in young children. The higher achievement score from either a global creativity score obtained from averaging all the pupil products or an individual score achieved through one expressive form would be used to rate a student.

7. A qualitative study of gifted and nongifted groups of students involved in various levels of creative and/or problem solving activities is proposed in order to further describe the two populations. The current study suggests that a hierarchy of participation may be noted according to whether the activity provides for concrete or more abstract levels of participation.

8. It is proposed that the effects of synectics training on the creativity of homogeneously grouped gifted students be compared with the results obtained from heterogeneously grouped gifted students. This will enable the researcher to determine whether collaborative work by homogeneously grouped gifted students contributes to their growth. The study should be mainly descriptive; however, a creativity pretest and posttest is suggested.

9. Another similar study is proposed in which several nongifted students are grouped with gifted students for synectics training. These subjects should be compared with nongifted students who are homogeneously grouped for the training.

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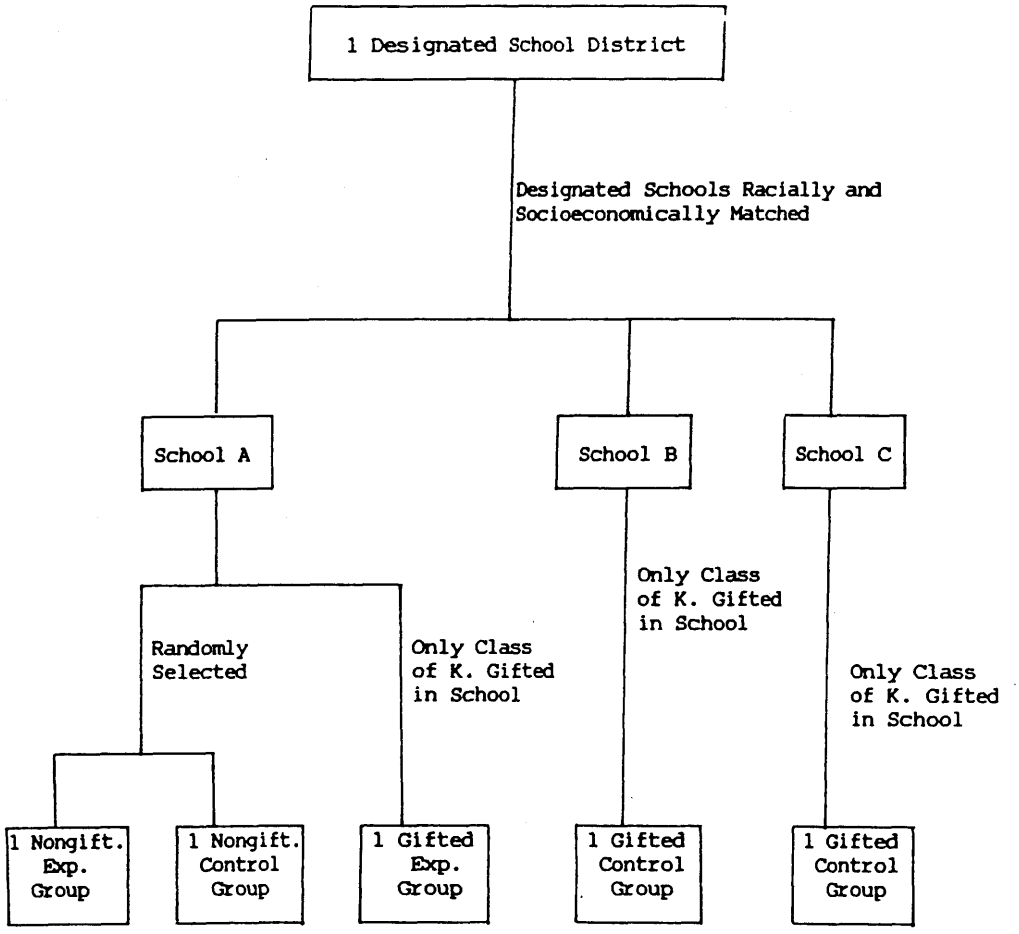
# APPENDICES

# APPENDIX A

## Research Sample Design

RESEARCH DESIGN



# APPENDIX B

## Permission to Conduct Study

The research council has concluded its evaluation of your application to conduct a research study in the [redacted] Independent School District. It is with pleasure that I inform you that the council approved your study, "The Effect of Synectics Training on Gifted and Nongifted Kindergarten Students." (With the agreed upon modifications).

You may begin making contacts now and begin data collection activities in our district during July of 1991. Notify my office in writing of the dates when you will conduct your data collection and the date on which it will be concluded. I will be your contact person in the district. You should inform all concerned that your research project has been approved by the Planning, Research, and Evaluation Department. You will also be working closely with Ms. [redacted].

Speaking for the research council, I wish you the best of success in your research efforts and look forward to receiving a copy of your report. Upon completion, a copy of your findings should be filed with the Planning, Research, and Evaluation Department. If I may assist in any way, please contact me.

You are requested to submit a letter to the [redacted] Independent School District's Planning, Research, and Evaluation Department stating that all student data will remain confidential, that is, no students or personnel will be identified by name in this or future studies involving your data.

Sincerely yours,

Dear Parents:

During the months prior to the winter holidays, an additional teacher will be in your child's classroom providing instruction with the classroom teacher. Twice each week she will provide enrichment activities which complement the regular classroom curriculum. Since these activities will be conducted in small group settings, they will provide your child with additional opportunities for language development and expression as well as practice in creative thinking.

Sincerely,

Principal

# APPENDIX C

## Data Gathering Forms

# STUDENT INTERVIEW

Child's Name _____

## Open-ended Question

"I would like to write about you, to write something that will tell about _____(child's name). What's the first thing I should put in what I write about you?".....(WRITE DOWN RESPONSES - after each response - up to 10 - ask...)"And what else should I write to tell about you?"

## Unfamiliar Object Question

**Circle Object Being Used A. flat rectangle B. fat round cylinder with holes C. long cylinder with grooves at one end**

"I brought something with me today that I hope you can tell me about." (show the object - let child hold and manipulate it) "What do you think this could be"....."What could we do with it" (Write down answers up to 10)

# STREAMLINED SCORING SHEET
## TORRANCE TESTS OF CREATIVE THINKING, FIGURAL FORMS A and B

Name:_____ Test Date:_____ Form:_____

Grade:_____ Age:_____ Sex:_____ School:_____

| | | Raw Score | Standard Score |
|---|---|---|---|
| 1. Fluency: Act. 2 _____ + Act. 3 _____ | = | _____ | _____ |
| 2. Originality: Act. 1 _____ + Act. 2 _____ + Bonus _____ + Act. 3 _____ + Bonus _____ | = | _____ | _____ |
| 3. Abstractness of Titles: Act. 1 _____ + Act. 2 _____ | = | _____ | _____ |

4. Elaboration: (Circle appropriate number 1-6 for A *or* B)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A | Act. 1: | 1(0-5) | 2(6-12) | 3(13-19) | 4(20-26) | 5(27-33) | 6(34+) |
| | Act. 2: | 1(0-8) | 2(9-17) | 3(18-28) | 4(29-39) | 5(40-50) | 6(51+) |
| | Act. 3: | 1(0-7) | 2(8-16) | 3(17-27) | 4(28-37) | 5(38-47) | 6(48+) |
| B | Act. 1: | 1(0-5) | 2(6-13) | 3(14-21) | 4(22-29) | 5(30-37) | 6(38+) |
| | Act. 2: | 1(0-9) | 2(10-19) | 3(20-29) | 4(30-39) | 5(40-49) | 6(50+) |
| | Act. 3: | 1(0-14) | 2(15-24) | 3(25-34) | 4(35-44) | 5(45-54) | 6(55+) |

| | | | |
|---|---|---|---|
| | = | _____ | _____ |
| 5. Resistance to Premature Closure: Act. 2 _____ | = | _____ | _____ |
| **TOTAL** | = | | _____ |
| **MEAN** | = | | _____ |

| **Ability** | **Interpretation** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1. Fluency | | | | | | | | | |
| 2. Originality | | | | | | | | | |
| 3. Abstractness of Titles | | | | | | | | | |
| 4. Elaboration | | | | | | | | | |
| 5. Resistance to Premature Closure | | | | | | | | | |
| **Standard Score** | **40** | **60** | **80** | **100** | **120** | **140** | **160** | **180** | |
| **Percentile** | | **2** | **16** | **50** | **84** | **98** | **99+** | | |

**Checklist of Creative Strengths:**

_____ 1. Emotional Expressiveness (in drawings, titles)
_____ 2. Storytelling Articulateness (context, environment)
_____ 3. Movement or Action (running, dancing, flying, falling, etc.)
_____ 4. Expressiveness of Titles
_____ 5. Synthesis of Incomplete Figures (combination of 2 or more)
_____ 6. Synthesis of Lines (combination of 2 or more sets, Activity 3, Form A) *or* Synthesis of Circles (combination of 2 or more, Activity 3, Form B)
_____ 7. Unusual Visualization (above, below, at angle, etc.)
_____ 8. Internal Visualization (inside, cross section, etc.)
_____ 9. Extending or Breaking Boundaries
_____ 10. Humor (in titles, captions, drawings, etc.)
_____ 11. Richness of Imagery (variety, vividness, strength, etc.)
_____ 12. Colorfulness of Imagery (excitingness, earthiness, etc.)
_____ 13. Fantasy (figures in myths, fables, fairy tales, science fiction, etc.)
_____ **TOTAL (Bonus)**

**Creativity Index:** Mean_____ + Bonus_____ = _____

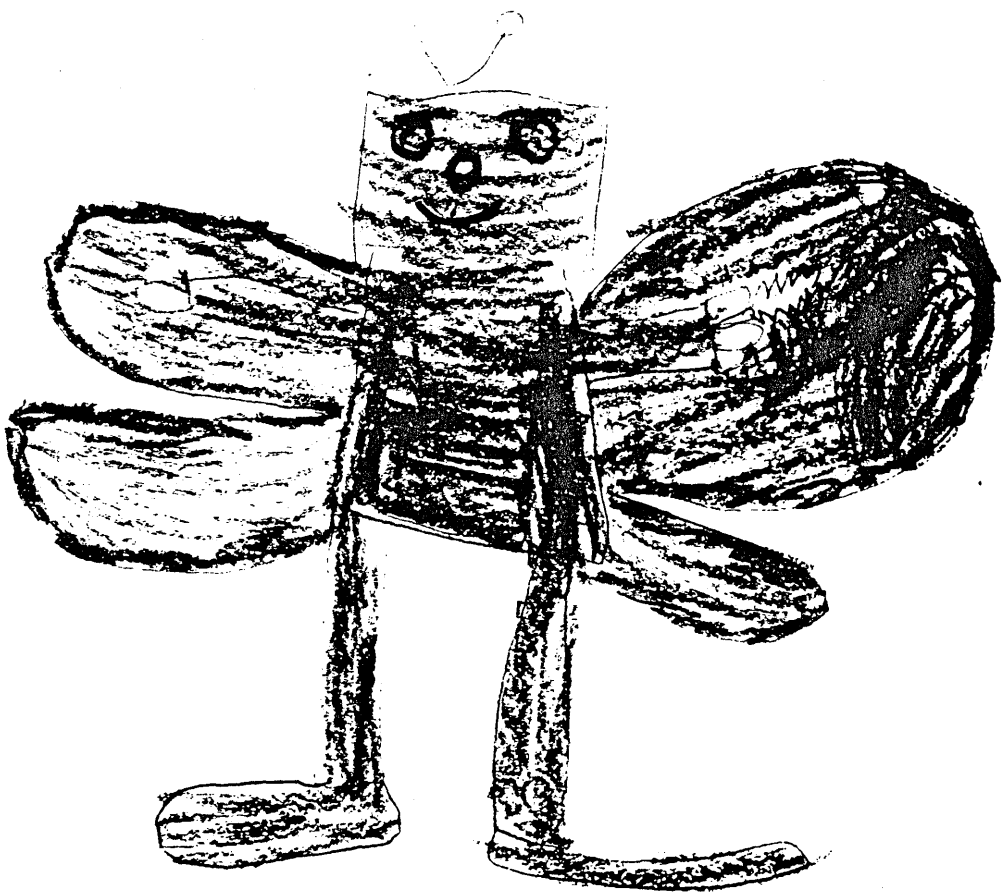
# APPENDIX D

## Pupil Products

Figural Pupil Product - Robot to Help Catch the Gingerbread Boy

Three Ideas Presented: butterfly wings and antennae; rabbit feet, kangaroo pouch

Product Score = Level 3(3-4 Ideas)



Figural Pupil Product - Robot to Help Catch the Gingerbread Boy

One Idea Presented: camouflage

Product Score = Level 2 (1-2 Ideas)

Figural Pupil Product From Highly Creative Student

Robot to Help Catch the Gingerbread Boy

Child's Description: ". . . my robot with the deer antlers could use them to break the Gingerbread Boy or to drag him with it and the wings could make it fly, and sometimes I think a Gingerbread Boy likes peanuts so the elephant's nose is spitting out peanuts and the snail's home is where they sometimes might keep the slime and in the snail's home will make what keeps the slime I was going to put there and a bunny's body and a duck's head and duck's feet and a rhino's horn and duck's (pause) and (pause) would you like to see what will (pause) what kinda like I wanted to work out?