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ABSTRACT

The purpose of the study was to evaluate the effectiveness of a supplementary program of 30 lessons to increase the productive thinking abilities (divergent thinking) of educable mentally handicapped students. An experimental group of 30 institutionalized children were given the supplementary lessons at a rate of three per week. The lessons, based on the brainstorming technique, were felt to encourage ideational fluency, familiarity with the principles of change, improved observational ability, increased sensitivity, and originality through improvisation. Significant improvement was noted for all but the factor of figural elaboration. It was concluded that enhancement of creative performance was feasible in institutionalized educable mentally handicapped students. The value of the brainstorming technique (in which the pupils' ideas were allowed to flow freely) as a specific teaching tool was stressed as having future educational program implications. The verbal functioning was found to be improved and the improvement was felt to be a reflection of a transition from convergent to divergent modes of thinking. The 30 lesson plans used in the experiment are included in the appendix. (CD)

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Department of Health, Education, and Welfare

U. S. Office of Education
Bureau of Education for the Handicapped

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ENHANCEMENT OF PRODUCTIVE THINKING IN INSTITUTIONALIZED MENTAL RETARDATES

SUMMARY

Enhancement of productive, creative thinking was studied in an institutionalized, educable, mentally retarded population. The principle purpose of the study was to determine whether the creative, divergent thinking performances of EMR subjects, as measured on selected subtests of the Torrance Tests of Creative Thinking, would be significantly increased following a systematic supplementary educational program. The research evaluated the effectiveness of a thirty lesson program devised by Rouse (1963) and primarily based on the "brainstorming" technique which was added to the daily curricula of the EMR subjects. A review of the literature revealed disagreement concerning the feasibility of this program with similar subjects.

The subjects were sixty-two resident students at an urban State School. They were the pupils of three teachers, each of whom taught two comparable classes. There were thirty experimental and thirty-two control subjects. The subjects were pretested with Form A of the Torrance Tests of Creative Thinking and posttested with Form B.

All of the Figural and three of the Verbal subtests were used. Performances on the subtests were scored for four figural and three verbal creativity factors. These were figural fluency, flexibility, originality, and elaboration, and verbal fluency, flexibility, and originality. Differences between pre- and posttest performances were obtained and analyzed, using Wilcoxon Rank-Sum Tests. The experimental group was taught thirty lessons at the rate of three per week. The status quo was maintained for the control group subjects.

Significant improvement was found for the experimental group subjects following the training program for six of the seven creativity factors. Only figural elaboration was not significantly improved.

IQ was found to be non-significantly correlated with pretest creativity functioning. Improvement following training for verbal creativity factors was significantly and inversely related to IQ. None of the figural creativity factors was significantly correlated with IQ. CA was found to be significantly and directly correlated with pretest creative functioning on two figural creativity factors and inversely correlated for two verbal factors. Improvement following training was significantly and inversely correlated with CA for three of the seven factors. MA was found to be significantly and directly correlated with pretest creative functioning on two verbal creativity factors. Improvement following training was significantly and inversely correlated with all verbal and one figural creativity factor.

It was concluded that the enhancement of productive thinking was feasible in the institutionalized, mentally retarded population. The brainstorming technique was well accepted by both subjects and teachers, and was the unique feature of the educational experience provided by the lessons. The implications for future educational programs for EMR students included the value of brainstorming as a specific teaching tool. It was felt that the improvement demonstrated by the experimental group subjects was a reflection of an alteration in mental set, from convergent to divergent modes of thinking. Regardless of other variables, verbal functioning was improved in the experimental group.

CHAPTER I

INTRODUCTION

Creativity may be regarded as an aspect of every person's intellectual functioning. As with other human characteristics, individual differences in creativity exist. The literature is replete with studies concerned with creative and productive abilities of normal and supranormal subjects; only recently has the retardate begun to be considered for study. Rouse (1963) noted that stereotyped thinking about the mentally retarded individual's intellectual performance has hindered the effective consideration of these traits in the subnormal, whose verbal handicap had further served to perpetuate the concept of his nonproductive thinking capacities.

One of the major goals of all educational processes is the fullest development of each person regardless of his status or role in life. For the educable mentally retarded (EMR) individual, training has too often been designed to maximize his ability to think in the accepted, usual mode; it has concentrated on convergent thinking to the exclusion of novel, productive, divergent thinking.

This study was designed to evaluate the effectiveness of a supplementary program of education developed specifically to increase the productive thinking abilities of educable mentally retarded children

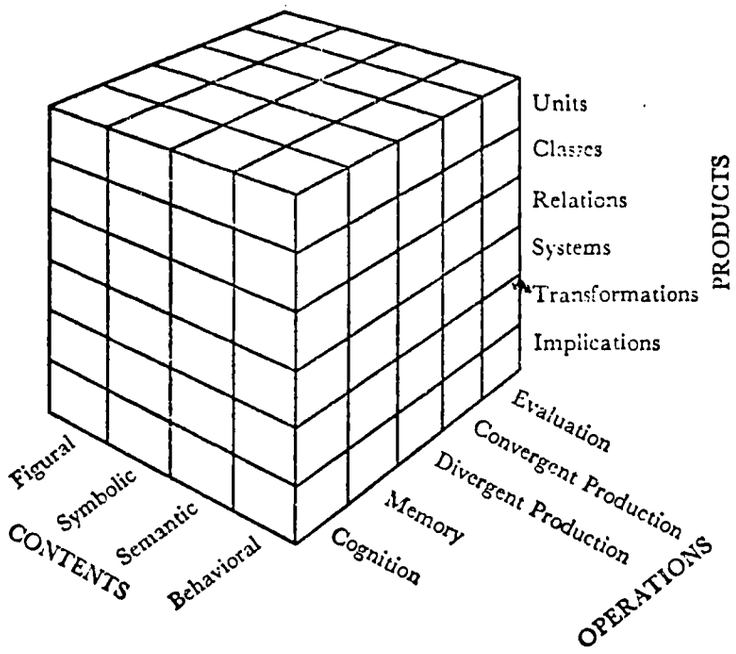
(Rouse, 1963) residing in a State School. If EMR subjects in an institutional environment could be taught successfully by methods heretofore applied only in the day school setting, then a rethinking of the goals of education for the intellectually subnormal individual would be justified.

CREATIVITY AND PRODUCTIVE THINKING

Structure of Intellect

One of the major contributors to both theoretical and empirical investigations of creativity has been Guilford. In the 1950's the nature of intellect became a major area of investigation. During the course of Guilford's (1962) factor-analytic research a structure-of-intellect model was developed which encompassed all intellectual functions. A major contribution of Guilford's work was in the area of divergent production, where little prior systematic data were available. "In fact, the Aptitudes Project began primarily as an investigation of reasoning, creativity, and problem-solving" (Anastasi, 1968, p. 375). Guilford (1962) proposed a threefold classification of intellectual functioning, schematically represented by a cubical model, with primary divisions into "Operations," "Content," and "Products" of thinking. Figure 1 illustrates Guilford's theoretical model for the "Structure-of-Intellect."

"Operations," the first primary dimension which constitutes intelligent thought were factored into four major categories, "Cognition," "Memory," "Production," and "Evaluation."



Theoretical model for the complete "Structure of Intellect"
Department of Psychology
Project on Aptitudes of High-Level Personnel
University of Southern California
June 1960

Figure 1

An earlier (Guilford, 1957) schema factored intellect into two operations "Memory" and "Thinking"; the latter further subdivided into the three distinct categories of "Cognition," "Evaluation," and "Production." Guilford's (1957) theoretical formulation is schematized in Figure 2.

"Memory" served to retain various types and bits of information. "Cognition" was likened to recognizing and discovering and formed the

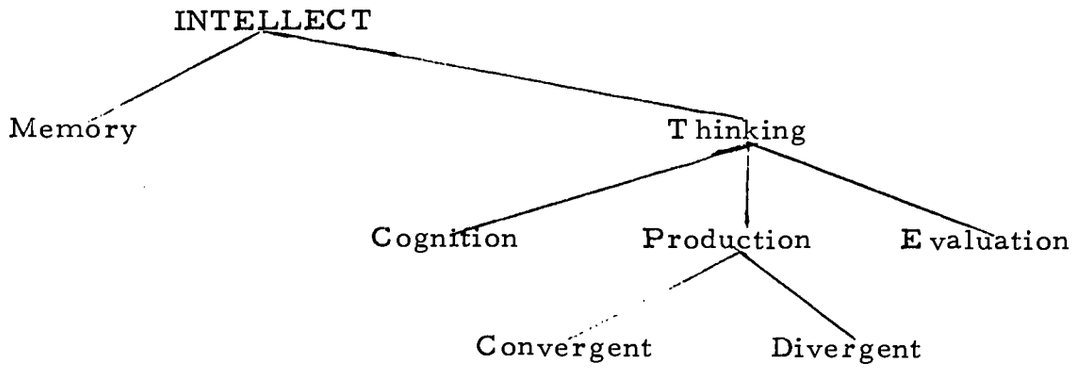


Figure 2. Diagram of the Structure-of-Intellect depicting the major categories of intellectual factors and their logical relationships (from Guilford, 1957, p. 113)

basis for understanding. "Production" referred to the creation of new information from already available data by means of "thought." The operation of production was further subdivided into "Convergent" and "Divergent" thinking. Convergent thinking proceeded to a stereotyped solution while divergent thinking required the individual to go off in different, unusual directions. Indications of creativity would be seen in an individual's divergent thinking capacities. "Evaluation" involved judgments about the adequacy and accuracy of that data which were recognized, recalled, or produced (Guilford, 1957).

Guilford's second major dimension of intellect, "content," was based on the nature of the information or content of thought. "Content" included the abilities to deal with "figural," "symbolic," and "seman-

tic" information. The general category of concrete intelligence was represented by the ability to deal with figural and symbolic data, i.e., the physical properties of the information, including numbers, letters, syllables, etc. These had no inherent meaning beyond that assigned to them by consensus. "Semantic" content was conceptual in nature and consisted of ideas. Abstract intelligence was a combination of semantic and symbolic contents (Guilford, 1956). A fourth type of content, "behavioral," was added on a theoretical basis. Behavioral content was related to social awareness.

The third dimension in Guilford's schema, "products," sought to arrive at the scope of intellect according to the products of thought. Products resulted when a particular operation was applied to a specific content. Six general types of products might be involved, a "unit" of thought, a "class" of units, the awareness of "systems", "relations," "transformations," and "implications." Guilford concluded that every intellectual ability could be represented by an intersection of an operation with a type of content, forming a discrete product.

Ninety abilities were theoretically possible by combining Guilford's three major divisions of intellect; more than half of these have been empirically evaluated. Guilford (1962) concluded that the principal abilities comprising "creativity" were fluency, flexibility, and originality, all of which were located in the broader category of divergent thinking. Fluency was defined as the ability to produce large

numbers of ideas in a given period of time; flexibility as the ability to produce ideas from different classes of content; and originality as the ability to produce statistically unusual ideas. An individual who was facile in the production of ideas, who was not rigid and set in conventional modes of problem-solving, who could go off in new directions of thought, who did not parrot the ideas of others, and whose ideas were at least new to him and possibly even new to his cultural group would be the creative individual.

All of the above abilities, related as they were to divergent thinking, were located in the verbal sphere as to content. Guilford (1962) noted that a similar but distinct set of abilities existed in the non-verbal content areas. "These abilities to think divergently to produce results, differ according to the kind of information with which the person deals" (Guilford, 1962, p. 162). Guilford assumed that each factor which comprised intelligence represented a continua, so that every individual possessed each trait to some degree. He further postulated that performance on tests designed to measure a specific trait could be used to infer the individual's ability in that area. If continua exist, investigations into the various intellectual components need not be limited to the upper ranges of these factors.

Problem-solving, whether or not the product was tangible, was the end product of creative thinking. "Creative thinking is distinguished by the fact that there is something novel about it; novel, that

is, to the thinking individual. The degree of creativity shown is directly proportional to the degree of novelty" (Guilford, 1967, p. 96). To Guilford, the stages of problem-solving and those of creative production were essentially the same, could be explained by a single theory, and together constituted "productive thinking." Guilford acknowledged the importance of motivational factors in productive thinking but felt that only through attention to its purely intellectual aspects could the phenomenon be understood.

More specifically, Guilford (1950, 1959a, 1962, 1967) theorized that individuals differed on at least seven factors which were closely associated with productive thinking abilities. These were:

1. Sensitivity to problems - the ability to recognize that a problem existed which required solution. In the structure-of-intellect model this was the "evaluation of semantic implications."
2. Fluency - The facility with which ideas could be generated.
3. Flexibility - The ability to reject conventional, habitual ways of handling material and to attempt new, unusual ones.
4. Originality - The novelty of the ideas generated, at least to the thinker.
5. Elaboration - The ability to take a simple concept and embellish it to produce a more complex, new idea.

6. Analysis of information - The ability to understand bits of data and to synthesize the information.

7. Redefinition - The ability to transform the meaning or function of something such that a new role emerges.

Guilford (1967) melded the results of his factor-analytic studies into what has been termed a "transfer theory of productive thinking." He concluded that once the new idea was generated, additions made, and the structure modified, the productive thinker must finally evaluate his creation and achieve feedback as to its correctness and utility.

Creativity and Intelligence

Wechsler defined intelligence as "the aggregate or global capacity of the individual to act purposefully, think rationally, and deal effectively with his environment" (1944, p. 3). It has been pointed out that traditional measurement of intelligence was heavily dependent on the evaluation of convergent thinking abilities, while virtually ignoring divergent thinking and transformations (Guilford, 1962; Masland, Sarason, and Gladwin, 1958; Robinson and Robinson, 1965; Taba, 1963). Too many validity studies have been based on academic achievement in the evaluation of intelligence tests. Robinson and Robinson (1965) concluded that "perhaps the most popular view among today's psychologists is that intelligence does not exist as an entity but only as a trait or complex of traits grouped by theoreticians to describe a class of behaviors which may broadly be labeled intelligent" (p. 10).

If academic achievement were an efficient predictor of productive thinking ability, the identification of highly creative individuals would be simple. Taylor and Holland (1967) after reviewing the work of several investigators concluded that there was a low relationship between standard intelligence tests and measures of creative abilities; with most correlation coefficients ranging from .20 to .40 in unselected samples and from zero to negative correlations in samples of individuals with high intelligence. Getzels and Jackson (1962) reported that IQ tests do not measure creative abilities with significant accuracy, though a high IQ may assist the individual to demonstrate his abilities. Torrance (1962c) found that approximately seventy percent of highly creative individuals were overlooked when traditional intelligence measures were the criteria for inclusion.

Creativity and Mentally Retarded Subjects

The implication that creativity was identifiable only among the intellectually gifted has not been substantiated by research. Torrance (1962c) indicated that creative ability may be found throughout the continua of intellect, except at the extreme lower end. Wilson (1958) asserted that those abilities necessary for creativity were distributed to some degree among all people. Chorness (1959) demonstrated that productive thinking was spread across the range of intelligence found among civilian Air Force personnel. Tisdall (1962a) reported low correlation coefficients between productive thinking and IQ scores.

Tisdall (1962a) found that educable mentally retarded subjects who were placed in special classes in the public schools did not significantly differ from a control group of normal children with equal chronological ages (CA) on measures of verbal fluency, flexibility, and originality, but did differ significantly from a matched group of EMR children who had regular class placements. This suggested that special teaching techniques providing increased stimulation could result in enhancement of creative abilities. Measures of non-verbal functioning did not significantly differentiate the three groups.

In contrast to Tisdall's (1962a, 1962b) results, Kelson (1965) found that there were significant differences in verbal creativity between EMR and normal subjects. She explained the difference in findings by the slightly different IQ ranges of the EMR groups in the two experiments, (Tisdall IQ range was from 65 to 85; the Kelson IQ range from 50 to 75), the greater refinement and inclusiveness of instruments employed in the Kelson research, and the socioeconomic backgrounds of the two populations.

Kelson's findings concurred with those of Tisdall in that no significant differences between EMR and normal subjects existed on non-verbal measures of productive thinking. She noted the tendency of investigators to collect data exclusively with verbal tasks and that this practice lead to the ". . . implicit correlative assumption, i.e. that because the retarded are not verbally fluent they are not

creative ..." (p. 23). Kelson also demonstrated that correlations between IQ and creativity were non-significant in both verbal and non-verbal areas for retarded children.

The finding that retarded subjects performed as well as intellectually normal ones on non-verbal dimensions of productive thinking while being significantly inferior on verbal tasks, was explained by Smith (1967) as reflecting a relatively greater efficiency with, and positive reactions to, non-verbal stimuli.

> . . . to attribute the lack of manifest creative thought to intellectual retardation alone may be inappropriate, since educable mentally retarded children are often associated with circumstances which are inhibiting, highly structured, threatening and rigid. Such an environment is thought to stifle creative thought.
>
> (Smith, 1967, p. 575)

ENHANCEMENT OF PRODUCTIVE THINKING

Research devoted to the possibility of enhancing productive thinking abilities has generally employed subjects of high intelligence. Maslow (1967) commented 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. 43). He stressed that the function of education should be the maximization of improvization and inspiration ". . . rather than approaching creativeness from the vantage point of the finished work of art, of the great creative work . . . ." (Maslow,

1967, p. 44). In recent years researchers and educators have been concerned with the nurturance of creativity and allied and related abilities. The acquisition of the "good life" requires cultivation of balanced new ideas (Mooney and Razik, 1967). In order to provide individuals capable of such productions, education must be designed to encourage new ideas rather than devoting itself to the sole task of "learning" the old.

Torrance, Yamamoto, Schenetski, Palamutlu, and Luther (1960) indicated that the cultivation of productive thinking in children was a feasible task. They demonstrated that there was little relationship between creative thinking abilities and traditional measures of intelligence, and that an awareness of this should permit more people to be educated to a higher level than previously thought possible. Torrance (1959, 1961, 1962a, 1962c) documented that children in the elementary grades could be trained to think productively in relatively short periods of time.

Crutchfield (1967) subdivided a sample of children into three intellectual ranges, those with intelligence quotients (IQ) above 115, those with IQ's between 100 and 115, and those with IQ's below 100. Of the 481 subjects (Ss) involved in this research, 267 were given a creative problem-solving course while the remaining 214 served as controls.

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> . . . The results show that for <u>each</u> of these three levels the trained children markedly surpass the controls in

> test performance. There is, by the way, an appreciable correlation between IQ and our criterion test scores, but it is notable that the effect of training overrides the effect of intelligence to such a degree that the low-IQ children after training actually surpass the untrained high-IQ children.
>
> (Crutchfield, 1967, pp. 204-205)

Crutchfield demonstrated that trained children achieved three times as many solutions to problems as untrained ones. It should be noted that he applied the designation "low-IQ children" to those subjects whose IQ's fell at or below 100 and was not referring to retarded subjects. Crutchfield felt that the essential methodological problem was providing feedback without unduly reinforcing conventional, convergent responses.

True (1957) reported that college students who received a single fifty minute creativity training exposure produced an increased quantity of ideas over control students. He found that the increase shown by an individual was directly proportional to his pretest level of functioning.

Cartledge and Krauser (1963) used first grade children in their study of the effects of training on productive thinking. There were four groups of subjects, two experimental and two control; the two experimental groups, one motivated for quantity and the other for quality received training consisting of five 20-minute periods, whereas the two control groups, similarly motivated, received no training. The experimental groups were found to produce both a

greater quantity and better quality than the control groups.

Parnes and Meadow (1959) and Meadow and Parnes (1959) utilized the so-called "brainstorming" technique to train college students in a creative problem-solving course. Brainstorming was defined as a technique which allowed "a given period of time for listing all the ideas that come to one's mind regarding a problem, without judging them in any way . . . ." (Parnes, 1962b, p. 254). The individual was instructed to disregard the quality of the responses entirely. In applying this technique, Parnes and Meadow (1959) found that subjects who learned brainstorming produced better quality ideas than control subjects who had been given a creative problem-solving course without brainstorming. It was concluded that brainstorming reduced factors which might serve to inhibit the free flow of thoughts. The authors also concluded that creative imagination could be developed deliberately, that a creative problem-solving course which used the brainstorming technique improved the individual's ability to produce worthwhile ideas, and that systematic instruction in applied imagination produced increased confidence, initiative and leadership (Parnes, 1962a, pp. 186-187). Parnes (1963) concluded that such creative problem-solving courses were equally beneficial to those of relatively high and low intelligence levels, and relatively high and low initial creative ability. Caution must be exercised in applying these results to the general population since they were obtained on a

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preselected sample.

Universities and corporations have instituted courses designed to improve the creative problem-solving potential of the participants and have demonstrated the practical utility of such efforts (Hansen, 1962; Samstad, 1962). The technique of brainstorming has been a prominent feature of some of these courses, and, when used, proved to be a valuable adjunct.

Training Retarded Subjects

Research on the potential creative abilities of the educable mentally retarded (EMR) has been sparse. Iscoe and Giller (1959) delineated the traditional assumption that retarded subjects approached problems concretely, as opposed to the more abstract approach of the intellectually normal. They attributed this phenomenon, at least in part, to:

> . . . the comparatively impoverished environment in which the mentally retarded person is frequently placed . . . . The lack of stimulation and satisfactory experiences from his environment may combine to produce the results obtained . . . .
>
> (p. 115)

Lowenfeld (1962) cited personal experiences in which significant increases in the creative productions of institutionalized retarded children took place through the use of art media. He concluded that the intellectually retarded individual could produce artistic creations equal to those of others of the same mental age if he received increased stimulation.

Rouse (1963, 1965) devised a series of lesson plans to be used to supplement the educational experiences of EMR children. The sessions incorporated concepts which were felt to be important to creative, productive thinking.

> . . . Just as the ability to read or reason mathematically is an asset for doing well on some instruments designed to measure intelligence, it was thought that experience in the areas covered in the lessons might enhance an individual's performance on tests of productive thinking . . . .
>
> (Rouse, 1963, p. 31)

The program was based on the principles suggested by Torrance (1962b) and were designed to be highly stimulating to the students. The lessons encouraged drawing, writing stories and poems, but the majority of the time was spent developing the efficient use of the brainstorming technique. The brainstorming sessions were limited to fifteen minutes each and were taught by the regular classroom teachers who consulted with Rouse weekly. The sessions were used to encourage both fluency of thought and the verbal report of ideas. The thirty lessons were given one per school day over a six week period. Rules designed to overcome fears which might interfere with free flow of ideas, as adapted from Wilson, were:

> 1. Judgment is ruled out. Criticism of ideas must be withheld.
> 2. Free-wheeling is welcomed. The wilder the idea, the better; it is easier to tame down than to think up.
> 3. Quantity is wanted. The greater the number of ideas, the better.
> 4. Combination and improvement are sought. In addition to contributing ideas of their own, participants

> might suggest how ideas of others can be joined into still another idea . . . .
>
> (Wilson, 1958, p. 119)

The status quo was maintained for the control subjects. Pretesting and posttesting were accomplished with identical subtests of the Minnesota Tests of Creative Thinking. The subtests selected were "Product Improvement" and "Circles."

The subjects were 78 Caucasian children in ten South Carolina public school special classes for the educable mentally retarded. Their chronological ages (CA) ranged from 7-7 to 17-2, their intelligence quotients (IQ) from 58 to 81. There were 47 subjects in the experimental group and 31 subjects in the control. Rouse found that gain scores were significantly increased in the experimental group while the control group remained unchanged. The hypothesis that a productive thinking training program would improve the performance of EMR subjects on selected measures of creative thinking was supported. She concluded that brainstorming sessions provided valuable experiences in "learning by doing" and that EMR subjects were able to derive significant improvement from these sessions.

Budoff, Meskin, and Kemler (1968) attempted to replicate Rouse's (1963) research using a public school sample from Boston. The subjects were 26 EMR students in Jr. High School special classes, of whom 13 were trained and 13 served as controls. A pretest-posttest design was used to evaluate the effectiveness of the training

program; the same subtests of the Minnesota Tests of Creative Thinking were administered at both testing sessions. The only significant gain reported was in originality on the Circles Task. All other differences were non-significant. Budoff, et al., found that their results failed to replicate those reported by Rouse, and concluded that the obtained differences could be attributed in part to the familiarity of the Boston subjects with the examiners.

> . . . . Since EMR populations who do not have an exposure to investigations prior to testing may be suspicious and less responsive, the higher posttest scores of the South Carolina sample may reflect, in part, decreased apprehensiveness towards unfamiliar examiners as well as the increase due to training . . . .
>
> (Budoff, et al., 1968, p. 198)

When Budoff, et al. (1968) made a comparison of their subjects with matched CA subjects from the Rouse (1963) experiment, large pretest differences favoring the Boston group were found on six of the measures of creative thinking. These differences disappeared following training.

There were, however, other differences between the two experimental groups not pointed out by Budoff and his associates. Rouse (1963) had the classroom teacher who normally instructed the classes teaching the experimental curricula while Budoff, et al., (1968) used a special teacher. This teacher, unfamiliar to the students, may have made the subjects uncomfortable, thereby reducing their ability to absorb the new type of material. In addition, their total experimental

group consisted of 13 subjects, as compared with the 47 employed in the Rouse study. Dr. Rouse stated, in a personal communication dated August 9, 1969, that she did not consider the Budoff et al. (1968) study a replication of her experiment. The authors of the Boston research had omitted several lessons and in one lesson had changed the stimulus object.

The foregoing review of related research on the enhancement of productive thinking among EMR subjects indicated that some confusion existed regarding its feasibility. In order to investigate the findings of Rouse (1963, 1965) and Budoff, et al. (1968) and to provide evidence regarding the effects of such training, the following hypotheses were tested:

Main Hypothesis

1. A systematic training program would significantly enhance divergent thinking in educable mentally retarded individuals, as measured by selected subtests, both Verbal and Figural, of the Torrance Tests of Creative Thinking.

Secondary Hypotheses

2. A significant correlation would exist for control group subjects between pre- and posttest creative performances in educable mentally retarded individuals, as measured by selected subtests, both

Verbal and Figural, of the Torrance Tests of Creative Thinking.

3. Pretest creative performance, as measured by selected subtests, both Verbal and Figural, of the Torrance Tests of Creative Thinking, would be unrelated to intelligence quotients for all subjects.

4. Difference scores on the seven creativity factors, as measured by selected subtests, both Verbal and Figural, of the Torrance Tests of Creative Thinking, would be unrelated to the intelligence quotients of the experimental group subjects.

5. Difference scores on the seven creativity factors, as measured by selected subtests, both Verbal and Figural, of the Torrance Tests of Creative Thinking, would be unrelated to the chronological ages of the experimental group subjects.

6. Difference scores on the seven creativity factors, as measured by selected subtests, both Verbal and Figural, of the Torrance Tests of Creative Thinking, would be unrelated to the mental ages of the experimental group subjects.

CHAPTER II

EXPERIMENTAL DESIGN

The procedure followed in the study was:

1. Pretesting six intact classes of EMR subjects with the Torrance Tests of Creative Thinking, Form A. There were three teachers each teaching two classes.
2. Training three of the classes, one taught by each of the teachers, with a program designed to improve the productive thinking abilities of the pupils. Each teacher trained his own experimental class. The status quo was maintained for the experimental classes.
3. Posttesting all of the subjects (Ss) with the Torrance Tests of Creative Thinking, Form B.
4. Statistical analyses of all pre- and posttest data.

The Ss, instruments, general administration of the tests, scoring, and experimental treatment have been described below.

SUBJECTS

The Ss utilized in this study were 64 adolescent and young adult resident students at Willowbrook State School. Willowbrook is located on Staten Island in New York City and draws its population from a

generally urban catchment area.

The Ss were the total number of students taught by three teachers, each of whom had two comparable classes, composed of individuals of approximately the same chronological age (CA), intelligence quotients (IQ), mental ages (MA), and academic achievement. The following criteria for inclusion in the study were met by the Ss: All Ss have IQ's between 40 and 80, are considered educable mental retardates, have

TABLE 1

COMPARISON OF IQ, CA, AND MA FOR EXPERIMENTAL AND CONTROL GROUPS IN AN EDUCABLE MENTALLY RETARDED POPULATION

		Experimental (N=30)	Control (N=32)	t
IQ	Range	46 - 84	45 - 80	
	Mean	59.13	60.00	.46
	SD	8.52	6.04	
CA	Range	153 - 257	129 - 253	
	Mean	197.20	203.25	.73
	SD	30.79	30.95	
MA	Range	80 - 158	84 - 164	
	Mean	116.13	120.84	.75
	SD	23.27	25.22	

Note -- CA and MA in months

CA's between 12 and 22 years, have MA's not lower than 5 years, have sufficient oral communication skills to be understood for correct recording of verbal responses, and adequate motor coordination to manipulate a pencil or crayon for non-verbal responses. Deaf and/or

blind individuals were excluded. Demographic data for the experimental (E) and control (C) groups (Table 1) were analyzed using t tests for the significance of the difference between means. No significant differences were found between the overall afternoon and morning groups. The three pairs of classes, E versus C, were evaluated with WRST tests to further insure the comparability of the E and C groups (Table 2).

TABLE 2

COMPARISON OF THE PAIRS OF CLASSES, ONE EXPERIMENTAL AND ONE CONTROL, TAUGHT BY THREE TEACHERS

		Class A		Class B		Class C	
		E (N=10)	C (N=12)	E (N=9)	C (N=9)	E (N=11)	C (N=11)
IQ	Range	46-84	48-80	52-69	45-76	52-67	50-69
	WRST	104.5/149.5		87.5/83.5		137/116	
CA	Range	198-250	200-253	182-257	194-262	153-178	149-180
	WRST	105.5/148.5		76.5/94.5		122/131	
MA	Range	96-158	108-162	102-158	92-164	80-115	84-110
	WRST	99/155		81.5/89.5		133.5/119.5	

Note -- CA and MA in months

The evaluation of this data showed no significant differences between any of the pairs of classes. The morning classes became the control group, the afternoon classes the experimental group. This gave preferential treatment to the C group by assigning any fatigue factors to the E group.

Investigation of the teacher variable was simplified by the use of only those teachers who were assigned to both an E and C group. It was assumed that differences in any particular teacher's E and C groups following training would be due to the experimental experiences rather than to personality or other factors.

MEASURES OF CREATIVE THINKING

Torrance (1966) discussed the nature of creativity as an awareness of problems or gaps in knowledge, a searching for solutions for these deficiencies, the testing and retesting of ideas, and communication of results. The Bureau of Educational Research of the University of Minnesota, which functioned under the direction of Torrance, sought and developed tasks which would reliably elicit these abilities. The results obtained by testing were assessed in terms of Fluency, Flexibility, Originality, and Elaboration, as described by Guilford (1959). Torrance initially adapted some of the Guilford test materials for use with young children but later restructured them into more complicated tasks than the factorially pure tests employed by Guilford.

> One major difference between Guilford and Torrance is that, whereas each of Guilford's tests was designed to identify or represent a single factor, Torrance soon initiated more complex tests each of which could be scored on several factors . . . .
>
> (Goldman, 1967, p. 269).

The subtests used consisted of six tasks, three from the Verbal and the entire Figural section (3 tasks) of the Torrance Tests of

Creative Thinking (1966). Form A was used for pretesting, Form B for posttesting. These subtests were selected because they had been employed and found applicable in one or more studies of creative functioning with retarded populations (Tisdall, 1962a; Rouse, 1963; Kelson, 1965; Budoff, et al., 1968). Rouse (1963, 1965) and Budoff, et al., (1968) had used only one Verbal and one Figural subtest from which to evaluate seven aspects of creative functioning. In view of the disparate results obtained by these authors, it was reasoned that increasing the number of subtests used in both pre- and posttesting would help to stabilize and clarify the obtained results. In addition, the use of parallel forms rather than repeating the identical subtests would lessen memory effects.

Verbal Activities

1. Product Improvement. The subject was presented with a drawing of a stuffed toy elephant (Form A) or a stuffed toy monkey (Form B) and told its general dimensions. The examinee was instructed to describe all of the ways he could think of to make it more fun to play with. A time limit of ten minutes was imposed and the responses recorded verbatim. Responses were scored for fluency, flexibility, originality, and elaboration.

2. Unusual Uses. The subject was asked to give as many novel, interesting, and unusual uses he could think of for empty cardboard boxes (Form A) or empty tin cans (Form B), the responses recorded

verbatim. There was a ten minute time limit. Responses were scored for fluency, flexibility, originality, and elaboration.

3. Just Suppose. The subject was confronted with a picture illustrating an improbable situation, ". . . a great fog were to fall over the earch and all we could see of people would be their feet" (Form A) or ". . . clouds had strings attached to them which hang down to earth" (Form B), and asked to imagine it to be happening. The subject was requested to give as many ideas as he could think of describing what might happen. Responses were recorded verbatim. There was a five minute time limit. Responses were scored for fluency, flexibility, and originality.

Figural Activities

1. Picture Construction. The subject is given pencils and crayons and a booklet containing either a small elliptical piece of colored paper (Form A) or a small kidney shaped piece of colored paper (Form B). The task requires that the subject glue the colored paper onto a blank sheet of paper in order to make a meaningful picture of which the colored form is an essential part. There is a ten minute time limit, after which he is asked to name his drawing. The production is scored for originality and elaboration.

2. Picture Completion. The subject was given one of two sets of ten ambiguous, incomplete figures and asked to take a pencil or crayon, and, by adding lines, sketch an interesting, unusual object or picture.

He was asked to title each drawing. There was a ten minute time limit. The productions were scored for fluency, flexibility, originality, and elaboration.

3. Lines or Circles. The subject was presented with either 20 pairs of parallel lines (Form A) or 42 circles (Form B) and asked to make as many objects or pictures out of them as he could, using pencil or crayon. There was a ten minute time limit. The drawings were scored for fluency, flexibility, originality, and elaboration.

Reliability and Validity

Test-retest coefficients varying from .71 to .93 were reported in the test manual, with verbal tasks higher than figural, fluency and flexibility higher than originality and elaboration. Product-moment coefficients of correlation between Forms A and B are reported to range from .50 to .93, although some studies suggested lower reliability in incomplete batteries. Validity data is difficult to accumulate particularly when the construct under consideration is complex.

Torrance (1966) reported a wide variety of studies involving children and adults. The results of these studies were encouraging. Criteria for creative functioning differed widely among the studies, ranging from peer and teacher nominations to educational achievement, from face validity to predictive validity. Germaine to the present research were those studies of growth resulting from creative thinking experiences. Recent studies reported by Torrance (1966)

included those where students were engaged in creative thinking activities integrated into their course work. In all studies, experimental Ss demonstrated greater gains in creative functioning than their non-trained controls, as measured on the Torrance Tests of Creative Thinking. Cartledge and Krauser (1963) reported similar results with first-grade Ss.

Torrance (1966) acknowledged the need for additional evidence concerning validity of the Torrance Tests of Creative Thinking. It seemed reasonable to accept the data now available, recognizing that much of it remains face validity still in need of statistical evaluation.

Scoring

Accurate scoring of the Torrance Tests of Creative Thinking, a complex task, required considerable prior experience. Trained individuals obtained inter- and intrascorer reliability coefficients ranging from .76 to .99. Scorers with considerable experience have been found to average in excess of .90 (Torrance, 1966). In order to eliminate any interference with objectivity of scoring and to provide evaluations most likely to coincide with the principles set down by Torrance, all test booklets were professionally scored by the Personnel Press Scoring Service. This organization employed scorers personally trained by Torrance. In addition, this effectively controlled for any possible experimentor bias in the scoring which might have arisen from knowledge of which subject received training. In this connection,

it should be noted that the teachers neither administered the tests nor were informed of the results.

Composite scores were obtained for each subject by summing the results obtained separately for each creativity factor in each test administered during pretesting, and, similarly for each during posttesting. All verbal fluency scores were combined, all verbal flexibility scores were combined, and verbal originality scores were combined. The same procedure was followed for the four figural creativity factors, fluency, flexibility, originality, and elaboration. The above followed the procedures suggested by Torrance (1966). In all, there were seven pairs of scores for each of 62 Ss which represented pre- and posttest performances.

EXPERIMENTAL TREATMENT

Permission to conduct the research was obtained from the administrative personnel of Willowbrook State School. The three teachers who would be involved were contacted and their cooperation solicited. This was readily forthcoming. The nature of the experiment was explained to them and copies of the Lesson Plans for the Enhancement of Productive Thinking (Appendix A) distributed for study.

The E Ss were available only in the afternoon and the C Ss only in the morning, making it necessary to test accordingly. All Verbal

tests were individually administered to avoid contamination, responses were given orally by the subject and recorded verbatim by the examiner. Figural tests were given in small groups in accordance with the suggestions made by Torrance (1966). All tests were administered by two PhD candidates thoroughly familiar with individual testing procedures. Each examiner tested both E and C subjects.

The experimental group was taught according to the Lesson Plans for the Enhancement of Productive Thinking (Rouse, 1963). These lessons were altered only insofar as essential to make them applicable to the institutional setting. The thirty lessons were taught at the rate of three per week for ten weeks, in contrast to Rouse (1963, 1965) and Budoff, et al., (1968) who completed the lessons in six weeks, five per week. This change in experimental design was made in order to avoid satiation effects reported by both Rouse and Budoff, et al., as well as to accommodate the teachers involved whose schedules would not permit the greater concentrations. The teachers met with the experimenter once a week during the training, discussed the coming week's lesson plans, asked and answered questions, and discussed problems which had arisen the previous week. It was felt that these meetings increased the uniformity of teaching techniques. The lessons were taught by each teacher to his own students during the regular class period towards the end of the school day. The teachers maintained the status quo for the control group Ss.

The lessons were designed to give the Ss in each experimental class experience in brainstorming in order to encourage development of the following:

1. ideational fluency
2. the principles of change
3. improved observational abilities
4. increased sensitivity to taken for granted items
5. improvisation to facilitate originality

The program was thought to be highly stimulating and enriching as an approach to the development of productive, creative thinking (Rouse, 1963, 1965).

The teachers were provided with notebooks containing copies of the lesson plans and paper for comments and observations. They were asked to render opinions as to the success or failure of each lesson. These were not seen by the experimenter until the conclusion of the experiment.

The teachers were instructed to follow the general rules for brainstorming which were designed to overcome any fears which might reduce the free flow of ideas during the 15 minute brainstorming sessions. These rules were:

1. Judgment is ruled out.
2. "Free-wheeling" is welcomed.
3. Quantity is wanted.

4. Combination and improvement are sought.
(Wilson, 1958)

Posttesting began at the conclusion of the training period and was completed within a four week period. Verbal and Figural Activities, Form B were used.

STATISTICAL EVALUATION

The statistical analyses were primarily concerned with comparison of the change from pre- to posttest performances for E and C subjects. Examination of the data indicated that the difference scores were not normally distributed. The Wilcoxon Rank-Sum Test (WRST) was used whenever a comparison of E vs. C performances was needed. Wilcoxon Rank-Sum Test (WRST) was used because it makes no assumptions concerning the shape of the distribution or the equality of variances. The WRST, less powerful than t tests, increased the possibility of Type II errors. The .05 level was retained for rejection of the null hypothesis.

Calculation of the WRST proceeded from the ranking of the results obtained by both E and C Ss. All E ranks were summed, all C ranks were summed. These totals were then compared with a table of values which must be attained for significance (Wilcoxon, Katti, and Wilcox, 1963).

CHAPTER III

RESULTS

Results of the study follow and supplementary findings also have been presented. Calculation and pre- and posttest difference scores for all subjects and examination of the data indicated a non-normal distribution. F ratios for homogeneity of variance were calculated (Table 4); when variances were significantly different, non-parametric treatments were used. Where F ratios for homogeneity of variance were non-significant, t tests were used. Frequency distributions were prepared for E and C groups, for each of seven creativity factors, for the total groups, and by CA, MA, IQ, and by class placement.

Evaluation of the Treatment Program

It was hypothesized that a series of 30 lessons designed to enhance the productive thinking of institutionalized mentally retarded individuals would significantly improve their performance on the seven creativity factors, as measured by the Torrance Tests of Creative Thinking. In order to determine that the results were obtained on similarly creative groups, t tests were computed on the pretest performances of the E and C groups. Ranges, means, and standard deviations as well as the results of the t tests have been presented in Table 3. F

ratios for homogeneity of variance of the pretest performances of both groups show no significant differences; t tests showed no signifi-

TABLE 3

COMPARISON OF PRETEST SCORES FOR EXPERIMENTAL AND CONTROL GROUPS ON SEVEN CREATIVITY FACTORS IN AN EDUCABLE MENTALLY RETARDED GROUP

Factor		Experimental Group	Control Group	F	t
Figural Fluency	Range	7 - 24	5 - 31		
	Mean	16.33	19.28		1.74
	SD	5.38	6.49	1.45	
Figural Flexibility	Range	7 - 21	4 - 25		
	Mean	14.13	15.91		1.32
	SD	4.68	5.88	1.58	
Figural Originality	Range	4 - 30	6 - 49		
	Mean	17.33	21.00		1.67
	SD	7.15	9.99	1.78	
Figural Elaboration	Range	10 - 110	22 - 128		
	Mean	49.63	55.94		.89
	SD	27.83	27.75	1.01	
Verbal Fluency	Range	4 - 31	2 - 37		
	Mean	13.37	13.63		.04
	SD	6.84	7.41	1.18	
Verbal Flexibility	Range	2 - 23	1 - 20		
	Mean	8.97	8.75		.19
	SD	4.83	4.04	1.43	
Verbal Originality	Range	0 - 16	0 - 14		
	Mean	4.53	4.43		.10
	SD	3.95	3.59	1.21	

cant differences in pretest performances. Posttest ranges, means, and standard deviations have been presented in Table 4.

The differences between pre- and posttest performance, E vs. C,

were compared by use of WRST on the seven creativity factors (Table 5). Figural fluency, figural flexibility, figural originality, verbal

TABLE 4

POSTTEST RANGES, MEANS, AND STANDARD DEVIATIONS FOR EXPERIMENTAL AND CONTROL GROUPS ON SEVEN CREATIVITY FACTORS IN AN EDUCABLE MENTALLY RETARDED GROUP

Factor		Experimental Group	Control Group
Figural Fluency	Range	8 - 28	8 - 26
	Mean	17.87	15.88
	SD	4.72	4.86
Figural Flexibility	Range	8 - 25	8 - 19
	Mean	15.03	13.22
	SD	3.94	3.09
Figural Originality	Range	5 - 47	5 - 33
	Mean	20.27	17.06
	SD	8.71	6.75
Figural Elaboration	Range	17 - 97	15 - 98
	Mean	50.60	43.07
	SD	22.39	19.33
Verbal Fluency	Range	7 - 50	3 - 24
	Mean	22.87	11.44
	SD	5.50	5.33
Verbal Flexibility	Range	4 - 28	2 - 16
	Mean	14.70	7.69
	SD	4.57	3.45
Verbal Originality	Range	0 - 25	0 - 14
	Mean	8.77	4.50
	SD	5.23	2.74

fluency, verbal flexibility, and verbal originality were found to be significant ($P < .01$) for experimental group improvement. Only figural elaboration was not significant. F ratios for homogeneity

of variance, ranges, means, and standard deviations, as well as the sums of ranks for the difference scores have been presented in Table

TABLE 5

COMPARISON OF EXPERIMENTAL AND CONTROL GROUPS ON SEVEN CREATIVITY FACTORS, DIFFERENCE SCORES FROM PRE- TO POSTTEST IN AN EDUCABLE MENTALLY RETARDED GROUP

Factor		Experimental Group	Control Group	F ratio	Wilcoxon
Figural Fluency	Range	-7 to 10	-19 to 10		
	Mean	1.50	-3.16		1157.5**
	SD	3.78	7.85	4.33[a]	
Figural Flex.	Range	-6 to 11	-16 to 8		
	Mean	0.90	-2.78		1162**
	SD	3.62	5.47	2.28[b]	
Figural Orig.	Range	-5 to 31	-24 to 9		
	Mean	3.07	-4.94		1139.5**
	SD	10.65	8.16	1.70	
Figural Elab.	Range	-32 to 51	-76 to 25		
	Mean	0.83	-10.28		1077
	SD	19.16	24.59	1.65	
Verbal Fluency	Range	-5 to 32	-14 to 10		
	Mean	8.80	-2.19		1323.5**
	SD	4.95	5.09	2.49[a]	
Verbal Flex.	Range	-4 to 16	-9 to 7		
	Mean	5.73	-1.06		1298**
	SD	4.95	3.31	2.43[a]	
Verbal Orig.	Range	-3 to 15	-6 to 6		
	Mean	3.17	0.13		1138**
	SD	4.69	2.89	2.62[a]	

** $P < .01$ 763/1137
a $P < .02$ (one-tailed)
b $P < .10$ (one-tailed)

5. F ratios showed significant differences in the variances of all measures other than figural originality and elaboration. The variances

were not consistently greater for either E or C groups, indicating no consistent bias.

Forms A and B of the Torrance Tests of Creative Thinking

It was hypothesized that control group subjects would show significant correlations between their pre- and posttest performances on Forms A and B of the Torrance Tests of Creative Thinking. Pearson product-moment correlation coefficients were computed for the seven creativity factors, pre- and posttest performances of the control group Ss. High correlations indicated parallel form and long-term reliability for the two versions of the test, while low correlations suggested the opposite. All correlations were significant at the .001 level, supporting the hypothesis. The obtained correlation coefficients appear in Table 6 together with reliability coefficients reported by Torrance (1966, p. 21) obtained with a normal IQ, school age population. The first group of correlations shown were obtained on 118 Wisconsin fourth, fifth, and sixth graders tested approximately two weeks apart; the second group consisted of 26 Minnesota fifth graders tested approximately eight months after the first administration. Figural measures were generally less reliable than verbal, with figural fluency .66, figural flexibility .45, figural originality .59, and figural elaboration .62; verbal fluency was .73, verbal flexibility .62, and verbal originality .61. The correlation coefficients obtained with the retarded population were lower than those reported with

normal individuals on each of the seven creativity factors.

Intercorrelations. Intercorrelations among the seven creativity factors were computed on the pretest performances of all E and C Ss

TABLE 6

CORRELATION COEFFICIENTS FOR PERFORMANCES ON FORMS A AND B OF THE TORRANCE TESTS OF CREATIVE THINKING IN AN EDUCABLE MENTALLY RETARDED GROUP AND NORMAL GROUPS

	Coefficients of Correlation		
	Institutionalized Retardates (N=32)	Normals[a] Gr. 4-6 (N=118)	Gr. 5 (N=26)
Elapsed time between testing	14 to 16 weeks	Two weeks	Eight Months
Figural Fluency	.66	.71	.80
Figural Flexibility	.45	.73	.64
Figural Originality	.59	.85	.60
Figural Elaboration	.62	.83	.80
Verbal Fluency	.73	.93	.79
Verbal Flexibility	.62	.84	.61
Verbal Originality	.61	.88	.73

[a]Torrance, E. P. Torrance Tests of Creative Thinking. Princeton: Ginn & Co., 1966, p. 21

combined. (Table 7). Data in parenthesis in Table 7 are intercorrelations reported by Torrance (1966, p. 82) for Figural and Verbal, Form A. Comparisons indicated that intercorrelations were higher for the retarded than normal subjects on all three intercorrelations of

verbal factors with other verbal factors. Four of the six figural factors interrelated with other figural factors were higher than with normals. When the factors involved were a mixture of verbal and figural, all twelve possible intercorrelations were lower in the retarded group than in the normal.

TABLE 7

INTERCORRELATIONS OF FIGURAL AND VERBAL, FORM A ON THE TORRANCE TESTS OF CREATIVE THINKING FOR AN INSTITUTIONALIZED RETARDED GROUP AND A HETEROGENEOUS SIXTH GRADE MICHIGAN GROUP[a]

Measure	Figural Flex.	Figural Orig.	Figural Elab.	Verbal Flu.	Verbal Flex.	Verbal Orig.
Figural Fluency	.93 (.77)	.59 (.68)	.72 (.20)	.06 (.52)	.11 (.40)	.05 (.39)
Figural Flexibility		.61 (.66)	.51 (.18)	.02 (.43)	.12 (.37)	.05 (.33)
Figural Originality			.51 (.34)	.04 (.43)	.11 (.43)	.09 (.43)
Figural Elaboration				.22 (.23)	.18 (.28)	.26 (.31)
Verbal Fluency					.90 (.79)	.78 (.39)
Verbal Flexibility						.83 (.74)

[a]Adapted from Torrance, E.P. Torrance Tests of Creative Thinking. Princeton: Ginn and Company, 1966, p. 82.

IQ and Creativity

The hypothesis, that pretest performance on the Torrance Tests

of Creative Thinking would be unrelated to the IQ of all subjects, was supported. Correlation coefficients on pretest scores and IQ were computed for all 62 subjects (Table 8). In no case was the FSIQ of the subjects found to significantly correlate with creative performance.

TABLE 8

CORRELATION OF FSIQ, E AND C COMBINED, VIQ, AND PIQ, WITH PRETEST PERFORMANCE ON SEVEN CREATIVITY FACTORS IN AN EDUCABLE MENTALLY RETARDED GROUP

Factor	FSIQ (N=62)	VIQ (N=31)	PIQ (N=31)
Figural Fluency	.04	.20	.02
Figural Flexibility	.10	.21	.10
Figural Originality	.04	.01	.19
Figural Elaboration	.02	-.07	.17
Verbal Fluency	.22	-.13	.20
Verbal Flexibility	.23	-.10	.14
Verbal Originality	.17	.22	.08

To further evaluate the above hypothesis, 31 subjects were selected from both E and C groups. These subjects had been tested with either the WISC or WAIS, having verbal, performance, and full scale IQ's available; the remaining 31 subjects had been tested with the Stanford Binet. Pearson product-moment correlations were computed for pretest performance with both verbal and performance IQ (Table 8). None of the correlation coefficients reached significance. These data

supported the hypothesis.

The hypothesis that improvement in performance from pre- to posttest would not be significantly related to the IQ of the E subjects was supported for figural factors only. Pearson correlation coefficients between IQ and difference scores on the seven creativity factors were computed (Table 9). Improvement on the Torrance Tests of

TABLE 9

CORRELATION OF DIFFERENCE SCORES WITH IQ FOR EXPERIMENTAL SUBJECTS IN AN EDUCABLE RETARDED GROUP (N=30)

Factor	Difference Scores - IQ
Figural Fluency	.10
Figural Flexibility	-.32
Figural Originality	-.01
Figural Elaboration	.13
Verbal Fluency	-.65***
Verbal Flexibility	-.39*
Verbal Originality	-.68***

* $P < .05$
*** $P < .001$

Creative Thinking was significantly and inversely correlated with all verbal creativity factors. No significant correlations were found between improvement of Figural measures of creativity and IQ.

Additional analyses of the data were achieved by dividing the E

and C groups into three comparable pairs of subgroups with IQ in the "low" group 45 - 55, the "middle" group 56 - 60, and the "high" group 61 - 84. WRST were then computed on the difference scores for all measured creativity factors (Table 10). The E subjects in the "low"

TABLE 10

COMPARISON OF DIFFERENCE SCORES FOR THREE IQ LEVELS EXPERIMENTAL VS. CONTROL GROUP SUBJECTS IN AN EDUCABLE MENTALLY RETARDED GROUP

Factor N for C/E	Low (IQ 45 - 55) N=11/10	Middle (IQ 56 - 60) N=10/10	High (IQ 61 - 84) N=11/10
Figural Fluency	125.5	137*	134
Figural Flexibility	126	132*	139*
Figural Originality	120	133.5*	145*
Figural Elaboration	117	144**	114.5
Verbal Fluency	159.5**	142.5**	146*
Verbal Flexibility	140**	141**	143.5*
Verbal Originality	157.5*	130.5	124

* $P < .05$
** $P < .01$

IQ group showed significant improvement for all verbal measures but not for figural factors. E subjects in the "middle" IQ group showed significant improvement for all creativity factors except verbal originality, which was not significant. E subjects in the "high" IQ group achieved significant improvement in figural flexibility, figural origi-

nality, verbal fluency, and verbal flexibility.

CA and Creativity

No hypothesis was made concerning the relationship of CA and pretest performance on the Torrance Tests of Creative Thinking. In order to help interpret changes following experimental treatment, the correlation coefficients for the seven creativity factors with CA were computed and tabulated (Table 11). Figural fluency and figural flexi-

TABLE 11

CORRELATION COEFFICIENTS FOR CA AND PRETEST PERFORMANCE, C AND E COMBINED, IN AN EDUCABLE MENTALLY RETARDED GROUP

Factor	Pretest Performance
Figural Fluency	.66***
Figural Flexibility	.56***
Figural Originality	.03
Figural Elaboration	-.09
Verbal Fluency	-.25*
Verbal Flexibility	-.06
Verbal Originality	-.39**

* $P < .05$
** $P < .01$
*** $P < .001$

bility were found to correlate significantly and directly ($P < .001$) with CA. Verbal fluency ($P < .05$) and verbal originality ($P < .001$) were significantly and inversely correlated with CA.

The hypothesis that difference scores on the seven creativity factors would not be significantly related to the CA of the E subjects was only partially supported. Pearson product-moment correlations were computed (Table 12). Figural flexibility ($P < .001$), figural elaboration ($P < .05$), and verbal originality ($P < .05$) were found to be significantly and inversely correlated with CA.

TABLE 12

CORRELATION COEFFICIENTS FOR CA AND DIFFERENCE SCORES, EXPERIMENTAL GROUP, IN AN EDUCABLE MENTALLY RETARDED GROUP

Factor	Difference Scores
Figural Fluency	-.01
Figural Flexibility	-.71***
Figural Originality	-.18
Figural Elaboration	-.41*
Verbal Fluency	-.33
Verbal Flexibility	-.14
Verbal Originality	-.43*

* $P < .05$
*** $P < .001$

The E and C groups were then divided into three comparable pairs of subgroups with CA, in months, for the "low" group 149 to 175, the "middle" group 176 to 209, and the "high" group 210 to 262. WRST were computed, for the three groups, E vs. C, on the difference scores for all measured creativity factors (Table 13). In the "low" group,

all factors showed significant improvement for the E group subjects, except for figural elaboration. In the "middle" group, only verbal

TABLE 13

COMPARISON OF DIFFERENCE SCORES FOR THREE CA LEVELS EXPERIMENTAL VS. CONTROL SUBJECTS IN AN EDUCABLE MENTALLY RETARDED GROUP

Factor N for C/E	Low (CA 149-175) N=10/10	Middle (CA 176-209) N=10/10	High (CA 210-262) N=12/10
Figural Fluency	142.5**	118	147.5*
Figural Flexibility	140.5**	115	143
Figural Originality	136.5*	121.5	131
Figural Elaboration	116	126	121
Verbal Fluency	148**	139.5**	157**
Verbal Flexibility	139.5**	146.5**	153**
Verbal Originality	144**	113	130.5

* $P < .05$
** $P < .01$

fluency and verbal flexibility showed significant improvement. In the "high" group, figural fluency, verbal fluency, and verbal flexibility were significantly improved for the E group subjects.

MA and Creativity

No hypothesis was offered concerning the relationship between MA and pretest performance on the Torrance Tests of Creative Thinking. In order to clarify data dealing with modifications in performance

following experimental treatment, correlation coefficients were calculated and tabulated for pretest performance, E and C subjects combined, with MA (Table 14). Only verbal fluency ($P < .01$) and verbal

TABLE 14

CORRELATION COEFFICIENTS FOR MA AND PRETEST PERFORMANCE, CONTROL AND EXPERIMENTAL GROUPS COMBINED, IN AN EDUCABLE MENTALLY RETARDED POPULATION

Factor	Pretest Performance
Figural Fluency	-.01
Figural Flexibility	-.01
Figural Originality	.13
Figural Elaboration	.10
Verbal Fluency	.32**
Verbal Flexibility	.29*
Verbal Originality	.11

* $P < .05$
** $P < .01$

flexibility ($P < .05$) were significantly and positively correlated.

The hypothesis that difference scores on the seven creativity factors would be unrelated to the MA of the E group subjects was not supported. Correlation coefficients were computed and tabulated (Table 15); figural flexibility, verbal fluency, verbal flexibility, and verbal originality were found to be significantly and inversely correlated ($P < .001$) with E group improvement following experimental treatment.

The E and C groups were divided into three comparable subgroups, with MA in the "low" group from 80 to 101, the "middle" group 102 to 130, and the "high" group 134 to 164. WRST were then computed for the three groups, E vs. C (Table 16) on the difference scores for the

TABLE 15

CORRELATION COEFFICIENTS FOR MA AND DIFFERENCE SCORES, EXPERIMENTAL GROUP, IN AN EDUCABLE MENTALLY RETARDED POPULATION

Factor	Difference Scores
Figural Fluency	.04
Figural Flexibility	-.61***
Figural Originality	-.14
Figural Elaboration	-.02
Verbal Fluency	-.92***
Verbal Flexibility	-.67***
Verbal Originality	-.60***

*** $P < .001$

seven creativity factors. The "low" group showed significant improvement for all factors except figural elaboration. The "middle" MA group showed significant gains for all factors except figural flexibility and figural originality. The "high" group showed significant improvement ($P < .05$) for figural flexibility, figural originality, verbal fluency, and verbal flexibility.

Class Placement and Creativity

No hypothesis was offered concerning the effect of individual differences between teachers on the improvement of the classes. The

TABLE 16

COMPARISON OF DIFFERENCE SCORES FOR THREE MA LEVELS EXPERIMENTAL VS. CONTROL SUBJECTS IN AN EDUCABLE MENTALLY RETARDED GROUP

Factor N for C/E	Low (MA 80-101) N=10/10	Middle (MA 102-130) N=9/10	High (MA 134-164) N=13/10
Figural Fluency	132*	117*	146
Figural Flexibility	133*	112	154.5*
Figural Originality	136.5*	112.5	154*
Figural Elaboration	110	125**	128
Verbal Fluency	154.5**	137**	152.5*
Verbal Flexibility	150.5**	137**	154.5*
Verbal Originality	135.5*	137**	110

* $P < .05$
** $P < .01$

data were analyzed by separately comparing the difference from pre- to posttest performance, C vs. E, for each teacher's classes, using WRST (Table 17). Classes A and B showed significant improvement on verbal fluency and verbal flexibility, only. Class C showed significant improvement ($P < .01$) for all creativity factors except figural elaboration. A complicating factor arises when considering the above

data. Class C was composed entirely of subjects whose age fell in the "low" CA group and most were also in the "low" MA group. Class C's

TABLE 17

COMPARISON OF DIFFERENCE SCORES FOR THREE PAIRS OF CLASSES, EXPERIMENTAL VS. CONTROL, FOR SEVEN CREATIVITY FACTORS IN A MENTALLY RETARDED GROUP

Factor N for C/E	Class A (N=12/10)	Class B (N=9/9)	Class C (N=11/11)
Figural Fluency	136.5	90.5	174**
Figural Flexibility	133	80	172**
Figural Originality	132	99.5	167.5**
Figural Elaboration	126	105	132.5
Verbal Fluency	146.5*	116.5**	186.5**
Verbal Flexibility	152.5**	112*	182.5**
Verbal Originality	130	85	175**

* $P < .05$
** $P < .01$

superior performance may be related to any one or any combination of the three factors of CA, MA, and/or teacher.

CHAPTER IV

DISCUSSION

The principal goal of special education is the maximum utilization of each individual's potential, regardless of his handicaps or limitations. The relationships between age, intelligence, training, and creative functioning have important implications for the educational process.

Enhancement of creative performance was demonstrated to be feasible in an institutionalized educable mentally retarded population. The use of "brainstorming" was well accepted by both subjects and teachers; the latter commented favorably on the procedure. The highly significant improvements over pretest functioning registered by the experimental subjects was coupled with generally enthusiastic acceptance of the special lessons. Six of the seven creativity factors measured by the Torrance Tests of Creative Thinking showed statistically significant ($P < .01$) improvement, indicating that creativity was not a static function but was open to growth and modification if the subjects were offered adequate, appropriate freedom and encouragement. The experimenter was aware that experimenter bias was a factor in such research. A conscious effort was made to avoid bias

throughout the investigation.

The results strongly supported those reported by Rouse (1963, 1965) and were in distinct contrast to those obtained by Budoff, et al, (1968). Budoff, et al, drew thirteen subjects from the Rouse sample. These were matched to their population. A substantial pretest gap was found between the two groups, favoring the Boston group which functioned at a considerably higher level. This disparity disappeared following training. Budoff, et al (1968), explained this phenomenon in terms of the greater stimulation which the Boston population received routinely. The same explanation did not apply to the present study. The Willowbrook students attended classes embracing the usual curricula for retardates but, in addition, received considerable stimulation from speech classes, shop, home economics, typing, and similar special services. It was felt that the improvement manifested by the subjects was a reflection of an alteration in mental set, from convergent to divergent modes of thinking. It was also apparent that regardless of the variable (CA, MA, IQ) teased apart from the subjects' performance, verbal creative functioning was significantly improved following the training program.

Intelligence and creative functioning have appeared to be uncorrelated (Kelson, 1965; Rouse, 1963, 1965; Tisdall, 1962a-1962b; Wilson, 1958). In this study the correlation coefficients ranged from

-.13 to .23, supporting the earlier data. Guilford (1959) identified most of the creative abilities as factors in the category of divergent thinking. Guilford placed intelligence, as assessed by IQ tests, in the cognitive category. Creativity and intelligence, therefore, were not seen as the same traits nor operations. The results fit within Guilford's theoretical framework since IQ was not found to be related to pretest creative functioning. Improvement in creative productivity, as measured by the Torrance Tests of Creative Thinking, was found to be significantly and negatively correlated with IQ for all verbal factors. These results differed from those reported by Rouse (1963), who found significant, positive correlations between IQ and gain scores for verbal fluency and elaboration, as measured on the Product Improvement Task only, and for Figural flexibility and originality, as measured on the Circles Task only. These differences from the Rouse (1963) results may be explained by the greater inclusiveness of the present study. Where Rouse had used the same single subtest for verbal measurement and one for figural measurement, the present research had used three from Form A for Verbal and three for Figural pretesting, and three from Form B for Verbal and three for Figural posttesting. It was possible that the higher IQ subjects in the Rouse study had greater memory effects thereby vitiating any larger improvement which might have been seen in the lower IQ levels.

Retarded individuals usually have a more severe verbal than non-

verbal handicap (Kelson, 1965; Smith, 1967). It seemed possible that the special lessons which encouraged productive thinking had served to break through this difficulty by giving the subjects with the lowest IQ an alternative, more satisfactory method for expressing themselves. The freedom of the brainstorming sessions allowed this group to make even greater gains than their peers with somewhat higher IQs. The data appeared to support this synthesis. These results may also be attributed to the training period being less a learning situation than a releasing of inhibition, with the lowest IQ subjects profiting most due to their presumed greater inhibitions before training. An alternative explanation would be a regression effect, where the lowest IQ group has the farthest to rise towards the more average performance. It seemed possible that the relatively higher IQ subjects had been closer to their fullest development before the experimental intervention. The "low" IQ group showed significant improvement on the three verbal creativity factors while the "middle" and "high" groups improved on two of the three factors. The "low" IQ group showed no significant gains for the figural creativity factors, while the "middle" and "high" groups showed significant improvement on four and three factors respectively. The apparent lack of improvement in non-verbal aspects of creative functioning in the lowest IQ group may have been related to the fact that the lessons were primarily verbal in nature, although drawing and similar tasks

were included. This group may have needed more encouragement in this area or a different approach to achieve significant change; for these subjects the primarily verbal lesson plans provided inadequate assistance in transfer to the non-verbal.

Is CA related to creative functioning in a retarded population? Rouse (1963) reported significant positive correlations between CA and figural fluency, flexibility, originality, and elaboration, using only one subtest of the Torrance Tests of Creative Thinking. Analysis of all subjects showed relationships that were highly significant and directly correlated with figural fluency and flexibility and negatively correlated with verbal originality. The older the retarded individual, the better his creative functioning in the figural areas; younger retardates were more verbally original. This may have been related to the shorter duration of school exposure for younger individuals and the consequently briefer time when verbal expression has been restricted along convergent lines. The results partially supported those reported by Rouse (1963) who had found significant positive correlations between CA and pretest performance for all figural creativity factors. She reported no significant relationships for verbal measures, in contrast with the present study.

Improvement following experimental intervention was negatively correlated with CA for all creativity factors; significance was reached for figural flexibility, figural elaboration, and verbal origi-

nality: a trend towards significance was seen for verbal fluency. Younger retarded individuals seemed to have improved more than older ones. When the entire experimental group was divided into three CA levels, the youngest group showed significant improvement on six of the seven creativity measures, the "middle" group for verbal fluency and flexibility, and the "high" group for verbal fluency and flexibility as well as figural fluency. With increasing age, the subjects were harder to stimulate, particularly in terms of their non-verbal productions. Teacher comments indicated that the older individuals appeared to be embarrassed by being asked to draw or make unusual lines and designs.

The relatedness of MA and creative functioning was examined. One finding (Rouse, 1963) concerning this relationship was located in a search of the literature. MA was reported to be significantly and directly correlated with all figural creativity measures. This was based on only one subtest of the Torrance Tests of Creative Thinking. The pretest performances of untreated subjects in the present research indicated that no figural factors were significantly correlated with the MA of the subjects. Verbal fluency and flexibility were significantly and positively correlated with MA showing that individuals with higher mental ages had verbal productions which were more creative than lower MA individuals. Higher MA was associated with greater naive divergent thinking abilities in the

pretest population.

Highly significant, negative correlations between improvement on selected measures of creative functioning and MA were seen for the experimental group subjects, for all verbal measures and for figural flexibility. Corroborating these findings, experimental group subjects in the "low" MA group showed improvement in six of seven measures, while subjects in the "middle" and "high" groups showed improvement on five and four measures respectively. It seemed that the low MA subjects were more readily able to divest themselves of the convergent mode in favor of the divergent, particularly in terms of figural productions. All three groups showed improvement in verbal creativity.

The class which showed greatest gains in productive thinking was composed of low CA, low MA subjects, both of which appear to be significant factors in ready accessibility to the creativity training. "Low" IQ was seen in all three classes, and these subjects, too, were most open to divergent thinking through the training. Improvement was seen in six of the seven factors for all subjects. It appeared that those individuals who were youngest, with lowest mental ages, and least well endowed intellectually were those who derived the most benefit from the special program.

The parallel forms of the Torrance Tests of Creative Thinking were found to be significantly correlated and to provide useful alterna-

tives for one another. Reliability coefficients obtained with the retarded group were lower than those reported by Torrance (1966, p. 21). However, all correlation coefficients which were obtained were highly significant and indicated that the Torrance Tests of Creative Thinking were suitable for use with low IQ, institutionalized subjects. Form B was decidedly more "difficult" than Form A, both for the retarded group and for normal subjects. The manual for the Torrance Tests of Creative Thinking (Torrance, 1966) obviated the problem of the greater difficulty of Form B over Form A by converting the composite raw scores into T-scores, for each of the seven creativity factors. These T-scores were provided to the nearest multiple of five; they contained too many rounding errors to be of use in this research. When less than the full battery is used, the T-scores cannot be determined. The control subjects, as a group, did not seem to be showing a deterioration in their performances from the first administration to the final testing, except in individual cases. Rather their difference scores reflect the greater difficulty of Form B.

The creativity factors which were purported to be measured by the Torrance Tests of Creative Thinking were not independent factors in the sense which Guilford (1956) implied. The verbal factors were intercorrelated with one another as were the figural factors. When verbal and figural factors were intercorrelated, they showed

low relationships, suggesting that these were relatively independent of one another in the educable mentally retarded population. This low relationship might indicate that the verbal and figural processes were different mental abilities, as Guilford and others had suggested.

The implications for education of a program which would help raise the level of productive thinking in the institutionalized mentally retarded population included the value of brainstorming as a specific teaching tool. The teachers were forced to allow the students' ideas to flow freely regardless of how unusual, peculiar, or aberrant they may have appeared. Taba (1963) felt that brainstorming was inapplicable to work with children, however Rouse (1963) disagreed. She noted that two-thirds of the lessons "... were actual brainstorming sessions involving specific problems of one kind or another" (p. 53).

Rouse (1963) noted that the inclusion of brainstorming sessions in the curriculum for the educable mentally retarded would not require sweeping changes, that the lessons could be taught over a long period of time. Rouse referred to satiation effects in the intense, five days per week sessions. This was not encountered with the more spaced, leisurely, three times per week.

The increasing costs of institutionalization coupled with better education within the institution have both obliged and encouraged families to take their educable mentally retarded children back to the family unit. Once home, there is an impetus to integrate the

retardate into the social and economic life of the community. Getzels and Jackson (1962), in their landmark study, documented that high IQ and high creativity were difficult for the observer to distinguish. The conclusions of their study and of Rouse's (1963, 1965) research and the implications of this investigation pose a serious challenge to the educational system.

The conclusions and concepts discussed above have implications for further research. How closely does improvement in performance on the Torrance Tests of Creative Thinking correlate with transfer of training to life situations? Will the improvement demonstrated in this study be retained?

The relationship of CA and MA to creative functioning should be further investigated. The relationship of IQ, CA, and MA to improvement in productive thinking which follow training should be studied. It would be desirable to retest the IQs of the subjects following the enhancement experience to see if there has been any measurable change.

CHAPTER V

SUMMARY AND CONCLUSIONS

Creativity, an aspect of every person's intellectual functioning, has only recently been considered in the mentally retarded. Training for the educable mentally retarded individual has been designed to maximize convergent thinking abilities to the exclusion of novel, productive, divergent thinking. The purpose of this study was to evaluate the effectiveness of a supplementary program of education developed specifically to increase the productive thinking abilities of retarded youngsters (Rouse, 1963). The subjects used were resident students at Willowbrook State School. It was reasoned that if EMR subjects living in an institutional environment could be taught successfully by methods heretofore applied only in the day school setting, a rethinking of the goals of education for the intellectually subnormal would be justified.

Rouse (1963) devised a series of thirty lesson plans designed to supplement the educational experiences of EMR Ss. The sessions incorporated concepts felt to be important for creative, productive thinking and were designed to be highly stimulating. The lessons encouraged drawing, story writing, and development of the efficient

use of brainstorming. Rouse (1963) found that creative productivity, as measured on subtests of the Torrance Tests of Creative Thinking, was significantly improved for experimental group subjects. Budoff, Meskin, and Kemler (1968) attempted to replicate the Rouse (1963) experiment but were unsuccessful.

The present study had as an additional goal, the investigation of the contradictory results obtained by Rouse (1963) and Budoff, et al. (1968). Variables such IQ, CA, and MA, which might influence creative performance in the EMR population, were also of interest. Seven creativity factors were investigated: Figural fluency, figural flexibility, figural originality, figural elaboration, verbal fluency, verbal flexibility, and verbal originality. These were the factors suggested by Guilford (1962) as those involved in divergent, creative production.

The subjects were 62 adolescent and young adult resident EMR students at Willowbrook State School, Staten Island, New York. They were the pupils of three teachers, each of whom taught both morning and afternoon sessions. Each teacher instructed two comparable classes composed of Ss with approximately the same IQ, CA, and MA. The following predetermined criteria for inclusion were met by all subjects. The subjects had Full Scale IQs between 40 and 85, CA's between 12 and 22 years, MA's not lower than 60 months, sufficient oral communication skills to be understood for correct re-

cording of verbal responses, and adequate motor coordination for correct recording of verbal responses. Deaf and/or blind students were excluded.

The morning and afternoon groups were not significantly different. The former became the control group and the later the experimental group, assigning fatigue factors to the experimental group.

Pretesting of the six EMR classes used selected subtests of the Torrance Tests of Creative Thinking, Form A. Form B was used for posttesting.

The experimental group was taught according to the Rouse (1963) lesson plans which were altered only insofar as essential to make them applicable to the institutional setting. The 30 lessons were taught at a rate of three per week. The lessons encouraged ideational fluency, familiarity with the principles of change, improved observational ability, increased sensitivity to taken-for-granted items, and the facilitation of originality through improvisation. The status quo was maintained for the control group.

Significant improvement following the training program was found for six of the seven creativity factors. Figural elaboration was not significantly improved.

IQ was found to be non-significantly correlated with pretest creative functioning. Improvement following training was unrelated to IQ for figural measures. Improvement in verbal factors was

found to be significantly and inversely related to IQ.

CA was found to be significantly and directly related to pretest creative performance for figural fluency and figural flexibility. CA was significantly and inversely correlated with verbal fluency and verbal originality. Other factors were not significant. Difference scores were significantly and inversely correlated for CA with figural flexibility, figural elaboration, and verbal originality.

MA was found to be significantly and directly correlated with pretest performance in verbal fluency and verbal flexibility. Improvement following training was significantly and inversely correlated with all verbal factors and with figural flexibility.

Enhancement of creative performance was demonstrated to be feasible in an institutionalized mentally retarded population. The use of brainstorming was well accepted by both pupils and teachers. The results strongly supported those of Rouse (1963) and were in distinct contrast to those reported by Budoff, et al. (1968). It was felt that the improvement manifested by the experimental group subjects was a reflection of an alteration in mental set, from convergent to divergent modes of thinking.

Verbal creative functioning was improved regardless of the other variables of IQ, CA, and MA. In general, younger, lower IQ subjects showed the greatest improvement. It seemed that the special lessons had served to break through the severe verbal handicap of

retardates by providing a new, more satisfactory means of self-expression. In addition, the lower IQ subjects, those with the greatest handicap, may have exhibited a regression effect by demonstrating a greater verbal gain than the other subjects.

A program which successfully helped to raise the productive thinking in institutionalized retardates has important implications for the education of all such individuals. The value of brainstorming as a specific teaching tool for work with retardates, is also challenging. The teachers were forced to allow the students' ideas to flow freely regardless of how peculiar they may have seemed. Inclusion of brainstorming sessions in the curricula for educable mental retardates would not require sweeping changes since the lessons could be taught over a long period of time.

The rapidly rising costs of institutionalization coupled with the overriding value of self-actualization have obligated educators to assist the individual in gaining his maximum level of performance. Guiding the individual to expand his productive thinking abilities would appear to be a desirable goal; to achieve this goal in mental retardates, it will be necessary to use specifically designed enhancement programs.

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APPENDIX A

LESSON PLANS FOR THE ENHANCEMENT OF PRODUCTIVE THINKING

Lesson Plans for the Enhancement of Productive Thinking

Sue Thompson Rouse

Foreward

The following lessons are a part of an experimental study designed to release and/or enhance the productive thinking of educable mentally retarded children. There are many avenues which might be followed to approach this goal. The investigator has chosen to see if this could be accomplished primarily through a procedure known as "brainstorming" to obtain as many ideas as possible in relation to a given problem. The experimental portion of this study is to consist of 30 lessons given daily.

When the lesson involves the process of "brainstorming," please follow these simple rules:

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

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

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

4. Combination and improvement are sought. In addition to contributing ideas of their own, participants might suggest how ideas of others can be joined into still another idea. (Wilson, 1958, p. 119.)

In order to keep the time element as nearly identical as possible for all teachers participating in the study, please limit all actual "brainstorming" sessions to fifteen minutes each. This does not include the introductory remarks or review, only the time when the flow of ideas is started and you begin placing them on the board. The time devoted to other lessons that do not involve this process will necessarily be more flexible.

It is suggested that these lessons be given early in the school day, possibly as part of the opening exercises.

Please keep a careful log in this notebook of all lessons--listing suggestions, outcomes and evaluations. The investigator is especially interested in comments on the behavior of the children. Refer to all children by the names given the investigator at the beginning of the study. In a study such as this, the individual becomes "lost." However,

since all children have been coded, it is necessary that the investigator have the full name, especially if there are two children in the class who have the same first name. This will enable the code to be easily traced by the investigator.

For one reason or another, some children were not included in the pretest, although all children in each class are to participate in the lessons. Regardless of whether they were included or not, if there are behavior incidents pertinent to the sessions, include comments on all children.

No attempt has been made to measure the academic achievement of the children during this study, but please take special note of any change that might possibly be attributed to a "therapeutic overflow" from these lessons. This must be done with great care, for there are many variables that would have to be considered. However, it would be very exciting if, for instance, a child had been observed to be rather poor academically prior to the beginning of the experiment, and were to begin to "blossom" as the experiment progresses.

Lesson Plan 1 Teacher:_____

Date:_____

A. Aim: To introduce children to the technique of "brainstorming," where ideas are accepted, no matter how far-fetched or impractical they may sound.

Specific aim: To encourage fluency.

B. Procedure:

Motivating question: Ask children if they have ever wandered through the toy section of a store and looked at all of the toys on display.

1. Show children a toy fire truck and ask them to pretend that they have been approached by a manufacturer of toys to suggest ideas for making the fire truck more fun to play with, regardless of the cost.

2. List suggestions on board without comment on "goodness" or "badness" of the suggestions, but give praise for fluency.

If, in the flow of ideas, none of the following suggestions appear, proceed to ask the following questions:

a. What would happen if we made it larger? (Magnification)

b. What would happen if we made it smaller? (Minification)

c. What could we add? (Addition)

d. What would happen if we took something away? (Subtraction)

e. What would happen if we took something away and put something in its place? (Substitution)

f. What would happen if we took it apart? (Division)

g. How could we rearrange it? (Rearrangement)

h. What would happen if we multiplied it? (Pairs, sets, etc.) (Multiplication)

Lesson Plan 1

i. What would happen if we changed its position? (Reversal) (Not especially applicable to a truck, but the ease of reversing it by handling it might be discussed)

j. What would happen if we made it out of a different kind of material? (Material)

k. What would happen if we gave it motion? (Sensory appeal: motion)

l. What would happen if we gave it odor? (Odor)

m. What would happen if we gave it light? (Light)

n. What would happen if we gave it sound? (Sound)

o. What would happen if we changed the color? (Color)

p. What would happen if we changed the shape? (Shape)

q. What would happen if we made it stronger? (Adaptation)

r. What would happen if we put it to other uses? (Other uses)

List any new suggestions yielded by these questions on the board along with the other suggestions.

3. Count the suggestions.

4. Teacher makes copy of ideas for later transfer to a reading chart.

Activity: Appoint a committee of three to make a large line graph of the number of ideas produced in this lesson. They will have to explore how this can best be done. (Guide them into a graph that can be cumulative in nature).

C. Materials needed:

a. Toy fire truck
b. Chart paper

Lesson Plan 1

c. Chalk
d. Large piece of paper for the graph
e. Felt marker or black crayon

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children. Make list of ideas offered for part of the record of this day's lesson.

Reference: E. P. Torrance, Priming creative thinking in the primary grades. Elem. Sch. J., 1961, 62, 34-41.

Lesson Plan 2 Teacher:_____

Date:_____

A. Aim: To develop principles for stimulating new ideas.

Specific aim: To develop principles of magnification and minification.

B. Procedure:

1. Review ideas produced during lesson 1 in regard to the toy fire truck. Read the chart of the ideas, allowing children to participate in the oral reading, even if it means that they must have much help with the word. Examine graph of ideas.

2. Call attention to the ideas that suggested making the truck larger and smaller.

3. Show children a set of squares in this order:

   a. the first plate has a square 4" X 4"

   b. the second plate has a square 6" X 6" (Magnification)

   c. the third plate has a square 2" X 2" (Minification)

Be sure that the children understand that the figure is still a square, only its size has been either increased or decreased.

4. Transfer: Ask for illustrations of other figures where the same thing could happen. (i.e. circles, triangles, rectangles, parallelograms) Draw these on the board so the children can see them. Show cubes of different sizes.

5. Assignment: Ask the children to think of all of the illustrations they can of additional uses of the same principle where the shape remains essentially the same, only the size changes to either larger or smaller (i.e. compact cars, large cars).

Lesson Plan 2

C. Materials needed:

1. Three plates for a set of squares:
   a. 6" X 6"
   b. 4" X 4"
   c. 2" X 2"

2. Chalk

3. Chart of ideas listed from Lesson 1

4. Graph of ideas listed from Lesson 1

5. Three cubes of different sizes

Comments:

1. Outcome: Did the lesson go as planned? If no, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Reference: E. P. Torrance. Priming creative thinking in the primary grades. Elem. Sch. J., 1961, 62, 34-41.

Lesson Plan 3 Teacher:_____

Date:_____

A. Aim: To develop further principles of magnification and minification, and expand principles introduced in Lesson 1.

Specific aim: To develop principles for change.

B. Procedure:

1. Review ideas presented in Lesson 2 that illustrated that it is possible to change the size, but not the basic shape of an object.

2. Children were asked at the conclusion of Lesson 2 to think of things that have undergone a change in size primarily. Ask them to tell you what they have thought of, and if necessary, start the flow of ideas with the following suggestion: compact cars. Praise for fluency.

3. List all suggestions on the board.

4. Count them.

5. Make copy of ideas for later transfer to reading chart.

6. Have children add the number of ideas to the cumulative idea chart.

C. Materials needed:

a. Chalk
b. Chart paper
c. Cumulative graph that has already been started.

Comments:

1. Outcome. Did the lessons go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Lesson Plan 4 Teacher:_____

Date:_____

A. Aim: To reenforce application of principles involved in effecting change.

Specific aim: To develop principles involved in effecting change by adding something.

B. Procedure:

1. Review ideas produced in Lesson 1 by reading the chart of that lesson's ideas. Allow children to participate, even if they must have help with the words.

2. Review ideas of how something could be made bigger or smaller. Show cubes and use oral recall of ideas produced.

3. Say, "Now watch carefully what I am going to do."

   Draw a 12" square on the board, saying, "This is what we call a square because all of its sides are the same length."

4. Put a large A in the middle of the square, and ask, "What have I done?" (added something)

5. Erase the A and put a large $ sign in the center, saying, "And now I'm adding something else."

6. Erase the $ sign and put a small 2" square to project above but rest on the top of the 12" square, saying, "Now I'm adding something outside of the square, but attached to it."

7. Erase the small 2" square and put two small circles at the bottom of each lower corner, saying, "This is something different, but I'm still adding it to the square.

Activity: Give each child a piece of newsprint on which a 6" square has been drawn. Say, "Now I want you to add one thing or several things to the square I am giving you. Put your additions either inside or outside of the square, or both inside and outside. Try to think of something that noone

else will think of. We'll allow five minutes. We'll talk about your drawings tomorrow."

C. Materials needed:

a. Yardstick
b. Chalk
c. A piece of newsprint for each child with a 6" square ruled on it.
d. Reading chart from Lesson 1.
e. Cubes used in Lesson 2.

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Lesson 5 Teacher:_____

Date:_____

A. Aim: To develop principles for stimulating new ideas.

Specific aim: To review week's activities.

B. Procedure:

1. Present toy fire truck to children. Ask them to recall orally ideas of changes that could be made by the manufacturer to make it more fun to play with.

2. Say, "Also this week we talked about how some things have had their sizes changed by either making them larger or smaller, but that is about all, since they are still used for the same purpose. Let's see how many of these we can remember." (Oral recall. Do not list on the board).

3. Say, "Yesterday we learned that we can change things by adding something to something else, and you added things to a square on a piece of paper. . You were supposed to try to think of things nobody else would think of. We'll talk about these now and I want each of you to tell what it was that you added and what you made from the square."

C. Materials needed:

a. Toy fire truck used in Lesson 1.
b. Pictures prepared by children in Lesson 4.

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Lesson Plan 6 Teacher:_____

Date:_____

A. Aim: To develop principles for stimulating new ideas.

Specific aim: To develop principle of subtraction.

B. Procedure:

1. Review previous principles for stimulating new ideas (i.e. magnification (larger), minification (smaller), and addition.

2. Say, "Today we are going to talk about how things may be changed by taking something away."

Draw a 12" square on the board. From the center of the square, draw lines to each bottom corner and erase the bottom line, saying, "See, I've taken something away, and the first shape now looks different because I've done this. You can change the looks of anything by taking something away, but let's think of ideas where taking something away from a car might even make it better. For instance, this was before your time, but there are a few of these cars still around that have running boards on the sides by the doors for you to step on before getting into the car. You could even stand on them if you wanted to. Well, the new designs do not have running boards on the sides--they have been taken away.. (Write this on the board). Can you think of any other ideas?"

If ideas are slow in coming, ask the following leading questions:

a. How about the size? (smaller--leading to compact cars)
b. How about the height from the ground? (lower)
c. How about the width? (narrower)
d. What are some things that could be left off? (omission)
e. How about speed? (make them so that they will go slower)
f. Size of ads in the paper? (reduce them in size)

Transfer:

Lesson Plan 6

Ask if they can think of anything else where taking something away might make it better (i.e. less make up; furniture and household appliances; clothing; etc.)

List all suggestions on the board. Praise fluency.

Add number of ideas to cumulative graph.

C. Materials needed:

a. Chalk
b. Previously prepared cumulative graph.

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Lesson Plan 7 Teacher:_____

Date:_____

A. Aim: To develop principles of stimulating new ideas.

Specific aim: To develop principles of multiplication and division.

B. Procedure:

1. Give each child a previously prepared 8" square on a sheet of newsprint. This square will also have been lined for equal division into four 4" squares. Give each child a pair of scissors.

2. Say, "So far we've talked about how something can be changed by making it larger, smaller, adding something, or taking something away. Today we are going to see what happens when we divide something into equal parts. First of all cut out the large square in the center of the paper that I just gave you."

   After this is done, ask them to divide the square into four equal parts by cutting along the lines that cross in the middle of the square.

3. Ask, "How many squares are there now?" (four)
   "Put one aside, how many now?" (three)
   "Put two aside, now how many are there?" (two)

4. Say, "Sometimes things are sold in twos. What is this called?" (a pair)
   Say, "Sometimes we can buy things that have more than two, what is this called?" (a set)

5. Say, "Now let's think of things that are either sold in pairs or sets. As fast as you think of ideas, I will write them on the board." Praise for fluency.

C. Materials needed:

a. A piece of newsprint with an 8" square that has been ruled with lines so that it will be divided into four 4" squares.
b. A pair of scissors for each child.
c. Chalk
d. Previously started cumulative graph.

Lesson Plan 7

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Lesson 8 Teacher:_____

Date:_____

A. Aim: To develop principles for stimulating ideas.

Specific aim: To develop principle of substitution.

B. Procedure:

1. Review by saying, "We've learned how things can be changed. Who remembers what some of these ideas were?" (i.e. larger, smaller, addition, subtraction, multiplication and division).

2. Say, "Today, let's talk about substituting or using something to take something else's place as a way of making changes. For instance, suppose I were sick and couldn't be here, they would send someone to take my place. This person would be a substitute teacher. I'll write this on the board, and let's see how many things you can think of in general where something can be substituted for something else--perhaps even making it better. As fast as you think of ideas, tell them to me and I'll write them down."

List ideas. Praise for fluency.

(Some suggested ideas that might be used as leading questions: nylon and dacron for silk; plastic for china, glass, and leather; frozen items for garden-fresh items and home-cooked preparations; commercially canned products for home prepared foods; scotch tape for glue; etc.)

C. Materials needed:

a. Chalk

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Lesson 9

Teacher:_____

Date:_____

A. Aim: To develop principles for stimulating ideas.

Specific aim: To develop principle of combination.

B. Procedure:

1. Review by asking for recall of principles of magnification, minification, addition, subtraction, multiplication, division and substitution.

2. Show children a can opener. Ask if they can think of ways to combine it with something that would make it more useful or sell better.

Suggestions which might be helped by leading questions: improve its design by combining it with parts that would have other uses; combine related items in a display with the opener; offer a group price on a "package," such as a case of food in cans and an opener, or an assortment of party treats and an opener.

List ideas. Praise fluency.

C. Materials needed:

a. Can opener
b. Chalk

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Reference: S. J. Parnes. Student workbook for creative problem-solving courses and institutes. Buffalo: Univer. of Buffalo Bookstore, 1959. Pp. 47-51.

Lesson 10 Teacher:_____

Date:_____

A. Aim: To develop principles for stimulating new ideas.

Specific aim: To develop principles of change of color and change of position.

B. Procedure:

1. Show the children a white 8" square. Take this away, and show a red 8" square, asking if they noticed any difference between the two squares. (Color. Remark that the red square could have been some other color. Ask them to name other colors you could have used).

2. Rotate the white square until it assumes the form of a diamond to the person who is looking at it. Do the same thing with the red square, asking if the children noticed what you did. (Changed position)

3. Say, "In advertising, this is done all of the time to catch our attention. Sometimes they use colors to make us notice, and sometimes they change the position to one that we would not expect to see. This is supposed to make us look twice and perhaps remember their product when we go to make a purchase."

"Let's pretend that we are manufacturing a car that we want people to buy. See how many ideas you can think of in using color and/or change of position in our ads to make people notice them. As fast as you think of ideas I will write them on the board for you."

List ideas. Praise fluency.

Suggestions for leading questions: run a white on black or red ad; print letters upside down or reversed; place the car on top of building where it can be seen; etc.

C. Materials needed:

a. Two 8" squares, one white, one red.
b. Chalk

Comments:

Lesson 10

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Lesson Plan 11 Teacher:_____

Date:_____

A. Aim: To develop elaboration.

Specific aim: To stimulate students' imagination.

B. Procedure:

Hand out a paper which contains previously prepared lines. Ask children to put their names in the upper right hand corner.

Say "As you look at those lines they may suggest something to you. Using these lines, make whatever object you care to make, but try to have yours be different from everybody else's. You may use more lines if you wish--as many as you would like to use. When you have finished your drawing, you may color it if you want to."

Collect drawings when they are finished.

C. Materials needed:

a. Previously prepared paper with lines on it.
b. Pencils
c. Crayons

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Reference: R. E. Myers and E. P. Torrance. Invitations to thinking and doing. Minneapolis: Perceptive, 1961., p. 3.

Lesson Plan 12 Teacher:_____

Date:_____

A. Aim: To encourage elaboration.

Specific aim: Exploratory activity in creative thinking.

B. Procedure:

1. Say, "Yesterday you took some lines and turned them into a picture. I will now return your pictures to you, and you will write a story about it. It can be any kind of a story you would like it to be. I will help you with words that need to be spelled and your sentences. Be sure to give your story a title."

   (Note: for teachers of younger children who cannot write as yet, let them dictate their story to you, and you write it for them. This procedure may have to be followed with older children who have not acquired sufficient skill in this area).

2. Attach stories to pictures. Let children share their stories. Display on bulletin board.

C. Material needed:

a. Pictures prepared in lesson 11.
b. Paper on which to write stories. (Notebook paper for older children; primary paper for younger children).
c. Pencils or pen.

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Note: Get a brick for tomorrow's lesson.

Lesson Plan 13 Teacher:_____

Date:_____

A. Aim: To encourage flexibility.

Specific aim: To adapt to a change of "set" wherein something is used for a purpose other than that for which it was intended. In this case, a brick.

B. Procedure:

1. Show children a brick. Ask them if they know what it is. Say, "Tell me all of the uses you can think of for a brick. As fast as you can think of ideas, I will list them on the board."

2. List suggestions on board without comment on "goodness" or "badness" of the ideas, but give praise for fluency.

   If, in the flow of ideas, the uses for the brick seem to be confined to building, ask the following leading questions:

   a. Say, "What other uses can we think of? For instance, suppose I have a pile of papers that might blow away." (as a weight) Allow for other suggestions where the brick might be used as a weight. Follow this procedure each time you suggest a change of "set."

   b. "Suppose I had some books that wouldn't stand up." (support)

   c. "Suppose I were to see a dog running after a young child and wanted to stop it." (a missile)

   d. "Suppose I wanted to keep my car from rolling." (a brace)

   e. "Suppose I needed some red coloring, what could I do with the brick to get the coloring material I needed? (pulverize it, and mix it with another substance)

   f. "Suppose I wanted to smooth a surface and didn't have any sandpaper." (an abrasive)

Lesson Plan 13

These are only suggestions for encouraging flexibility in "set." You may think of others.

3. Count the suggestions.

4. Transfer ideas to a reading chart and cumulative graph.

C. Materials needed:

a. Brick
b. Chalk
c. Chart paper

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Reference: R. C. Wilson. Creativity. In N. B. Henry (Ed.) Education for the gifted. Yearb. Nat. Soc. Stud. Educ., 1958, 57, Part II. Chicago: Univer. Chicago Press, p. 121.

Lesson Plan 14 Teacher:_____

Date:_____

A. Aim: Vocabulary enrichment.

Specific aim: To become aware of words that serve a specific purpose.

B. Procedure:

1. Review lesson 13 by reading the chart of ideas for the uses of a brick.

2. Say, "Today, let's think of all of the words that name things that would make us feel good on a cold day. As fast as you think of them, tell me and I'll put them on the board." Praise for fluency.

3. Count words.

4. Transfer list to a reading chart and number of ideas to the cumulative graph.

C. Materials needed:

a. Chalk
b. Chart paper

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Reference: R. C. Wilson. Creativity. In N. B. Henry (Ed.) Education for the gifted. Yearb. Nat. Soc. Stud. Educ., 1958, 57, Part II. Chicago: Univers. Chicago Press, p. 121.

Lesson Plan 15 Teacher:_____

Date:_____

A. Aim: Practice in "brainstorming."

Specific aim: To develop independence and fluency.

B. Procedure:

1. Review reading chart prepared from lesson 14.
2. Say, "Suppose that you couldn't go outside, what could you do to entertain yourself in the house? As fast as you think of ideas, tell them t: me and I will write them down for you on the board."
3. List suggestions and count them. Transfer number to cumulative graph.

C. Materials needed:

a. Chalk

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?
2. Evaluation: Were the aims achieved?

Additional comment of behavior of children.

Reference: A. F. Osborn. Applied imagination. (Rev. ed.) New York: Charles Scribner's Sons, 1961, p. 69.

Lesson Plan 16 Teacher:_____

Date:_____

A. Aim: To develop flexibility

Specific aim: To develop facility in improvising.

B. Procedure:

1. Review reading chart prepared for different uses of a brick, saying, "Last week we thought of different uses for a brick. Now let's list all of the things that we can think of that could be used as a hammer. As fast as you tell them to me, I will write them on the board for you.

2. List suggestions and count them.

3. Transfer to a reading chart and number to cumulative graph.

C. Materials needed:

a. Chalk
b. Chart paper

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Note: Clear with principal the walk around the block for tomorrow's lesson.

Reference: R. C. Wilson. Creativity. In N. B. Henry (Ed.) Education for the Gifted, Yearb. Nat. Soc. Stud. Educ., 1958, 57, Part II. Chicago: Univer. Chicago Press, p. 124.

Lesson Plan 17 Teacher:_____

Date:_____

A. Aim: To become conscious of the world about us.

Specific aim: To develop fuller use of the senses.

B. Procedure:

1. Review the five senses.

2. Say, "Today, we are going to take a walk around the block--using our senses. We could call this a 'sensible trip.' When we get back to the room, we'll make a list of all of the things we saw. I particularly want you to watch for things that are round, but look for other things, too."

3. Review procedures for moving as a group in public (i.e. good manners, safety regulations, etc.)

4. When you return to the room, list all things observed on the board.

5. Count them, and transfer to a reading chart.

C. Material needed:

a. Chalk
b. Chart paper

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

If it is raining, hold this lesson until it can be substituted. Proceed with lesson 18 instead.

Reference: R. C. Wilson. Creativity. In N. B. Henry (Ed.) Education for the gifted. Yearb. Nat. Soc. Stud. Educ., 1958, 57, Part II. Chicago: Univer. Chicago Press, p. 120.

Lesson Plan 18 Teacher:_____

Date:_____

A. Aim: To develop further use of the senses.

Specific aim: To become sensitive to needs in improving a classroom.

B. Procedure:

1. Say, "Today, let's look around us and see how many ways our classroom could be improved in things like the way it was designed, the furniture, the conveniences, etc. As fast as you think of ideas, tell them to me and I will write them on the board for you. Don't worry about how much it would cost, just so it would make our classroom a better place in which to spend the day."

2. List suggestions on board.

3. Count them and transfer to a reading chart and number to cumulative graph.

C. Material needed:

a. Chalk
b. Chart paper

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Reference: R. C. Wilson. Creativity. In N. B. Henry (Ed.) Education for the gifted. Yearb. Nat. Soc. Stud. Educ., 1958, 57, Part II. Chicago: Univer. Chicago Press, p. 119.

Lesson Plan 19 Teacher:_____

Date:_____

A. Aim: To develop further use of the senses.

Specific aim: To become sensitive to needs in improving a public school building.

B. Procedure:

1. Say, "Today we are going to pretend that we are building inspectors and that there is money available to make our school building better for us to use. We are going to walk around the building (weather permitting, tour the grounds, too), and look for all of the things that could be improved--no matter how much they will cost. When we return, we'll list all of our suggestions on the board."

2. Review procedures for moving as a group in public (i.e. good manners, safety regulations).

3. List all suggestions on the board.

4. Count them and transfer to a reading chart. Add number to cumulative graph.

C. Materials needed:

a. Inform your principal that you will be taking this walk, and its purpose.
b. Chalk
c. Chart paper

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Lesson Plan 20 Teacher:_____

Date:_____

A. Aim: To develop further facility with "brainstorming."

Specific aim: To become sensitive to the fact that some people by their behavior are a problem to others.

B. Procedure:

1. Review by saying, "This week we've been looking at our world about us and have even made suggestions as tc how it could be improved for our use." Read charts made of week's suggestions.

2. Ask, "What would you do with a six-year old child who goes into temper tantrums when he doesn't get his own way?" (Be certain children understand what a temper tantrum is) "As fast as you think of ideas, tell them to me, and I'll write them on the board for you." Praise fluency.

3. Discuss the suggestions to see if the children can grasp the fact that perhaps some of the suggestions might have an extremely bad effect on the child. (i.e. if putting the child in a dark closet is mentioned).

4. Transfer suggestions to reading chart and number to cumulative graph.

C. Materials needed:

a. Chalk

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims met?

Additional comment on behavior of children.

Reference: A. F. Osborn. Applied imagination. (Rev. ed.) New York: Charles Scribner's Sons, 1961, p. 189.

Lesson Plan 21 Teacher:_____

Date:_____

A. Aim: To encourage originality.

Specific aim: To produce a picture and write a story about it.

B. Procedure:

1. Have each child draw three random lines in colored crayon on a piece of paper. Have the children exchange papers. The one who receives the "squiggle" then draws a picture, using the lines as part of the picture. Each child names his picture and writes a story about it. (Children who cannot write may dictate the story to the teacher).

2. Remind the children that in a story:

   a. Something must happen.
   b. It must happen in sequence.
   c. It should have a definite ending.

3. Attach story to the picture.

C. Materials needed:

a. A piece of blank paper for each child for the "squiggles."
b. Crayons
c. Paper for the story

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Reference: R. C. Wilson. Creativity. In N. B. Henry (Ed.) Education for the gifted. Yearb. Nat. Soc. Stud. Educ., 1958, 57, Part II. Chicago: Univer. Chicago Press, p. 123.

Lesson Plan 22 Teacher:_____

Date:_____

A. Aim: To gain facility in oral participation through group activity.

Specific aim: To share pictures and stories created in Lesson 21.

B. Procedure:

1. Ask each child to discuss his picture and tell or read his story created in Lesson 21.

C. Materials needed:

a. Pictures and stories created by each child.

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Lesson Plan 23 Teacher:_____

Date:_____

A. Aim: Vocabulary enrichment.

Specific aim: An exercise in seeing relationships.

B. Procedure:

1. Say, "We have words or phrases in our language that point out likenesses. Have you ever heard expressions such as 'sharp as a tack,' or 'snug as a bug in a rug?' We use the first one when we want to let people know that we think somebody is smart. The last one means that we feel warm and comfortable. Let's try to make some comparisons. I'll put the first part of the phrase on the board and you tell me some words that would complete the picture."

2. a. scarce as _____ (explain meaning of scarce if children are not familiar with this word)
   b. like finding _____
   c. funny as _____
   d. hard as _____
   e. crooked as _____
   f. wet as _____
   g. quick like _____
   h. soft as _____
   i. sells like _____
   j. nervous as _____

3. Allow for as many responses as the children can think of for each stimulus phrase. If the children come up with stereotyped responses, accept them, but encourage them to think of other words that would also fit the description.

C. Materials needed:

a. Chalk

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Lesson Plan 23

Additional comment on behavior of children.

Reference: R. E. Meyers and E. P. Torrance. Invitations to thinking and doing. Minneapolis: Perceptive, 1961., p. 17.

Lesson Plan 24

Teacher:_____

Date:_____

A. Aim: To develop "brainstorming" fluency.

Specific aim: To become sensitive to getting along with members of the family.

B. Procedure:

1. Say, "We all live in some kind of a home situation. What can each of us do to make our homes more happy? As fast as you think of ideas, tell them to me and I'll write them on the board for you."

2. Praise for fluency, and list suggestions. Count them.

3. Transfer suggestions to a reading chart and number to cumulative graph.

C. Materials needed:

a. Chalk
b. Chart paper

Comments:

a. Outcome: Did the lesson go as planned? If not, why not?

b. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Reference: R. C. Wilson. Creativity. In N. B. Henry (Ed.) Education for the gifted. Yearb. Nat. Soc. Stud. Educ., 1958, 57, Part II, Chicago: Univer. Chicago Press, p. 119.

Lesson Plan 25 Teacher:_____

Date:_____

A. Aim: To develop "brainstorming" fluency.

Specific aim: To become sensitive to the problem of accidents on our streets and highways.

B. Procedure:

1. Review lesson 24 and read the chart prepared from the suggestions.

2. Say, "We've been sharing ideas on many subjects. Today, let's think of ways to cut down on accidents on our streets and highways. As fast as you tell me your ideas, I'll write them on the board."

3. List suggestions and count them.

4. Transfer ideas to reading chart and number to cumulative graph.

C. Materials needed:

a. Chalk

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved:

Additional comment on behavior of children.

Assignment:

Say, "We often do not notice things about us. On your way home from school today and over the weekend, pay particular attention to things. For instance, you might really take a good look at your front door, your shoes, your parents, your brothers and sisters, bark on trees, the handles on the kitchen cabinets, clocks, street lamps, frames of pictures, etc. Monday we'll talk about what you saw that you hadn't really noticed before."

Lesson Plan 25

Reference: A. F. Osborn. Applied imagination. (Rev. ed.) New York: Charles Scribner's Sons, 1961, p. 12.

R. E. Meyers & E. P. Torrance. Invitation to thinking and doing. Minneapolis: Perceptive, 1961., p. 5.

Lesson Plan 26 Teacher:_____

Date:_____

A. Aim: To develop sensitivity to the world about us.

Specific aim: To increase powers of observation.

B. Procedure:

Say, "The last time we were together I asked you to look for things that you had not particularly noticed before. Perhaps you noticed something that's been around for a long time, but you had never really taken a good look at it. Let's share what we saw. Don't be afraid to mention it."

Keep notes of observations, but do not write them on the board.

C. Materials needed:

a. Notepaper for teacher use.

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Lesson Plan 27 Teacher:_____

Date:_____

A. Aim: To develop originality.

Specific aim: To develop powers of observation.

B. Procedure:

Say, "Let's pretend that we are going to write a poem. Everyone will have an opportunity to go to the window and look outside for a few minutes. Don't mention to anyone else what you noticed. When you come back to your seat write down all of the things you have seen. I will help you with the spelling and writing, if necessary.

1. If you write something that nobody else noticed, your score will be ten.

2. If only two or three people in the room noticed it, your score will be five on that idea.

3. If four or five people put down the same idea, the score on that item will be three.

4. If more than five noticed it, your score will be one.

You will see that the closer you observe or look and the more uncommon your responses, the higher your score will be. We'll take four minutes to look out the window. Don't forget that you are not to tell anybody else what you saw."

After the ideas have been written, ask each child to read or tell you what he saw. List these on the board and aid the children in scoring.

Collect the lists for Lesson 28.

C. Materials needed:

a. Notebook or primary writing paper
b. Chalk

Comments:

Lesson Plan 27

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Reference: R. C. Wilson. Creativity. In N. B. Henry (Ed.) Education for the gifted. Yearb. Nat. Soc. Stud. Educ., 1958, 57, Part II. Chicago: Univer. Chicago Press, p. 122.

Lesson Plan 28 Teacher:_____

Date:_____

A. Aim: To develop creative writing.

Specific aim: To write a poem.

B. Procedure:

Say, "Yesterday we wrote down ideas for a poem. Today, let's see if we can each write such a poem using our ideas. It is not necessary that all poems rhyme. Sometimes poets can tell beautiful thoughts without worrying about finding words that rhyme. You do whatever you wish. You may write a poem that has words that rhyme, or one that doesn't. I will help you with any words that you want to use. Be sure to give your poem a title."

C. Materials needed:

a. Lists of ideas from Lesson 27.
b. Notebook paper or primary writing paper.

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Lesson Plan 29 Teacher:_____

Date:_____

A. Aim: To develop originality.

Specific aim: To choose a title for a poem.

B. Procedure:

Read the poem, "Trees" by Harry Behm to the class. Ask children to think of clever or appropriate titles. Write these titles on the board, and have students select the best title. Discuss the relative merits of the title chosen and the real title.

C. Materials needed:

a. Trees by Harry Behm

Trees are the kindest things I know,
They do no harm, they simply grow

And spread a shade for sleepy cows
And gather birds among their boughs.

They give us fruit in leaves above,
And wood to make our houses of,

And leaves to burn on Hallowe'en,
And in the Spring new buds of green.

They are the first when day's begun
To touch the beams of morning Sun

They are the last to hold the light
When evening changes into night,

And when a moon floats on the sky
They hum a drowsy lullaby

Of sleepy children long ago ...
Trees are the kindest things I know.

b. Chalk

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

Lesson Plan 29

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

Reference: R. C. Wilson. Creativity. In N. B. Henry (Ed.) Education for the gifted. Yearb. Nat. Soc. Stud. Educ., 1958, 57, Part II. Chicago: Univer. Chicago Press, p. 122.

Harry Behm. Trees. In May H. Arbuthnot (Ed.) Time for poetry. New York: Scott, Foresman, 1951, p. 385.

Lesson Pl. 30 Teacher:_____

Date:_____

A. Aim: To think about productive thinking and the function of unusual or uncommon ideas.

Specific aim: To think of ways to practice this kind of thinking.

B. Procedure:

1. Say, "For the last six weeks we have been practicing daily on ideas. We've talked about how things could be changed. One of these ways of changing something was to make it larger. Let's see if we can remember other ways. I'll list them on the board for you." (This is a review of the principles listed in Lesson 1).

2. Ask, "Why is it important that people have ideas, especially ideas that are different or not common. Tell me reasons for this, and I will write them on the board."

   List ideas.

3. Say, "Now let's see if we can think of ways to practice this kind of thinking. Tell them to me and I will list them on the board."

   List ideas.

C. Materials needed:

a. List of principles from Lesson 1.
b. Chalk

Comments:

1. Outcome: Did the lesson go as planned? If not, why not?

2. Evaluation: Were the aims achieved?

Additional comment on behavior of children.

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APPENDIX B

COMPOSITE RAW SCORES FOR VERBAL AND FIGURAL CREATIVITY FACTORS

Figural Creativity Factors
Control Group N=32

S	Class	Sex	IQ	CA	MA	Pretest				Posttest				Difference			
						FLU	FLEX	ORIG	ELAB	FLU	FLEX	ORIG	ELAB	FLU	FLEX	ORIG	ELAB
1	C-1	F	55	208	115	29	22	20	58	12	12	14	33	-17	-10	- 6	-25
2	C-1	F	66	207	137	14	13	18	27	16	12	18	28	2	- 1	0	1
3	C-1	M	53	203	108	40	26	25	58	26	16	33	45	-19	-10	8	-13
4	C-1	F	80	200	162	10	10	20	25	25	13	11	36	5	3	- 9	11
5	C-1	F	74	201	149	10	8	9	46	17	13	12	59	7	5	3	13
6	C-1	F	48	227	109	16	15	15	44	12	9	16	26	- 4	- 6	1	-18
7	C-1	F	71	208	148	35	22	14	50	18	16	16	31	-17	- 6	2	-19
8	C-1	M	56	253	142	21	21	7	30	15	14	6	15	- 6	- 7	- 1	-15
9	C-1	F	59	234	138	16	16	13	31	23	17	15	20	7	1	2	-11
10	C-1	F	60	240	144	21	18	24	53	14	12	15	37	- 7	- 6	- 9	-16
11	C-1	F	49	244	120	13	10	17	27	21	18	26	52	8	8	9	25
12	C-1	M	67	233	156	19	16	31	34	15	15	21	26	- 4	- 1	-10	- 8
13	C-2	M	76	216	164	14	14	18	81	15	14	17	93	1	0	- 1	12
14	C-2	M	67	194	130	31	25	49	127	21	19	28	68	-10	- 6	-21	-59
15	C-2	M	58	248	144	20	16	29	44	18	10	17	43	- 2	- 6	-12	- 1
16	C-2	F	45	204	92	8	4	9	56	17	12	17	24	9	8	8	-32
17	C-2	M	50	218	109	9	7	16	128	19	7	16	128	10	7	3	-30
18	C-2	M	57	209	119	9	9	14	67	11	10	5	30	2	1	- 9	-37
19	C-2	M	60	262	157	15	12	29	50	11	10	27	24	- 4	- 2	- 2	-26
20	C-2	M	63	217	137	27	21	41	102	18	16	28	41	- 9	- 5	-13	-61
21	C-2	M	61	233	142	22	20	28	44	21	18	22	39	- 1	- 2	- 6	- 5
22	C-3	M	60	165	99	18	14	28	122	10	10	12	46	- 8	- 4	-16	-76
23	C-3	M	50	167	84	5	5	6	22	8	8	11	29	3	3	5	7
24	C-3	M	58	180	104	29	23	30	30	13	10	20	32	-16	-13	-10	2
25	C-3	M	51	175	89	28	22	19	30	21	14	7	34	- 7	- 8	-12	4
26	C-3	M	53	174	92	27	25	33	68	20	17	21	57	- 7	- 8	-12	-11
27	C-3	M	54	174	95	15	13	27	56	14	11	24	65	- 1	- 2	- 3	9
28	C-3	M	57	170	97	21	18	38	87	12	12	14	54	- 9	- 6	-24	-33
29	C-3	M	51	173	88	17	15	17	35	10	10	16	39	- 7	- 5	- 1	4
30	C-3	M	64	149	95	17	16	17	41	14	12	8	59	- 3	- 4	- 9	18
31	C-3	F	58	159	92	20	15	17	46	15	13	13	37	- 5	- 2	- 4	- 9
32	C-3	M	69	159	110	21	18	26	71	19	16	17	58	- 2	- 2	- 9	-13

Figural Creativity Factors
Experimental Group No=30

						Pretest				Posttest				Difference			
S	Class	Sex	IQ	CA	MA	FLU	FLEX	ORIG	ELAB	FLU	FLEX	ORIG	ELAB	FLU	FLEX	ORIG	ELAB
1	E-1	M	63	250	158	12	7	8	49	22	18	22	71	10	11	14	22
2	E-1	M	84	159	134	8	8	11	46	11	11	16	97	3	3	5	51
3	E-1	F	47	242	114	22	19	21	78	23	13	17	60	1	- 6	- 4	-18
4	E-1	F	46	209	96	19	14	30	35	12	11	26	24	- 7	- 3	- 4	-11
5	E-1	F	58	198	115	9	9	6	12	16	11	17	50	7	2	11	38
6	E-1	F	48	212	102	21	18	27	90	19	18	22	71	- 2	0	- 5	-19
7	E-1	M	48	210	101	12	11	22	34	20	14	36	42	8	3	14	8
8	E-1	M	72	218	157	20	19	23	61	20	18	21	55	0	- 1	- 2	- 6
9	E-1	F	56	245	137	13	10	8	25	16	13	15	29	3	3	7	4
10	E-1	M	72	201	145	17	21	21	54	18	16	19	33	1	- 5	- 2	-21
11	E-2	M	56	182	102	11	10	4	10	15	10	5	17	4	0	1	7
12	E-2	M	59	200	118	23	18	17	35	21	16	15	35	- 2	- 2	- 2	0
13	E-2	M	64	247	158	21	13	24	105	18	14	23	73	- 3	1	- 1	-32
14	E-2	M	69	214	148	24	21	22	32	23	21	19	34	- 1	0	- 3	2
15	E-2	M	69	197	136	18	17	16	62	21	18	13	66	3	1	- 3	4
16	E-2	M	61	237	145	10	8	23	110	13	11	25	83	3	3	2	-27
17	E-2	M	53	198	105	16	15	21	39	14	13	19	41	- 2	- 2	- 2	2
18	E-2	M	59	209	119	22	20	22	45	21	17	20	47	- 1	- 3	- 2	2
19	E-2	M	52	257	134	14	12	17	50	15	15	12	37	1	3	- 5	-13
20	E-3	M	56	169	93	9	9	12	40	8	8	10	37	- 1	- 1	- 2	- 3
21	E-3	M	60	168	101	20	16	16	99	20	17	15	87	0	1	- 1	-12
22	E-3	M	54	172	93	21	15	20	58	23	21	18	45	2	6	- 2	-13
23	E-3	M	56	155	87	12	11	6	39	16	13	7	39	4	2	1	0
24	E-3	M	59	174	103	24	21	28	36	26	17	8	38	2	- 4	-20	- 2
25	E-3	M	58	153	89	19	19	20	22	16	17	15	20	- 3	- 2	- 5	- 2
26	E-3	M	55	178	98	12	12	12	24	21	19	23	34	9	7	11	10
27	E-3	M	55	176	97	12	10	13	38	12	11	44	26	0	1	31	- 2
28	E-3	M	67	155	104	24	20	23	52	28	25	32	76	4	5	9	24
29	E-3	M	66	174	115	18	14	20	98	17	16	47	90	- 1	2	27	- 8
30	E-3	M	52	153	80	7	7	4	11	10	9	27	51	3	2	23	40

Verbal Creativity Factors
Control Group N = 32

S	Class	Sex	IQ	CA	MA	Pretest			Posttest			Difference		
						FLU	FLEX	ORIG	FLU	FLEX	ORIG	FLU	FLEX	ORIG
1	C-1	F	55	208	115	2	1	1	3	2	0	1	1	- 1
2	C-1	F	66	207	137	14	10	2	24	14	4	10	4	2
3	C-1	M	53	203	108	18	10	2	11	7	5	- 7	- 3	- 3
4	C-1	F	80	200	162	12	7	1	7	4	4	- 5	- 3	3
5	C-1	F	74	201	149	37	20	14	23	14	14	-14	- 6	0
6	C-1	F	48	227	109	10	9	2	10	4	5	0	- 5	3
7	C-1	F	71	208	148	8	7	2	8	6	5	0	- 1	3
8	C-1	M	56	253	142	9	5	1	16	12	7	7	7	6
9	C-1	F	59	234	138	8	6	2	8	7	2	0	1	0
10	C-1	F	60	240	144	8	6	3	7	5	2	- 1	- 1	- 1
11	C-1	F	49	244	120	9	6	5	8	7	1	- 1	1	- 4
12	C-1	M	67	233	156	4	3	0	7	4	1	3	1	1
13	C-2	M	76	216	164	11	9	6	10	6	4	- 1	- 3	- 2
14	C-2	M	67	194	130	27	16	9	22	16	8	- 5	0	- 1
15	C-2	M	58	248	144	15	10	4	13	10	4	- 2	0	0
16	C-2	F	45	204	92	5	3	1	7	5	4	2	2	3
17	C-2	M	50	218	109	26	12	6	19	13	6	- 7	1	0
18	C-2	M	57	209	119	11	8	5	14	11	7	3	3	2
19	C-2	M	60	262	157	9	7	1	6	4	3	- 3	- 3	2
20	C-2	M	63	217	137	6	4	1	7	6	2	1	2	1
21	C-2	M	61	233	142	12	8	4	11	9	4	- 1	1	0
22	C-3	M	60	165	99	5	4	0	8	4	3	3	0	3
23	C-3	M	50	167	84	14	10	6	4	8	0	-10	- 2	- 6
24	C-3	M	58	180	104	17	15	6	8	6	4	- 9	- 9	- 2
25	C-3	F	51	175	89	18	8	6	7	5	3	-11	- 3	- 3
26	C-3	M	53	174	92	17	13	10	13	9	6	- 4	- 4	- 4
27	C-3	M	54	174	95	19	12	9	14	7	6	- 5	- 5	- 3
28	C-3	M	57	170	97	15	10	10	14	10	8	- 1	0	- 2
29	C-3	M	51	173	88	16	8	3	14	6	6	- 2	- 2	3
30	C-3	M	64	149	95	23	13	11	16	6	5	- 7	- 7	- 6
31	C-3	F	58	159	92	14	10	3	14	9	6	0	- 1	3
32	C-3	M	69	159	110	17	10	6	13	10	5	- 4	0	- 1

Verbal Creativity Factors
Experimental Group N=30

S	Class	Sex	IQ	CA	MA	Pretest			Posttest			Difference		
						FLU	FLEX	ORIG	FLU	FLEX	ORIG	FLU	FLEX	ORIG
1	E-1	M	63	250	158	18	9	8	23	12	11	5	3	3
2	E-1	M	84	159	134	16	12	3	11	9	1	- 5	- 3	- 2
3	E-1	F	47	242	114	10	8	2	7	4	2	- 3	- 4	0
4	E-1	F	46	209	96	16	12	5	22	18	3	6	6	- 2
5	E-1	F	58	198	115	11	7	0	13	10	1	2	3	1
6	E-1	F	48	212	102	10	6	4	27	20	9	17	14	5
7	E-1	M	48	210	101	7	5	1	23	17	4	16	12	3
8	E-1	M	72	218	157	11	6	1	21	16	8	10	10	7
9	E-1	F	56	245	137	19	8	2	20	15	4	1	7	2
10	E-1	M	72	201	145	8	5	3	18	16	5	10	11	2
11	E-2	M	56	182	102	16	9	1	17	12	6	1	3	5
12	E-2	M	59	200	118	5	4	0	13	12	5	8	8	5
13	E-2	M	64	247	158	21	10	8	23	17	8	2	7	0
14	E-2	M	69	214	148	13	12	5	17	11	3	4	- 1	- 2
15	E-2	M	69	197	136	26	23	14	25	21	11	- 1	- 2	- 3
16	E-2	M	61	237	145	8	7	2	19	13	4	11	6	2
17	E-2	M	53	198	105	7	5	2	11	8	3	4	3	1
18	E-2	M	59	209	119	7	6	3	16	13	3	9	7	0
19	E-2	M	52	257	134	4	2	1	13	10	0	9	8	- 1
20	E-3	M	56	169	93	12	9	3	24	16	8	12	7	5
21	E-3	M	60	168	101	31	19	16	35	18	22	4	- 1	6
22	E-3	M	54	172	93	15	12	7	24	15	13	9	3	6
23	E-3	M	56	155	87	13	4	2	30	17	10	17	13	8
24	E-3	M	59	174	103	26	16	6	47	22	21	21	6	15
25	E-3	M	58	153	89	9	6	3	15	11	1	6	5	- 2
26	E-3	M	55	178	98	15	13	8	32	18	17	17	5	9
27	E-3	M	55	176	97	4	3	3	23	13	2	19	10	- 1
28	E-3	M	67	155	104	18	12	10	50	28	25	32	16	15
29	E-3	M	66	174	115	19	14	9	35	20	17	16	6	8
30	E-3	M	52	153	80	6	5	4	11	9	4	5	4	0

VITA

Judith L. Ladner, daughter of Edward and Valerie Feldman, was born on September 26, 1932, in New York, New York. She attended Adelphi Academy, New York City, and was graduated in June, 1949.

She entered Smith College, Northampton, Massachusetts, in September 1949 and received a Degree of Bachelor of Arts in June 1953. In September 1964 she was accepted as a psychology student in the Graduate School of Arts and Sciences of Fordham University. She received the Degree of Master of Arts in February 1966.

In August 1968 she completed her internship in clinical psychology at St. Vincent's Hospital, New York City. She has held the position of psychologist at Pilgrim State Hospital, Brentwood, New York since September 1968.

She has specialized in clinical psychology under the mentorship of George Domino, Ph. D.