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Teaching for Creativity

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PART ONE: Can We Teach Children to Think Creatively?*

It is difficult, if not impossible, for me to present an unbiased account of the status of knowledge about teaching children to think creatively.

I know that it is possible to teach children to think creatively and that it can be done in a variety of ways. I have done it. I have seen my wife do it; I have seen other excellent teachers do it. I have seen children who had seemed previously to be "non-thinkers" learn to think creatively, and I have seen them continuing for years thereafter to think creatively. I have seen, heard, and otherwise experienced their creativity. Their parents have told me that they saw it happening. Many of the children, now adults, say that it happened. I also know that these things would not have happened by chance because I have seen them "not happening" to multitudes of their peers.

My many years of experience in teaching children to think creatively make me prone to assume things that others question. For example, throughout my research on creativity I have assumed that children will not function very creatively if the testing or other activity interrupts or replaces highly interesting and valued activities. I have always guarded against using the physical education, art, or music periods for testing or conducting experiments. Whenever this was not avoided, it was always obvious to me that the children were not functioning at their highest level. Thus, when I began searching to find out if the *American Educational Research Journal* had ever published a study on creative thinking, I was surprised though pleased, to find that Elkind, Deblinger, and Adler (1970) had documented what I had long assumed to be true. These investigators tested 32 children ranging from five to 12 years on three creativity measures. Each child was tested twice, once when taken from an ongoing "interesting" task and once when taken from an ongoing "uninteresting" task. When the children expected to return to an "uninteresting" task, they were almost twice as "creative" as they were when they anticipated the resumption of an "interesting" activity. In my teaching and research I had observed this phenomenon hundreds of times. I "knew" that it was true. To me, it was so obvious that it required no documentation. Still, I was pleased to see such documentation.

I realize, too, that my deep involvement in creativity research and teaching may also make me unfit to evaluate the status of knowledge on teaching children to think creatively. I believe I have used as great a variety of devices as anyone to try to avoid deceiving myself. I cannot claim detachment. I try continually to move from involvement to detachment, for I believe that involvement is necessary to a genuine search for the truth. A part of my ongoing

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involvement is to teach a group of four and five year-olds once each week, and to teach in an elementary school at least two days each month. I believe that this kind of continuing involvement is necessary to keep me from deceiving myself and to make new discoveries possible.

I am particularly aware that many researchers are likely to discredit most of the 142 studies that I have surveyed for this paper, because 103 of them have used performance on the *Torrance Tests of Creative Thinking* as criteria. While I strongly favor and have used more "real life" criteria, I feel some responsibility for defending the validity of the instrument used in these 103 studies. It is unfortunate that the only study on the validity of these tests ever published in the *American Educational Research Journal* (Harvey, Hoffmeister & Coates, 1970) is filled with factual errors about the tests, and uses such irrelevant criteria as measures of supernaturalism, moral relativism, relativism of facts, concreteness-abstractness, and the like. I am unable to think of a logical rationale for expecting this type of validity. I prefer to place my confidence in the recently reported long-range predictive validity study (Torrance, 1971) using both publicly recognized and acknowledged adult creative achievements and self-reported peak creative achievements as criteria.

I realize that many educational psychologists (Cronbach, 1970; Elkind, Deblinger, and Adler, 1970) believe that the term "creativity" is too value laden and should not be used to designate the kinds of behavior involved in studies of teaching children to think creatively. On this score, I can only say that I believe the word describes the behavior investigated more adequately than any other word I know. Further, an effort has been made to stay within the limits of a definition I chose for my research in 1958. If one does not care to accept this definition, it is his privilege to use another label.

I must also acknowledge the criticism that "being able to think creatively" is not the same as "thinking creatively." All of us could probably think more creatively than we do. I am interested in the development of superstars, teachers who can equip children with the skills of creative thinking and with the motivations to continue thinking creatively throughout their lives. Even such superstars, however, cannot guarantee that their students will have a chance to behave creatively as adults.

In studying creative thinking and selecting studies for this survey I have not been bound by the constraint that Elkind places upon thinking even in its broadest sense, i.e. that it be logically determined. In creative thinking at its best there are strong elements of the emotional, the irrational. After this kind of thinking has occurred, however, it must be subjected to tests of logic. A part of the business of teaching children to think creatively is teaching them to understand and consciously to use these emotional, irrational processes and to formulate and apply criteria for evaluating alternative solutions.

It is becoming popular to maintain that "nobody can teach anybody anything" (Wees, 1971). When I teach children and see that creative thinking comes so naturally to most children, I vacillate on this issue myself. Yet when I find that children who are not being taught are so disabled as creative thinkers, I see how necessary teaching is. In my work I have characterized creativity as a natural human process motivated by strong human needs. Critics of efforts to teach children to think creatively have been quick to point out that if my definition is valid there is no need for teaching. Yet skills are involved, and skills of any kind have to be practiced to function very well. Ever present in all our experiments, however, is the question of just how much and what we are teaching and how much of the progress we observe is due to facilitating conditions that free natural processes to operate.

Procedure

Out of the studies of teaching children to think creatively that I have examined, 142 involve

qualification and presentation of evidence and a still larger number are narrative reports. Studies with college students and adults have not been considered. The tables summarize the nature of these studies and their degree of success.

In most cases I have had access to the documentary reports. In some cases, however, I have had to rely upon journal articles and abstracts, and some of these lacked information necessary for analysis. I am familiar with a number of studies for which I have been unable to obtain reports and these have not been included. Although my survey is not complete, in my opinion the evidence from the 142 studies summarized in the tables gives useful guidance.

Ways of Teaching Children to Think Creatively

To help organize the data from the 142 studies I have examined, I have classified them into the following categories of ways of teaching children to think creatively:

1. Training programs emphasizing the Osborn-Parnes Creative Problem Solving procedures (Osborn, 1963; Parnes, 1967 a, b) or modification of it.
2. Other disciplined approaches such as training in general semantics, creative research, and the like.
3. Complex programs involving packages of materials, such as the Purdue Creativity Program; Covington, Crutchfield and Davies' (1972) Productive Thinking Program; and the Myers and Torrance (1964, 1966 a, b) and Torrance (1965 a, b) ideabooks.
4. The creative arts as vehicles for teaching and practicing creative thinking.
5. Media and reading programs designed to teach and give practice in creative thinking.
6. Curricular and administrative arrangements designed to create favorable conditions for learning and practicing creative thinking.
7. Teacher-classroom variables, indirect and direct control, classroom climate, and the like.
8. Motivation, reward, competition, and the like.
9. Testing conditions designed to facilitate a higher level of creative functioning or more valid and reliable test performance.

The frequency and estimate of success attained in the studies in each of these categories are summarized in Table One. In judging success, a score of 1 was awarded if all the measured objectives of the experiment were attained. If the experiment had a single objective, such as increasing the degree of originality of thinking, a score of 1 was still assigned. However, if data were presented for fluency, flexibility, originality, and elaboration and the only statistically significant gain over the control group was in originality, a score of .25 was awarded. If 10 of 20 tests of significance reached the .05 level of confidence, a score of .50 was awarded.

It will be noted from Table One that the most popular approch to teaching children to think creatively has been through complex programs involving packages of materials, the manipulation of teacher-classroom variables, and the use of modifications of the Osborn-Parnes Creative Problem Solving training program. Somewhat less popular have been the creative arts as vehicles, motivation techniques, and facilitating testing conditions.

The best batting averages have been compiled by those experiments using the various modifications of the Osborn-Parnes training program and other disciplined approaches–over 90 percent. Programs involving the creative arts, complex programs involving packages of materials, media and reading programs, motivation, and facilitating testing conditions have also been relatively successful–around 75 percent. The poorest batting averages have been compiled by studies involving curricular and administrative arrangements and teacher-classroom variables.

Let us look more carefully at the summaries for each of the nine categories.

Table One.

Summary of successes in teaching children to think creatively according to type of intervention.

Type of Intervention	Number Studies	Number Successes	Percentage Successes
Osborn-Parnes CPS and/or modifications	22	20.0	91
Other disciplined approaches	5	4.6	92
Complex programs involving packages of materials	25	18.0	72
Creative arts as vehicle	18	14.5	81
Media and reading programs	10	7.8	78
Curricular and administrative arrangements	8	4.0	50
Teacher-Classroom variables, climate	26	14.4	55
Motivation, reward, competition	12	8.0	67
Facilitating testing conditions	16	11.0	69
TOTAL	142	102.3	72

Osborn-Parnes Modifications

From Table Two it will be noted that all of the experiments using combinations of techniques based on the Osborn-Parnes training program achieved some degree of success. The Torrance (1961 a, b) study which produced impressive results for the second and third grades but failed to produce significant results in the first grade was quite brief (20 minutes) and was later replicated with first graders with successful results by Cartledge and Krauser (1963) and Cropley and Feuring (1971). Almost any regular practitioner of this approach to teaching children to think creatively could furnish dozens of unpublished studies with results equally as impressive as the ones cited in Table Two.

Other Disciplined Procedures

From Table Three, it will be noted that I have included under "other disciplined procedures" a method of teaching reading involving creative dramatics and remediation, programs for training children in creative research, and a program for training in general semantics. It will be noted that all of these projects seem to have been rather successful. Perhaps their success can be attributed to the fact that all of them involved both the cognitive and affective attributes of the subjects and gave practice in creative thinking.

Packages of Materials

The experimental studies involving complex programs with packages of materials, as will be noted in Table Four, have been concentrated upon three programs: (1) the Covington, Crutchfield and Davies (1972) *Productive Thinking Program*, (2) the Purdue Creative Thinking Program, and (3) the Myers and Torrance ideabooks. Each of these sets of materials scores fairly well, especially when there is class and teacher involvement in their use. Without this involvement, however, the battling average for this category is rather low.

Less frequently evaluated are the Wisconsin materials developed by Davis and his associates, the Montessori materials, and the Chicago Inservice Training Kit. Only in the case of the Purdue Creativity Program have separate components and combinations of components

Table Two.

Summary of experiments involving Osborn-Parnes Creative Problem-Solving training and/or modifications.*

Investigator	Grade Level	Nature of Treatment	Significant (.05) Differences
Beleff (1968)	9th	Exercises in brainstorming and questioning in social studies	TTCT fluency
Bond (1963)	4th	Osborn-Parnes training	TTCT variables
Cartledge & Krauser (1963)	1st	Osborn principles; Torrance materials	TTCT variables
Chung (1968)	5th	Osborn/Torrance materials	TTCT variables High and Low IQ
Cropley & Feuring (1971)	1st	Osborn/Torrance materials	TTCT flexibility originality, elab.
Eberle (1965)	JHS	Osborn-Parnes and Myers-Torrance exercises	TTCT and Guilford variables
Eberle (1967)	8th	Osborn-Parnes; Myers-Torrance	TTCT and Guilford variables
Eherts (1961)	5th	Brainstorming and exercises	TTCT variables
Goodrich (1969)	6th	Exercises, open-structure, etc.	TTCT originality
Hutchinson (1963, 1967)	JHS	Brainstorming and other productive thinking	4 of 10 Guilford variables
J. C. Jones (1970)	5th 6th	Strategies of divergent thinking	TTCT all verbal figural fluency
Khatena (1969, 1971)	Kg.	Strategies of divergent thinking	TTCT variables
Olkin (1967)	9th	Creative problem solving	TTCT variables
Parnes (1966)	12th	Osborn-Parnes, programmed and instructor taught	TTCT and Guilford variables
Perkins (1963)	5th 6th 7th	Creative Problem Solving training	TTCT variables except elabora.
Rains & Chaturvedi (1970)	HS	Creative Problem Solving training	TTCT variables
Reyburn (1963)	5th	Divergent thinking in speaking and writing	TTCT fluency and originality
Rouse (1963, 1965)	EMR Ages 7-17	Brainstorming and creative problem solving	TTCT variables
Rusch et al. (1967)	6th	Deliberate strategies	5 of 7 Guilford and Denny-Ives variables
Sullivan (1969)	9-14 yrs.	Brainstorming and creative problem solving	Verbal creative abilities
Torrance (1961)	1st-3rd	Training in idea production	TTCT in 2nd and 3rd
Yee (1964)	12th	Osborn-Parnes training	TTCT variables High and Low IQ

Table Three.

Summary of experiments involving disciplined procedures other than Osborn-Parnes training program.*

Investigator	Grade Level	Nature of Treatment	Significant (.05) Differences
Allen (1969)	5th	Reading instruction involving remediation and creative dramatics	Fluency for all treatment groups. Originality in creative dramatics plus remediation. Elaboration in all creative dramatics treatments.
Dunn (1968)	4th-8th	Techniques of survey and descriptive research	Creative research products
Schaefer	4th-5th	One hour/week on creative expression, sense perception, etc.	TTCT variables
Torrance & Myers (1962)	6th Gifted	Experiences in historical, descriptive, and experimental research	TTCT variables and research products
True (1966)	6th	General semantics training	TTCT, fluency and flexibility

Table Four.

Summary of experiments involving complex training programs with packages of materials.*

Investigator	Grade Level	Nature of Treatment	Significant (.05) Differences
Bahlke (1967), Bahlke et al. (1967)	3rd 5th	Purdue Creativity Program	Figural and verbal originality; verbal fluency; figural and verbal elaboration on TTCT
Bahlke (1969), Bahlke et al. (1967)	4th 6th	Purdue Creativity Program	4th: All TTCT var. 5th: 5 of 7 TTCT 6th: 3 of 7 TTCT Exercises most eff.
Britton (1968)	6th	Myers-Torrance materials	TTCT verbal fluency flexibility and all figural variables
Casey (1968)	6th	Myers-Torrance	TTCT fluency, flexibility and originality
Covington (1967)	5th	Productive Thinking Program	Success in problem solving and reflective reading
Covington & Crutchfield (1965)	5th 6th	Productive Thinking Program	Problem solving and TTCT fluency and originality
Crutchfield (1966)	6th	Productive Thinking Program	Problem solving and TTCT fluency and originality

Table Four (continued).

Investigator	Grade Level	Nature of Treatment	Significant (.05) Differences
Davis (1971) Davis et al. (1969)	6th-8th	10-week Wisconsin course	TTCT fluency
DeRoche (1965)	6th	Creativity exercises in science	TTCT variables and science achievement
Eberle (1965, 1967)	JHS	Myers-Torrance materials	TTCT and Guilford variables
Feldhusen et al. (1969)	4th-6th	Purdue Creativity Program	TTCT verbal fluency and originality; fig. originality and elab.
Feldhusen et al. (1970)	4th-6th	Purdue Creativity Program	4th: All TTCT var. 5th: 5 of 7 TTCT 6th: 3 of 7 TTCT
Feldhusen et al. (1971); Thomas et al. (1971)	4th-6th	Purdue Creativity Program	Exercises single most effective component; presentation least
Freyermuth (1968)	Kg.	Montessori Program	TTCT variables
Olton (1969)	5th-6th	Productive Thinking Program	No gains without teacher and class involvement
Olton, Waldrop et al. (1967)	5th	Productive Thinking Program	Problems and TTCT variables; high and low IQ
Provus (1970)	3rd-8th	Chicago Inservice Training Kit	Subjective evaluations
Robinson (1969)	4th	Purdue Creativity Program	TTCT variables
Shackel & Lawrence (1969)	6th	Scrambled textbook programmed exercises	TTCT and French measures
Speedie et al. (1971)	4th-6th	Purdue Creative Program; 7 mo. later	4th Exercises and stories TTCT still held; effects washed out for 5th & 6th
Sporburg (1971)	6th	Productive Thinking Program; little class and teacher involvement	No effects on Guilford tests
Torrance (1965b)	4th-6th	Myers-Torrance exercises	No growth in creative writing
Treffinger & Ripple (1969)	4th-7th	Productive Thinking Program; without class and teacher involvement	No differences on any TTCT variables
Waldrop et al. (1969)	5th	Productive Thinking Program	TTCT variables and problems; high and low IQ
Woodliffe (1970)	5th	Myers-Torrance exercises	Workbook plus inservice program, highest TTCT gains

been evaluated. The exercises seem to come out best in these evaluations, and the presentations of principles of creative thinking poorest. All three programs seem to have been effective with both the high and low Intelligence Quotient groups.

Creative Arts

The 18 experiments involving one or more of the creative arts as a vehicle for teaching children to think creatively seem to have been rather effective, as will be noted from Table Five. These experiments range from programs in which the curriculum is built upon the creative arts (Fortson, 1969; Torrance & Fortson, 1968) through those involving the creative arts as an extracurricular activity (Skipper, 1969; Even, 1906) to those involving such experiences in single courses and those involving special summer or other out-of-school programs. Most of these programs have a distinct out-of-school flavor.

Media and Reading Programs

The experiments involving various types of media and reading programs score a rather good batting average, as will be noted in Table Six. There are a number of reading programs that have built-in creativity components but the Reading 360 Program (Clymer, et al., 1969) probably represents the most thorough-going attempt in this direction. It is the only such program for which there is even a partial evaluation, insofar as I know. The Imagi/Craft Program is quite similar to the Purdue Creativity Program and might have been included in the same category. Its initial field test was a large one and produced impressive results; thus, its originators have not seen fit to run additional evaluations. Of the ideas represented by the list of experiments listed in Table Six, the Junior Great Books Club, the set of stimuli developed by Baker, and the use of typewriters in elementary school creative writing seem to offer promise. My guess is that in the hands of a skilled teacher who understands creative learning and teaching any one of these devices could be counted upon to produce significant results.

Curricular and Administrative Arrangements

The various curricular and administrative arrangement studies listed in Table Seven do not appear to be tremendously promising. I know that there have been creativity evaluations of other curricular and administrative arrangements that purport to foster creative development (such as the open classroom, the ungraded school, and the like) but I have been unable to obtain reports of these efforts.

The only really bright spot in this category is Seides' experiment in placing artistically and musically talented slow learners in a talent class and giving them opportunities for talent development. This impresses me as a potentially productive idea and what happened in this experiment seems to be similar to what has happened with older youngsters talented in the arts in the North Carolina School of the Arts (Giannini, 1968).

Teacher-Classroom and Climate Variables

While the number of studies involving teacher-classroom and climate variables is impressive, their success in teaching creative thinking has not been outstanding, as will be noted from Table Eight. Studies that have relied upon the creative thinking abilities of teachers have rather consistently failed to show significant results. The motivations of the teacher seem to be more powerful; the two studies using the Torrance Creative Motivation Scale for identifying high and low creative teachers (James, 1964; Torrance, 1965b) showed reasonably promising, though not really outstanding, results.

Table Five.

Summary of experiments involving the creative arts as vehicles for teaching children to think creatively.*

Investigator	Grade Level	Nature of Treatment	Significant (.05) Differences
Engle (1970)	HS	Creative writing	Marketable, publishable creative writing
Even (1964)	11th	Visual arts	TTCT flexibility and originality
Fortson (1969)	Kg.	Creative-Aesthetic Approach	TTCT variables Starkweather original
Frankston (1964)	8th	Visual arts	No difference in art or poetry ratings
Grossman (1969)	Kg.	Visual arts	TTCT variables
Hagander (1967)	5th	Creative writing	TTCT variables
P. M. Jones (1968, 1969)	6th	Mime, drama, visual arts, imaginative activity	TTCT variables
Karioth (1968)	4th Disad.	Creative dramatics	TTCT variables for post-test only cond.; not for pretested groups
Madeja (1965)	HS	Visual art: convergent-divergent thinking	TTCT higher for divergent; high divergents made higher gains
Skipper (1969)	7th-10th	Living Arts Program	No gains on originality females, fluency and aesthetic sensitivity; males sensitivity to probs.
Torrance (1965e)	1st-3rd	Creative movement	TTCT variables
Torrance (1965b)	4th-6th	Creative writing	3 of 3 measures of creative writing
Torrance (1965b)	10th-12th	Man, Nature & the Arts Seminar (Perception)	10 of 12 TTCT var.
Torrance (1968, 1969); Torrance & Fortson (1968)	Kg.	Creative-Aesthetic Approach	TTCT variables
Torrance (1972)	Kg.	Alternate Kg. approaches, including Creat-Aesthetic	Creat. Aesthetic superior on questioning
Torrance & Torrance (1972)	1st-7th	Creativity Workshop (Summer)	TTCT variables
Vaughan & Myers (1971)	4th-5th	Music improvisation	TTCT fluency; musical creativity
Witt (197.)	2nd-4th	6-year program emphasizing music, art, drama, dance, etc.	Recognized creative achievements in one or more of the arts.

Table Six.

Summary of experiments involving reading programs and media as vehicles for teaching children to think creatively.*

Investigator	Grade Level	Nature of Treatment	Significant (.05) Differences
Abbott (1972)	4th	Multimedia sensory exercises	TTCT fluency, flexibility, and elaboration
Baker (1963)	5th	Films, pictures, recordings, etc. for writing	More original stories
Casper (1964)	5th Gifted	Junior Great Books Program	Guilford operational fluency; not originality
Dallenbach & DeYong (1969)	5th-6th	TV process series	Generally no gains on TTCT except parochial students
Karnes (1963)	4th	Typing, creative writing	Creative thinking measures and creative writing
O'Brien et al. (1964)	Nurs.	Increased number of toys	Increase in observed imaginative activities
Thatcher (1965)	5th-6th	Basal Reading vs. Individual Reading	Ind. Read. higher on TTCT but not conclusive
Nash & Torrance (1970)	1st	Reading 360 Program	TTCT fluency, flexibility, originality; questioning
Torrance (1964), Torrance & Gupta (1964ab), Torrance (1965)	4th	Imagi/Craft Program	TTCT variables
Torrance (1970)	1st	Manipulation of toys	Question asking

Most of the studies that have focused on observation and analysis of classroom interaction have been unsuccessful. However, most of them have been doctoral studies lacking in strong commitment from the school systems involved. Where highly competent and seasoned persons have been involved–Soar (1968), Clark and Trowbridge (1971), Mitchell (1967, 1971), with an inservice trainer such as George I. Brown (1971)–the results have been much more promising. A number of promising sidelights worth noting emerge from this category of studies. There are indications that the verbal creative thinking abilities receive useful practice in expert indirect influence teaching while the figural creative thinking abilities, especially elaboration, receive such stimulation under the expert direct teacher. The results obtained by Torrance (1969 a, b, c, d) with dyadic interaction also suggests that experimentation with small group arrangements might be promising.

Motivation Studies

A number of critics of the studies reviewed in the previous section have argued that the results obtained in the studies summarized in the foregoing tables have resulted from increased

Table Seven.

Summary of experiments involving curricular and administrative arrangements for teaching children to think creatively.*

Investigator	Grade Level	Nature of Treatment	Significant (.05) Differences
Bennett et al. (1971)	HS Gifted	Independent study	Unique projects; high subjective evaluation
Gold (1965)	4th-6th Gifted	Self-directed study	No significant gains on TTCT
Paton (1965)	4-yr. olds	Language enrichment	No significant gains on TTCT
Phillips & Torrance (1972)	1st-3rd	Cognitive-structured curriculum	Superior growth in causal thinking
Seides (1967)	7th Slow	Placement in talent class (art, music)	TTCT variables
Torrance & Phillips (1969)	1st-2nd	Cognitive-structured curriculum	1st: Fig. & Verb. Flex. 2nd: Verbal Orig. & Fig. Elab.
Torrance & Phillips (1970)	1st-3rd	Cognitive-structured plus consultants in art, music creative writing, etc.	1st: 4 of 7 TTCT 2nd: 7 of 7 TTCT 3rd: 4 of 7 TTCT
Vreeland (1967)	Elem. JHS	Summer enrichment program	Some negative effects Generally no effect on TTCT

motivation rather than from anything that was taught. The results summarized in Table Nine certainly suggest that motivation alone is powerful enough to "make a difference." Most of these results, however, have been achieved through different kinds of extrinsic motivation and generally these kinds of motivation have to be reapplied each time the desired performance is required and cannot be counted upon for continued creative thinking.

Facilitating Testing Conditions

Throughout the history of the development of tests of creative thinking ability, there has been a recognition that children have to be motivated to think creatively, if one is to obtain a valid measure of their creative thinking ability. Early in my own work, I experimented with extended time limits, take-home tests, and variations in instructions. The elements finally packaged in 1966 as the research edition of the *Torrance Tests of Creative Thinking* represents a considerable compromise between what my associates and I considered reasonable and feasible for use in schools and what we considered ideal. We realize that our solution is not the best one possible, and we are still considering and evaluating other alternatives. The results summarized in Table Ten indicate that improved performance on tests of creative thinking can probably be obtained by appropriate warm-up just prior to the administration of the test, by a game-like atmosphere, and by providing a variety of visual materials in the testing room. Take-home administrations or extended time limits may produce more valid results, but introduce a variety of practical problems that seem difficult to solve. Some children's lives are so completely and rigidly scheduled that they are unable to find the time to write the responses that they think of with take-home tests. There are also the elements of control,

Table Eight.

Summary of experiments involving teacher-classroom and climate variables in teaching children to think creatively.*

Investigator	Grade Level	Nature of Treatment	Significant (.05) Differences
Broome (1967)	5th	Teacher creativity	No differences on TTCT
Castelli (1964)	3rd-6th	Teacher creativity	No differences in classroom behavior
Clark & Trowbridge (1971)	All Levels	Extensive inservice education	Increased divergent thinking in classroom (Aschner-Gallagher)
Crabtree (1967)	2nd	Jointly-determined vs. predetermined structure	In jointly-determined, more originality, flexibility, constructive play
Denny (1966)	6th	Observation, climate, structuring	No increase on Guilford tests
Enochs (1964)	5th	Teacher inservice; application of Torrance principles	TTCT originality and total
Haddon & Lytton (1968)	11 12 yr.	Informal progressive teaching in primary school	6 divergent thinking tests
Haddon & Lytton (1971)	Ditto	Follow up 4 yrs. later	Verbal tests held up
James (1964)	7th	High and low teachers on Torrance Creative Motivation Scale	Boys of high teachers, 4 of 8 TTCT var. Girls of high teachers 5 of 8 TTCT var.
Kaltsounis (1969)	4th-6th Deaf	Mutual language method vs. combined method	No difference on TTCT
Mann (1966)	1st	Climate for preconscious freedom	No differences on TTCT
Marburg (1965)	5th	Classroom climate; high and low MTAI	No differences on TTCT
Mitchell (1967, 1971)	3rd-6th	Sensitivity training (Brown)	14 of 23 subgroups showed changes on TTCT variables
Raina (1971)	8th-9th	Creative vs. noncreative school climate	TTCT variables
Rappel (1970)	2nd-5th	Direct vs. indirect influence (Flanders)	No differences on TTCT except figural flex
Soar (1968)	3rd-6th	Degree of indirectness (Flanders)	TTCT variables related to a degree of indirectness
Torrance (1965b)	1st-6th	Application of princ. (respectful of questions, ideas, etc.)	Critical incidents of creative classroom behavior
Torrance (1965b)	Kg.-6th	Inservice on rewarding creative beh.	12 of 44 TTCT in favor of Exp.
Torrance (1965b)	Kg.-6th	Torrance Creative Motivation Scale of teachers	TTCT variables for K-3; creative writing, 4-6
Torrance (1969ade, 1970d)	Kg.	Dyads and alone	TTCT originality

Table Eight (continued).

Investigator	Grade Level	Nature of Treatment	Significant (.05) Differences
Torrance (1969b)	Kg.	Dyads, alone, class	Greater willingness to try diff. in dyads
Weber (1967)	4th	Indirectness of control in first 3 years and 4th	TTCT verbal var. under indirect first 3 yrs.; TTCT figural elab. in 4th
Werner (1972)	1st-6th	Minicourse	No differences on TTCT
Wodtke (1963); Wodtke & Wallen (1965)	2nd-5th	High and low controlling teachers	Low controlling; TTCT verbal measures in 4; high controlling; TTCT elab. in 5th

Table Nine.

Summary of experiments involving motivation to facilitate creative thinking.*

Investigator	Grade Level	Nature of Treatment	Significant (.05) Differences
Chung (1968)	5th	Achievement-ego motiv. vs. task-reward motiv.	Task-reward raised TTCT fluency and flexibility
Raina (1968)	9th	Competition, prizes	TTCT variables
Raina & Chaturvedi (1968)	HS	Competition, prizes	TTCT variables
Torrance (1965b)	6th	Reward for originality vs. correctness	Reward for originality resulted in more original stories
Torrance (1965b)	6th	Reward for fluency vs. originality	Reward for originality resulted in more original ideas
Torrance (1965b)	1st-6th	Competition vs. practice	TTCT flu., 1, 3, 4 TTCT flx., 2, 4 TTCT orig., 2, 3, 6
Torrance (1965b)	1st-6th	Peer critical vs. peer creative evaluation	23 of 56 differences on TTCT figural
Torrance (1965b)	Kg.-6th	Unevaluated practice vs. evaluated practice	53 of 84 differences on TTCT figural
Torrance (1965b)	3rd-6th	Publication of creative writing in magazine	9 of 12 measures of creative writing
Turknett (1971)	Kg., 2nd, 4th	Group vs. individual reward	No differences, TTCT
Ward, Kogan, Pankove (1970)	5th	Reward for production of ideas immediate and delayed	Fluency higher on Wallach tasks

Table Ten.

Summary of experiments involving testing conditions.*

Investigator	Grade Level	Nature of Treatment	Significant (.05) Differences
Aliotti (1969)	1st Disad.	Movement and verbal warm up day prior to testing	TTCT differences not significant
Boersma & O'Bryan (1968)	4th	Standard vs. relaxed	Relaxed: TTCT
Elkind et al. (1970)	5-12 yrs.	Interruption of interesting vs. uninteresting task	Uninteresting Wallach-Kogan variables
Feldhusen et al. (1971)	5th, 8th	Standard, incubation take home, game-like	Highest TTCTr's with ach. on Standard and lowest on game-like
Harper & Powell (1971)	1st-3rd	Absolute music vs. program music	Absolute music, TTCT
Khatena (1971b)	10th 12th	Variations in time limits for response	Increased time for incubation, increased originality, TTCT
Kogan & Morgan (1969)	5th	Test-like and game-like (timed)	Game-like, higher fluency and unique responses Wallach tests
Mohan (1970)	4th	Cue rich and cue poor testing room	TTCT variables; helped high creatives more than lows
Nash (1971)	1st Disad.	Warm-up immediately prior to testing	TTCT figural
Norton (1971)	6th	Music	No significant differences TTCT
Roweton & Spencer (1972)	Inter-mediate	Practice	Significant effect only on Figural A, TTCT
Torrance (1969a)	6th Gifted	Take home after timed administration	Take home more valid for teacher curiosity nominations, TTCT
Towell (1972)	4th	Untimed	No significant increment, TTCT
Van Mondfrans et al. (1971)	5th 8th	Standard, incubation, take home, game-like	Standard, highest verbal means; take home, scores that fit best concept of creativity as unitary factor orthogonal to intell., TTCT
Ward (1969a)	Nurs.	Cul-poor, cue-rich environment	No significant environment effect Wallach-Kogan measures
Ward (1969b)	7-8 yrs.	Successive time periods	Increased uncommonness with time.

copying, getting unauthorized help, losing booklets, and the like. (Many schools will not even permit children to take home their textbooks.) Scoring problems are also compounded by the fact that some children produce such a large number of responses that the scoring task becomes quite time-consuming.

Summary

An effort has been made to summarize the results of 142 studies designed to test approaches to teaching children to think creatively. Though most of these studies use performances on tests of creative thinking and other creative school performances as criteria, it is contended that the evidence provided by these studies provides useful guidance to educators.

The most frequently reported types of experiments are those that emphasize teacher-classroom variables, complex programs involving packages of materials, and modifications of the Osborn-Parnes training program in creative problem solving. Those having the highest percentages of success in teaching children to think creatively are those that emphasize the Osborn-Parnes training program, other disciplined approaches, the creative arts, and media-oriented programs.

In answer to the question posed by the title of this paper, it does indeed seem possible to teach children to think creatively. The most successful approaches seem to be those that involve both cognitive and emotional functioning, provide adequate structure and motivation, and give opportunities for involvement, practice, and interaction with teachers and other children. Motivating and facilitating conditions certainly make a difference in creative functioning but differences seem to be greatest and most predictable when deliberate teaching is involved.

Footnote

*References for tables can be located in the original publication of this article, *The Journal of Creative Behavior (1972), (6),* 114-143.

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PART TWO: Recent Trends in Teaching Children and Adults to Think Creatively

The foregoing paper (Torrance, 1972) was prepared in 1972. Mostly, I made an attempt to include all studies in which an attempt was made to teach children to think creatively. It will be noted that almost no study had been done before 1960. I (Torrance, 1986) conducted another study in which I attempted to locate all the studies with elementary and secondary children and also included 76 studies involving college students and adults. It was found that

the pace of this type of research had continued unabated. However, some new trends emerged in the type of treatment and in the criteria used for evaluating the outcomes. This paper will emphasize these changes.

Training for Creativity Skills as Seen in 1983

In spite of massive evidence, there are continuous and vigorous oppositions to attempts to train children and adults in creativity skills (Keating, 1980; Mansfield & Busse, 1981; Stanley, 1980). There were still arguments that creative problem solving skills cannot be taught. The time devoted to the teaching of the skills tended to decline and there existed a failure to master the basics, and the hundreds of experiments demonstrated that the efforts lacked validity and had methodological flaws.

In 1983, I examined 166 experimental studies at the elementary and secondary level and 76 at the college and adult level conducted since the 1972 survey.

Table One presents a survey of successes in teaching students to think creatively according to the type of training procedure for the 166 elementary and secondary studies since the 1972 survey and compares these results with those revealed by the 1972 survey.

Although there are fewer studies in the 1983 survey than in the 1972 survey using the Osborn-Parnes Creative Problem Solving procedure, the percentage of successes continues to be higher than for other categories of experimental intervention. However, this is somewhat misleading as many of the other types of training programs rely upon the Osborn-Parnes procedures as a general system and combine it with other strategies. The difficulty may be that these procedures are not taught well enough and practiced, weakening the effects. In 1983, there was a big increase in the number of studies using other disciplined approaches (from 5 to 22). However, there seems to be little or no tendency in these experimental studies to embrace such disciplined procedures as Synectics, Edward deBono's Lateral Thinking, and the Japanese procedures such as the "KJ" and "NM" methods. Instead, the experimenters tend to devise their own disciplined procedures.

Table One.

Summary of successes in teaching students to think creatively according to type of intervention prior to and after 1972.

Type of Intervention	No. Studies		No. Success		Percent Success	
	1972	1983	1972	1983	1972	1983
Osborn-Parnes CPS or modification	22	7	20.0	6.2	91	88
Other disciplined CPS procedures	5	22	4.6	16.2	92	73
Complex programs involving packages	25	31	18.0	18.7	72	60
Complex programs involving combination of strategies	—	15	—	11.5	—	77
Creative arts as vehicles	18	18	14.5	13.1	81	73
Media and reading programs	10	3	7.8	1.25	78	42
Curricular and administrative arr.	8	5	4.0	2.7	50	54
Teacher classroom variables	26	14	14.4	8.8	55	63
Motivation, reward, competition	12	6	8.0	3.5	67	58
Facilitating testing conditions	16	20	11.0	14.1	69	70
Affective education programs	—	13	—	10.3	—	79
Altered awareness	—	6	—	4.0	—	67
Other conditions	—	6	—	2.8	—	47
Total	142	166	102.3	112.6	72	68

The popularity of complex programs involving packages of materials continued but the percentage of successes for these dropped somewhat (from 72 to 60%). However, a new category of complex programing involving a combination of strategies emerged and the record of successes of these experiments was fairly high (77% in 15 studies). The use of the arts (drama, music, visual arts, etc.) continued to be fairly common (18 both in 1972 and 1983). The use of media and reading programs to teach creative thinking skills declined both in number and percentage of successes (from 10 to 3 studies and from 78 to 42%). The use of curricular and administrative arrangements and teacher-classroom variables remained at about the same number and level of success, as did facilitating testing conditions and the use of motivation, reward, and competition. In addition to complex programs involving combination of strategies, two other categories emerged: affective education programs and altered awareness such as meditation, fantasy, and imagery training. The affective education programs showed a success rate of 70% and the altered awareness treatments showed one of 67%.

Table Two presents a comparison of all of the elementary and secondary studies (both the 1972 and 1983 surveys) with the college and adult studies in the present survey.

There are striking differences between the elementary/secondary and college/adult studies both in type of training and in percentage of successes. As a whole, the college/adult training was somewhat more successful than the elementary/secondary training (86% compared to 70%). Especially striking is the lack of college/adult studies using complex programs involving packages of curriculum materials; media and reading; curricular and administrative arrangements; teacher/classroom variables; motivation, reward, and competition. There were also few college/adult studies involving the creative arts, and effective education programs. The most frequently used intervention at the college/adult level was the use of complex programs involving several strategies. In many cases these were courses in creative thinking or regular subject matter courses taught by creative procedures. Also, there were proportionately more studies at the college/adult level using mediation, fantasy, and other altered awareness procedures than at the elementary/secondary level. Interestingly, however, there was an absence

Table Two.

Comparison of successes of different approaches to teaching creative thinking at the elementary/high school and college/adult levels.

Type of Intervention	No. Studies		No. Successes		Percentage	
	Elem/HS	Adults	Elem/HS	Adults	Elem/HS	Adults
Osborn-Parnes CPS & modifications	29	17	26.2	15.0	90	88
Other disciplined CPS procedures	27	11	20.8	10.9	77	99
Complex programs involving packages	56	2	36.7	1.7	66	85
Complex programs combining strategies	15	26	11.5	22.7	77	87
Creative arts as vehicles	36	4	27.6	2.9	77	72
Media and reading	13	0	10.1	—	78	—
Curricular and administrative arr.	13	0	6.7	—	52	—
Teacher-classroom variables	40	0	23.2	—	58	—
Motivation, reward, competition	18	0	11.5	—	64	—
Facilitating testing conditions	36	0	25.1	—	70	—
Affective educational programs	13	2	10.3	—	79	85
Altered awareness	6	7	4.0	5.2	67	74
Other conditions	6	7	2.8	6.8	47	97
Total	308	76	214.9	65.2	70	86

of discussion about the appropriateness of these methods at the elementary/secondary level. However, the author is personally aware of studies of this nature at the elementary school level that were aborted on account of agitation by community pressure groups.

Although, there seems to be a general trend for the emergence of affective and altered state procedures, most of the training methods are highly cognitive in their approach. For example, Robert Meeker (1979) used the Structure of Intellect (SOI) Model for a training program with gifted children in grades 3-6 with pre and posttesting and experimental and control groups. The experimental groups showed statistically significant gains greater than the controls on the SOI tests of creativity. This experimental design and the results characterize a majority of the studies reported during the past decade. A new trend that seems to be emerging is the possible superiority of well-planned training programs involving music and imagery (Lowery, 1982), creative writing (Coleman, 1982), consciousness raising (Gourley, Kelly, & Zucca, 1977), practice in environmental scanning (Friedman, Raymond, & Feldhusen, 1978) and other procedures for helping students tap into their higher levels of consciousness. From the results reported in recent years, there are indications that some of these technologies for tapping into higher levels of consciousness may be at least as effective as the teaching of deliberate, systematic procedures of creative problem solving.

There has been a continuing debate as to whether creative thinking skills should be taught directly and through courses separate from the rest of the curriculum. Edward deBono (1975, 1983) has been the leading advocate of the direct teaching of creative thinking skills (or "lateral thinking" as he calls it). His instructional materials have been rather widely adopted in England, Australia, Ireland, and Venezuela. In fact, he (deBono, 1978) reported that 106,000 teachers in Venezuela were trained to use his program and every school child takes a course in thinking skills (2 hours of direct instruction per week). He defended the reduction in time spent in teaching information in order to focus on the direct teaching of thinking.

For some time, deBono (1969, 1983) has attacked the fallacy that we do not need to do anything specific to help highly intelligent individuals learn how to think. He also contended that many highly intelligent people are rather ineffective thinkers. From time to time, research in gifted education has indicated that intellectually gifted students are actually poorer problem solvers than average ability students. With increased attention to the teaching of thinking skills in gifted education, it might be expected that these findings would be outdated. However, in 1982, Ludlow and Woodrum reported a study that indicates that the teaching of thinking skills in gifted education has not been very pervasive. With 20 gifted learners and 20 average learners matched for age and sex, they found that the average learners used significantly more advanced thinking strategies than the gifted learners when continued access to feedback was permitted. The gifted learners demonstrated superior performance on problems involving memory and attention but not on measures of performance efficiency and strategy selection. Gifted education literature is replete with suggestions for teaching creative problem-solving skills to gifted children and with descriptions of program materials that have been used successfully for this purpose. Some of the more promising suggestions have been offered by Brown (1983); Callahan (1978); Davis (1971); Dirkes (1977); Firestien and Treffinger (1983); Foster (1979); Khatena (1978); Kopelman, Galasso, and Strom (1977); Shibles (1979); Torrance (1979); Treffinger (1980a, b); and Wilson, Greer, and Johnson (1973). Much new material for facilitating creative thinking has emerged during the past decade (Callahan & Renzulli, 1977; deBono, 1975, 1976; Macaranas, 1982; Manning & Brown, 1979; Myers & Torrance, 1984; Renzulli, 1973).

Two national/international curriculum and interscholastic competition projects emerged during this decade and did much to introduce and give practice in creative thinking skills in gifted education, the Future Problem Solving Program (Crabbe, 1982; Torrance, 1980) and Olympics of the Mind (Gourley, 1981). Currently, it is estimated that over 150,000 gifted

students participate each year in each of these programs in the United States alone. Considerable international interest has been aroused by both of these programs.

The Future Problem Solving Program was founded in 1974 by E. Paul and Pansy Torrance (Crabbe, 1982; Torrance & Torrance, 1978) with the goals of helping gifted students to:

1. Develop richer images of the future
2. Become more creative in their thinking
3. Develop and increase their communication skills, both oral and written
4. Develop and increase their teamwork skills
5. Integrate a problem solving model into their lives
6. Develop and increase their research skills

Each year, program participants suggest topics for the next year. These suggestions are then combined into a ballot which is submitted to all participants and the five topics receiving the largest number of votes are selected for study. Three of them become topics of the practice problems for which professional feedback is given; one is used for the state bowls, and the other is used for the national/international bowl. These five problems provide the solid substantive core for the year's program and changes each year. The Osborn-Parnes Creative Problem Solving Model was chosen for use in the program. The national organization also sponsors a scenario writing program each year, an advanced program in which teams study problems submitted by cooperating government and community agencies, corporations, and the like. Some states include community involvement and visual arts programs.

The Olympics of the Mind program was founded by Samuel Micklus and Theodore Gourley at Glassboro State College in New Jersey and had its debut in May 1978 with 28 New Jersey schools participating. This program was designed for highly creative students capable of developing unusual ideas and insights. Identification is based on the sport's tryout method and evaluation is based on the performances of the participants. The program appeals especially to students gifted in industrial design, but also has places for students gifted in creative writing, acting, leadership, and other creative expressive and problem-solving skills. Like the Future Problem Solving Program, this program spread rapidly to include students from all 50 states of the USA, many Canadian provinces, and several countries overseas. For the World Competition, both long-term and spontaneous problems are used. Long-term problems are given to participants (who work as a team) in advance of local, district, state or world competition. This affords teams time to prepare their own creative solutions to the problems. Spontaneous problems are given to the teams on the day of the competitions to challenge their ability to think "on their feet." The apparent success of this program demonstrated that the varsity sports model can be used to develop other types of gifted programs.

Throughout creativity research, various criteria have been used to judge, analyze, criticize and augment creativity behaviors. These behaviors can involve divergent thinking and/or ideational fluency.

Table Three gives an analysis of the kinds of criteria used in the 166 elementary/secondary and 76 college/adult studies examined. These data indicate that there is still a tendency to use psychometric measures such as divergent thinking or creative thinking scores to evaluate these studies. However, there is also considerable evidence of the use of more "real life" creativity indicators, such as the evaluation of creative products, creative behavior, and creative self-perceptions. This is especially true of the college/adult studies where earning money creatively, indicators of increased health and feelings of well-being, increased profits, and medical treatment techniques were among the criteria. Increased use of these more realistic criteria should help counteract common criticisms of creativity training research concerning the exclusive use of divergent thinking or creativity tests.

To get a better understanding of the nature of criteria other than scores on divergent thinking or creativity tests, the author examined the specific nature of the indicators used.

Table Three.

Frequencies and percentages of each type of criteria was used in the elementary/secondary and college/adult studies of effectiveness of creativity training.

Category or Subcategory of Criteria	Elem./Secondary Number	Elem./Secondary Percent	College/Adult Number	College/Adult Percent
Psychometric Criteria:				
TTCT (Torrance Tests)	126	76	29	39
SOI (Guilford Tests)	9	5	11	15
Other tests, including author-developed	38	23	21	28
Non-psychometric Criteria:				
Creative Products	6	4	8	11
Creative Behavior	14	8	28	37
Creative self-perception (self evaluation, satisfaction, attitudes, etc.)	6	4	21	28

The following are examples of some of these indicators found in the elementary/secondary studies:

1. Various kinds of expressions of increased satisfaction.
2. Evidences that the promotion of creative performances does not detract from academic achievement.
3. Subjects produced more types of creative writing.
4. Personality growth and healthier self concepts.
5. Student wrote a novel.
6. Students showed better attitude toward mathematics.
7. Self questionnaires, blind judging of drawings for creativity, direct observations of behavior, and personal interviews.
8. Socio-emotional changes resulting from the creative curriculum of Developmental Therapy.
9. Making decisions to follow creative alternatives.

As might be expected, the types of non-psychometric criteria used in the college/adult studies are far more varied than those used in the elementary-secondary ones. The following are examples of what might be called "bottom line" criteria reported in the adult studies:

1. A 5-year followup revealed a $60 per man/hour profit on time spent on Creative Problem Solving training (10,000 hours).
2. A physician was trained in Creative Problem Solving and now uses the techniques with his patients.
3. The use of specific methods designed to increase certain creative abilities resulted in increases in knowledge of course subject matter.
4. A course required students to write a "creativity policy" for an organization, plan 50 staff meetings, and earn $100 in a creative way. These were used as the basis for evaluating the effectiveness of the training.

The following are examples of task outcomes used as criteria for evaluating the effectiveness of college/adult creativity training:

1. Observed improvements in the dynamics of groups in performing tasks.
2. Evaluation of product creativity for novelty, resolution, elaboration, and synthesis.

3. Aphasia patients were given "divergent thinking therapy" and observed for improvement in speech.
4. After a workshop, author observed indicators of increased humanization of a school and creative productivity of the teachers.
5. Creative art or handicraft, creative writing, ideas for two inventions, and ideas for creative teaching methods.
6. Subjects performed better in coping with "real life" situational tests and were generally more productive.

The following kinds of criteria resulted from questionnaires and interviews:

1. A sample of elderly people in a creative art project reported improved health, increased sociability, greater activity and participation in creative activities other than art, etc.
2. After a creativity workshop, participants expressed more positive attitudes about their creativity and their confidence in fostering creativity.
3. Workshop participants rated themselves on "creativity traits" and "leadership traits."
4. Assessment was made of creative problem solving problem programs of the creativity workshop participants.
5. Student logs and self-evaluation following a creativity course.

The following multi-level criteria were reported in college/adult studies:

1. Samples of autobiographical writing, observation of the subject's behavior, and self-evaluations.
2. A post-workshop evaluation was used to assess changes in the actual behavior of the participants.
3. Subjects engaged in meditation training were evaluated on a criterion reference basis for heightened consciousness, perceived changes, invention, unusual visualization, humor, and fantasy.
4. Graduates of a nursing program were evaluated by employers and self-evaluated.

The following are examples of non-psychometric instruments used in assessing the effectiveness of creativity training:

1. Projective style device used to see if students identified with creativity symbols.
2. Students' artistic drawings were evaluated by judges.
3. Writing assignments were rated for creativity.
4. A comparison of the number of alternatives the subjects were able to generate before and after the training.
5. Creative Life Line Curve, self-perceived creative production across the life span.

Trends in Creativity Training Since 1983

A more thorough survey has been made of the studies conducted since 1983 as well as a larger number of studies involving college students and adults before 1983. While I have not yet completed any detailed and systematic analysis of the changes reflected by these studies, certain trends are apparent. I shall summarize these briefly.

1. *Increased attention to specific creative problem solving skills.*

Although some attention has been given to the development of specific creativity thinking skills prior to 1983, there seems to be an increase of such. Guilford (1959) and Torrance (1966) identified problem finding as an important thinking ability and included tests of it in their batteries. Getzels and Csikzentmihalyi (1976) identified it as important to creative perfor-

mance. However, it was not until later that studies involving training in problem finding appeared. A number of such studies have been conducted. For example: Basadur, Graen and Green (1982) conducted a study of effects ideation, problem finding and the solutions of problems of research in an industrial organization. They found that the problem finding and idea productions training resulted in significant systematic measures of effects both immediately after training and two weeks later. The results also suggest that the ideation trained and problem finding trained produced different results.

Another example is a study by Stratton and Brown (1972) who conducted a study emphasizing training in production and the judgment of solutions. They found that the production trained increased productivity but decreased quality.

All in all this line of research seems to indicate need for training and practice in each of the phases of the creative solving process.

2. *Cognitive theory emphasis*

For a considerable period of time cognitive theorists showed little interest in creative problem solving. However, in recent years we see quite a flurry of interest among cognitive theorists in creative problem solving. In a 1984 review, Norman Frederiksen reviewed quite a number of studies and theorists and their suggestions regarding how to teach creative problem solving. He shows how these suggestions are similar and different from the suggestions coming from creativity research itself. The cognitive theorists give attention to such concepts as information processing, the structure of problems, the elements in problem solving process, problem solving procedures, and pattern recognition. There has recently been a number of textbooks covering these concepts. For instance, Anderson (1982); Neves and Anderson (1981) describe in detail a theory about the acquisition of problem solving expertise. There also have appeared a number of courses on problem solving representing the cognitive approach. For instance, Rubenstein (1980); Larkin and Reif (1976); Elstein, Shulman and Sprafka (1978) work in this area. Frederiksen summarized these suggestions of cognitive psychology for instruction as follows:

1. Teach cognitive processes
2. Teach development of problem structure
3. Teach pattern recognition
4. Teach problem solving procedures
5. Teach knowledge base
6. Teach development of knowledge structures
7. Teach aptitude
8. Provide practice with feedback
9. Use models in instruction

3. *Guided fantasy and guided imagery*

Although guided fantasy and guided imagery have been mentioned as important in creative problem solving by numerous writers, it has only been recently that we have had any experiments on the efficacy on creative problem solving. Hershey and Kearns (1979) reported an experiment on the effects of guided fantasy on creative writing ability. They compared groups having guided fantasy sessions with groups having relaxation training. They found that the guided fantasy group achieved significantly better than the relaxation group on flexibility, fluency and originality of the Torrance Tests of creative training.

Khatena (1984) conducted a number of studies which demonstrated the positive effects of creative imagination imagery on creative problem solving. He also discusses the rationale training procedures and the measurement of creativity imagination imagery.

4. *Thematic fantasy play and the use of games*

There has been an increasing number of studies, mostly with preschool children, involving training for thematic fantasy play and games. Saltz and Johnson (1973) report a study of training in the fantasy play with disadvantaged children. They found a more frequent occurrence of dramatic play in their everyday activity and an increase in I.Q.

Robert D. Strom (1981) devised training programs in toy talk for use by parents, grandparents, babysitters and preschool teachers. He and his students have shown rather consistently positive results in the development of creativity as a result of toy talk.

These two lines of investigations are examples of thematic fantasy play and the use of games.

5. *Training in creative writing to improve creative thinking*

There has also been an increase in studies in creative writing as a way of improving performance in creative problem solving. Flowers and Hayes (1977) report one such study. They taught problem solving strategies and practiced these strategies in the creative writing process. They see writing as a form of problem solving.

Harmon (1976) reported a study of the influences of exploratory writing experiences on creative thinking with third grade children using the verbal form of the Torrance Test of Creative Thinking. They found significant gains on fluency, flexibility and originality for the experimental groups over the control groups.

Hilgers (1980) reported an experiment involving training college composition students in the use of free writing and problem solving for the rhetorical invention. Significant differences were found on the writing proficiency, the observation of ideas and observance of writing conventions. Their results suggest that free writing deserves serious attention from researchers and the applicability of problem solving techniques in the teaching of composition at the college level.

6. *The influences of the Quality Circles Movement*

Although the Quality Circles idea in the United States is rather old, the Quality Circles Movement in industry and education in the United States is very recent. It became a national program in Japan and was imported from Japan by American industry. It has therefore introduced into creativity research some of the Japanese creative problem solving methods. While it resembles the Osborn-Parnes procedure it is somewhat more structured and designed to bring into play the intuitive abilities. They have also been able to bring into research creative problem solving with real problems and real criteria. They have refined the process and set measureable goals. They have been able in many instances to spell out the conditions for excellence. The work of the Quality Circles has also been characterized by the future orientation of problem solving and planning. The Quality Circles have made participative management meaningful. Examples of these studies are: Alexander (1984); Hodgetts and Fountain (1983); and Ryan (1983).

7. *Multiple Criteria*

Creativity research of the past has been rather consistently criticized for using artificial criteria. The Quality Circle Movement has introduced realistic criteria such as:

1. Amount of money saved
2. Amount of money made
3. Absentee rate
4. Amount of time saved

5. Number of accidents occurring
6. Quality of the product

Examples of these studies include Kleinberg (1981); Mroczkowski (1984); Pascarella (1981); and Shaw (1981).

With this impetus from Quality Circles in industry, researchers have been able to invent more realistic criteria, as seen in the foregoing section.

Conclusion

A thorough and detailed analysis of studies on creative problem solving training reflects the growing maturity of research and practice in the area. We shall still have studies as primitive as the early ones we had in the 1940's and 1950's, somewhat more mature ones as in the 1960's but we will have more of the diverse ones found in the 1970's and 1980's. The field will remain a challenge and one with many unanswered questions but greater enlightment.

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