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E. PAUL TORRANCE

Scientific Views of Creativity and Factors Affecting its Growth

Definitions of Creativity

IF CREATIVITY and its growth are to be viewed scientifically, creativity must be defined in a way that permits objective observation and measurement and is compatible with common and historical usage. At the time I began a program of research concerned with factors affecting creative growth, I was unable to find such a definition for which there was any sort of consensus.

Some definitions are formulated in terms of a product (invention and discovery, for example); others, in terms of a process, a kind of person, or a set of conditions. The production of something new (to the individual or to the culture) is included in almost all of these definitions. Some writers have defined creativity as being different from conformity and as requiring non-habitual rather than habitual behavior. Some specify that creative contributions must be true, generalizable, and surprising in view of what existed at the time of the discovery. Some scholars insist that the term "creative" be reserved for very rare and particularized kinds of ability, while others apply the term to a general creative ability possessed to some degree by all essentially healthy individuals. Others have suggested that we think in terms of different levels of creativity, ranging from simple expressive creativity, where skills and the quality of the product are unimportant, as in the spontaneous drawings of children, to a kind of creativity that is manifested in an entirely new principle or assumption around which completely new developments flourish.

On the basis of an analysis of the diverse ways of defining creativity and what I consider the requirements of a definition for keeping a program of research on factors affecting creative growth in context, I defined creativity as the process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, disharmonies, and so on; identifying the difficulty; searching for solu-

tions, making guesses, or formulating hypotheses about the deficiencies; testing and retesting these hypotheses and possibly modifying and retesting them; and finally communicating the results. This definition describes a natural human process. Strong human needs are involved at each stage. If we sense some incompleteness or disharmony, tension is aroused. We are uncomfortable and want to relieve the tension. Since habitual ways of behaving are inadequate, we begin trying to avoid the commonplace and obvious (but incorrect) solutions by investigating, diagnosing, manipulating, and making guesses or estimates. Until the guesses or hypotheses have been tested, modified, and retested, we are still uncomfortable. The tension is unrelieved, however, until we tell somebody of our discovery.

There are many other reasons for favoring this definition. It enables us to begin defining operationally the kinds of abilities, mental functioning, and personality characteristics that facilitate or inhibit the process. It provides an approach for specifying the kinds of products that result from the process, the kinds of persons who can engage most successfully in the process, and the conditions that facilitate the process. The definition also seems to be in harmony with historical usage and equally applicable in scientific, literary, dramatic, and interpersonal creativity. Some scholars, however, disagree with my definition, and I shall review a few of their objections.

Ausubel¹ objects to the definition on the grounds that it does not distinguish between creativity as a highly particularized and substantive capacity and as a generalized constellation of intellectual abilities, personality variables, and problem-solving traits. He states that he does not deny the existence of general creative abilities but that such abilities do not constitute the essence of creativity. When one tries to spell out the abilities involved in the creative process as I have defined it, he obtains what Ausubel refers to as "a generalized constellation of intellectual abilities, personality variables, and problem-solving traits." This does not mean that this constellation constitutes the essence of even the process as I have defined it. A high degree of these abilities (usually designated as fluency, flexibility, originality, and ability to sense deficiencies, elaborate, and redefine) does not guarantee that the possessor will behave in a highly creative manner. A high level of these abilities, however, increases a person's chances of behaving creatively, and I believe that the validation studies to be summarized later support this contention.

There is considerable historical precedent for referring to crea-

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tive abilities and tendencies as “a constellation of general abilities, personality variables, and problem-solving traits,” rather than as a particularized and substantive capacity. Numerous scholars of the past have referred to creativity as a constellation of generalized abilities that may be manifested in particular ways depending upon interests, sensory deficiencies or acuities, and opportunity. For example, Burnham in 1892 pointed out that since Kant’s *Critique of Pure Reason* it has been customary to distinguish between reproductive imagination and creative productive imagination. There was a recognition that the mental abilities involved in remembering and reproducing information are different from those brought into play in recombining original impressions to produce new wholes. It is especially interesting that Burnham² saw creative imagination as limited by reproductive imagination but as varying in degree rather than in kind. It was the reproductive imagination or memory that is particularized, according to him. He also maintained that “all children, unless they be idiots, have productive or creative imagination in some measure.”

There are also objections³ that I have no right to use the term “creative” outside such fields as art, music, and writing. Kreuter and Kreuter charge that the orientation of my work has clearly been toward the recognition and development of scientific creativity and that even my definition shows this concern. My research associates have included artists, musicians, creative writers, philosophers, theologians, psychologists, sociologists, and anthropologists, and we have contributed to the professional literature in these and other fields. In our experimental work, we have actually included more activities related to art, creative writing, creative dance, and creative music than to science. Whenever I have talked with creative artists and writers about what happens to them when they are engaged in the creative process and how they guide the creative behavior of their students, the definition I have given seems to fit their creativity as well as it does that of the creative scientist.

Scientific investigators during the early part of this century generally championed the concept of a non-particularized, content-free mental creativity. Spearman, for example, asserted that “the power of the human mind to create new content—by transferring relations and thereby generating new correlates—extends its sphere not only to representation of ideas, but also to fully sensuous presentations, such as are given in ordinary seeing, hearing, touching, and the like, of every one of us.”⁴

Simpson⁵ advanced similar arguments in connection with his test of creative imagination. He defined creative ability as the initiative that one manifests by his power to break away from the usual sequence of thought. He believed that we should be concerned with identifying the searching, combining, synthetic type of mind and argued, as I have, that we should add tests of creative thinking ability to traditional tests of intelligence. He pointed out that intelligence tests call for reproductive kinds of abilities and do not evaluate what he termed "a vital creative energy." Noting that his test deals primarily with a visual imagery stimulus to creative action, Simpson conceded that some people would probably respond more creatively to an auditory stimulus. He argued, however, that in his test one gets an image of some object that he wishes to draw, but that the whole thinking process is involved in forming this image or association of neurograms. He held that visual imagery usually expands into scraps of kinesthesias, auditory imagery, and personal, organic, or verbal references.

Another objection to my definition of creativity is that it does not distinguish between creativity or creative problem-solving and other types of problem-solving. Some have maintained that it equates creativity with all thinking. It is one of the limitations of a brief verbal definition that there must be implicit distinctions and that only a few distinctions can be made explicit. Certainly implicit in my definition are the distinctions usually made by other scholars between creative thinking and problem-solving. Generally, creative thinking has been treated as one special kind of problem-solving. Newell, Shaw, and Simon state that problem-solving may be called creative "to the extent that one or more of the following conditions are satisfied:

1. The product of the thinking has novelty and value (either for the thinker or for his culture).
2. The thinking is unconventional, in a sense that it requires modification or rejection of previously accepted ideas.
3. The thinking requires high motivation and persistence, taking place either over a considerable span of time (continuously or intermittently) or at high intensity.
4. The problem as initially posed was vague and undefined, so that part of the task was to formulate the problem itself."⁶

Identifying Creative Ability or Potential

If one accepts the definition of creativity that I have offered, it becomes possible to recognize creative behavior, creative thinking abilities, and creative potential both through test and non-test procedures. How it is done will depend in large degree upon the reasons for wanting to recognize creativity, who is attempting to do so, and what professional resources are available. From the standpoint of the teacher and counselor, it would seem important to recognize those kinds of potential that make a difference in the way persons should be taught and guided. A major reason for my interest in developing measures of the creative thinking abilities is that I believe that such instruments can provide one useful basis for making instruction different for different students. Since abilities constitute, at least to some extent, the basis of needs and motivations, knowledge about a person's creative thinking abilities frequently provides clues about differential preferences for ways of learning.

The history of the development of tests of creative thinking, creative imagination, originality, and the like is a long and interesting one.⁷ Although there has been a variety of promising developments extending over at least the past seventy-five years, there has been so little sustained interest and support for them that there is not yet on the market a standardized battery of tests of creative thinking. During the past few years, Guilford⁸ has begun to make available through commercial channels some of his tests of divergent thinking, but it is not yet certain how low on the educational ladder these can be extended. Drawing upon Guilford's work for clues concerning task dimensions and scoring criteria, my associates and I believe that we are approaching a point where we can make available for experimental use alternate batteries of tests for use from kindergarten through graduate school.

These tests represent one rather sharp departure from the factor-type tests developed by Guilford and his associates. We made deliberate attempts to construct test tasks that would be models of the creative process, each involving different kinds of thinking and each contributing something unique to the batteries under development. Test tasks are thus fairly complex and have features that make use of what we know about the nature of the creative thinking processes, the qualities of creative products, and creative personalities.

Even a minimal description of the test tasks in these batteries, their objectives, and the results accruing from their use would re-

quire many times the space allotted to this paper. A brief description of some of the test tasks, their administration, and scoring, however, should show how the tests are related to the definition already offered and to the factors that affect creative growth.

One of the clearest and most straightforward models is found in the Ask-and-Guess Test of which there are several forms. In all forms, subjects are shown a picture (Mother Goose prints for children and certain professional groups, pictures similar to those used in the Thematic Apperception Test for nurses, a picture of boys starting a small business for salesmen, and so forth) and given the following series of instructions:

The next three tasks will give you a chance to see how good you are at asking questions to find out things that you do not know and in making guesses about possible causes and consequences of events. Look at the picture. What is happening? What can you tell for sure? What do you need to know to understand what is happening, what caused it to happen, and what will be the result?

Young children are asked to dictate their responses to an adult and older children and adults are asked to write theirs. In the written version, the following instructions are given for the first of the three tasks:

On this page, write out all of the questions you can think of about the picture on the page before this one. Ask all of the questions you would need to know for sure what is happening. Do not ask questions that can be answered just by looking at the drawing.

After five minutes, subjects are given the following instructions for the second task (Guessing Causes):

In the spaces below, list as many possible causes as you can of the action shown in the picture. You may use things that might have happened just before the event in the picture or something that happened a long time ago that made the event happen. Make as many guesses as you can. Do not be afraid to guess.

After another five minutes, the following instructions are given for the third task (Guessing Consequences):

In the spaces below, list as many possibilities as you can of what might happen as a result of what is taking place in the picture. You may use things that might happen right afterwards or things that might happen as a result long afterwards in the future. Make as many guesses as you can. Do not be afraid to guess.

The first task is designed to reveal the subject's ability to sense what he cannot find out from looking at the picture and to ask

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questions that will enable him to fill in the gaps in his knowledge. The second and third tasks are designed to reveal the subject's ability to formulate hypotheses concerning cause and effect. The number of relevant responses produced by a subject yields one measure of ideational fluency. The number of shifts in thinking or number of different categories of questions, causes, or consequences gives one measure of flexibility. The statistical infrequency of these questions, causes, or consequences or the extent to which the response represents a mental leap or departure from the obvious and commonplace gives one measure of originality. The detail and specificity incorporated into the questions and hypotheses provide one measure of ability to elaborate.

In another task, subjects are asked to produce unusual or provocative questions about common objects such as tin cans, cardboard boxes, or ice. Subjects are encouraged to ask questions that lead to a variety of different answers and that might arouse interest and curiosity in others concerning the object.

The Product Improvement Task calls for the production of clever, interesting, and unusual ways of changing a toy stuffed animal (for example, a toy dog, monkey, elephant, or kangaroo) so that it will be more interesting for children to play with. The Unusual Uses Test calls for interesting and unusual uses of common objects such as tin cans, cardboard boxes, and books. The Just Suppose Test presents the subject with an improbable situation and asks him to "just suppose" that the situation happened and to think of all of the things that might occur as a result. The improbable situations include such things as:

Just suppose when it was raining all the rain drops stood still in the air and wouldn't move—and they were solid.

Just suppose someone got caught in a big soap bubble and couldn't get out.

Each "Just Suppose" is accompanied by an interesting drawing depicting the improbable situation.

The Imaginative Stories Test calls for writing imaginative stories about animals and people having some divergent characteristic. Subjects are asked to select from one of a set of ten titles such as:

The Flying Monkey.

The Lion That Won't Roar.

The Man Who Cries.

The Woman Who Can But Won't Talk.

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The Sounds and Images Test asks the subject to produce imaginative and original images suggested by each of a series of four sound effects, ranging from a familiar and well-organized sound effect to one consisting of six rather strange and relatively unrelated sounds. The four-sound series is presented three times, and each time the subject is asked to stretch his imagination further.

Each of the tasks is based on a rationale developed from some research finding concerning the nature of the creative process, the creative personality, or the conditions necessary for creative achievement. The tasks are designed to involve as many different aspects of verbal creative functioning as possible. Most of the tasks are evaluated for fluency (number of different relevant ideas), flexibility (number of shifts in thinking or different categories of response), originality (number of statistically infrequent responses that show creative intellectual energy), and elaboration (number of different ideas used in working out the details of an idea).

Although a variety of figural test tasks have been developed, the standardized batteries consist of three tasks, each designed to tap a somewhat different aspect of creative functioning. The Picture Construction Test is accompanied by the following instructions:

At the bottom of this page is a piece of colored paper in the form of a curved shape. Think of a picture or an object in which this form would be an important part. Then lift up the piece of colored paper and stick it wherever you want it on the next page, just like you would a postage stamp. Then add lines with pencil or crayon to make your picture.

Try to think of a picture that no one else will think of. Keep adding new ideas to your first idea to make it tell as interesting and as exciting a story as you can.

When you have completed your picture, think up a name or title for it and write it at the bottom of the page in the space provided. Make your title as clever and unusual as possible. Use it to help tell your story.

This, as well as the other two figural tasks, can be administered at all educational levels from kindergarten to graduate school and to various occupational groups. It is a task to which kindergarteners can respond in groups and one which provides sufficient encouragement to regression to be useful with graduate students and other adults. In each battery a different shape (such as a tear drop or jelly bean) is used as the stimulus object.

The stimulus material for the Figure Completion Test consists of ten incomplete figures and is accompanied by the following instructions:

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By adding lines to figures on this and the next page, you can sketch some interesting objects or pictures. Again, try to think of some picture or object that no one else will think of. Try to make it tell as complete and as interesting a story as you can by adding to and building up your first idea. Make up a title for each of your drawings and write it at the bottom of each block next to the number of the figure.

The Repeated Closed Figures Test consists of two pages of closed figures (circles, squares, triangles, and so on). The instructions for the Circles version of this test are as follows:

In ten minutes see how many objects or pictures you can make from the circles below and on the next page. The circles should be the main part of whatever you make. With pencil or crayon add lines to the circles to complete your picture. You can place marks inside the circles, on the circles, and outside the circles—wherever you want to in order to make your picture. Try to think of things that no one else will think of. Make as many different pictures or objects as you can and put as many ideas as you can in each one. Make them tell as complete and as interesting a story as you can. Add names or titles in the spaces provided.

This triad of test tasks in a sense represents three different aspects of creativity or three different creative tendencies. The Incomplete Figures task calls into play the tendency toward structuring and integrating. The incomplete figures create tension in the beholder who must control this tension long enough to make the mental leap necessary to get away from the obvious and commonplace. Failure to delay gratification usually results in the premature closure of the incomplete figures and an obvious or commonplace response. The invitation to “make the drawing tell a story” is designed to motivate elaboration and the further filling in of gaps. The Circles Test, as well as other closed figures tasks, brings into play the tendency toward disruption of structure in order to create something new. The repetition of a single stimulus requires an ability to return to the same stimulus again and again and perceive it in a different way. The Picture Construction Test sets in motion the tendency toward finding a purpose for something that has no definite purpose and to elaborate it in such a way that the purpose is achieved. Discoveries and their applications may take place in two major ways: (1) there may be deliberate attempts to discover a creative solution to a problem or (2) some discovery may occur and the discoverer sets out to see what problems the discovery will solve. Theoretically, the Picture Construction Test symbolizes the latter.

These tasks tend to discriminate between the good elaborators and the productive original thinkers. Some subjects produce a large number of very original ideas but fail to elaborate any of them very well; some produce very few ideas of any kind but make them very elaborate or "fancy"; still others produce a large number of very commonplace ideas with little elaboration.

Thus, it is seen that we have tried deliberately to base the test stimuli, the test tasks, instructions, and scoring procedures on the best that we know from research about creativity. The same test tasks, in most instances, have been administered at all educational levels. This has made it possible to determine whether or not children and young people identified as "creative" behave in ways similar to the ways in which eminent creative people of the past behaved when they were children and young people. It also enables us to determine whether or not adults identified today as relatively creative on the basis of outside criteria behave in ways that can be called "creative" on the basis of test scores. In general, the evidence has been rather positive in spite of the complexities introduced by problems of motivation, unfavorable conditions, and the difficulties of conducting well-controlled studies. Much of this evidence has been summarized in *Guiding Creative Talent* and in *Rewarding Creative Behavior*.⁹ Only the briefest review is possible here.

In observational studies,¹⁰ we found that children scoring high on tests of creative thinking initiated a larger number of ideas, produced more original ideas, and gave more explanations of the workings of unfamiliar science toys than did their less creative peers when placed in five-person groups. When matched for intelligence, sex, race, and teacher, the most creative children in forty-six classrooms from grades one through six more frequently than their controls had reputations for having wild and fantastic ideas, produced drawings and other products judged to be original, and produced work characterized by humor, playfulness, relative lack of rigidity, and relaxation. Weisberg and Springer¹¹ studied a sample of gifted (high IQ) fourth-grade pupils. In comparison with those who made the lower test scores those who made the higher scores were rated significantly higher on strength of self-image, ease of early recall of life experiences, humor, availability of Oedipal anxiety, and even ego development. On the Rorschach Ink Blots, they showed a tendency toward unconventional responses, unreal percepts, and fanciful and imaginative treatment of the blots. Their performance was described as being both more sensitive and more independent than that of their

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less creative peers. Among sixth-grade children, Fleming and Weintraub¹² found significant negative relationships between the measures of originality, fluency, and flexibility and measures of rigidity. Yamamoto¹³ found correlations of around .50 between creativity test scores and a composite measure of originality based on creative writings.

Studies with adults have also been encouraging. In my own graduate classes, I have found rather consistently that those who achieve high scores on the tests of creative thinking develop original ideas in the content area of the course and make more creative applications of knowledge than do their less creative peers. Hansen and I found that the more creative business education teachers asked more provocative questions, more self-involving questions, and more divergent ones than their less creative peers. Hansen found a number of other significant differences between her high and low creative teachers, showing that the more creative teachers, as identified by the tests, behaved more creatively in the classroom as judged by detailed classroom observations. Blockhus¹⁴ found that the students of the more creative business education teachers showed more growth in originality during a semester than did the pupils of the less creative ones. Sommers¹⁵ found that students carefully identified by college industrial arts instructors as creative scored significantly higher on the tests of creative thinking than did their less creative peers. Wallace¹⁶ found that saleswomen ranking in the upper third on sales in a large department store scored significantly higher on tests of creative thinking than did their peers ranking in the lower third. He also found that the more creative women had tended to gravitate to those departments judged by personnel managers as requiring more creativity. Wallace¹⁷ also found that measures of originality and fluency differentiated the several echelons of personnel in a large national sales organization. The measures of flexibility and elaboration failed to differentiate the highest echelon of sales executives from the lower groups but differentiated within the various lower levels.

Some studies have shown that the measures described herein are positively related to various kinds of school achievement, while others have shown that such measures are unrelated or negatively related to measures of school achievement. A careful examination of these studies suggests that methods of assessing school achievement and methods of instruction may both be important factors in creative growth.

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Bentley¹⁸ found the following set of correlation coefficients for four different measures of achievement in a graduate class of 110 students in educational psychology and a composite measure of creative thinking ability based on a battery of the Minnesota tests and the Miller Analogies Test, an instrument commonly used in graduate school admission procedures:

<i>Achievement Measure</i>	<i>Creativity Miller's</i>	
Recognition (multiple-choice test)	.03	.47
Memory (completion and short-answer test)	.11	.41
Productive Thinking (creative applications)	.53	.37
Evaluation and Judgment (decision making)	.38	.27

If one examines closely the research concerning the interaction between different kinds of abilities and different methods of instruction, an interesting picture unfolds.¹⁹ When knowledge is obtained by authority, a measure of mental age or intelligence is a better predictor of achievement than measures of originality, fluency, and the like. When knowledge is obtained in creative ways, for example by discovery or experimentation, the measures of originality, fluency, and the like seem to be better predictors than scores on intelligence tests. More will be said about these studies in the final section of this paper.

Checklists of activities done on one's own, checklists of creative achievements, biographical or life experience inventories, an inventory of personal-social motivations, a personality checklist, and a variety of other non-aptitude measures also promise to be useful. Other investigators²⁰ have reported promising results from such well-known instruments as Strong's Vocational Interest Blank, the Allport-Vernon-Lindzey Study of Values, the Myers-Briggs Type Indicator, the California Psychological Inventory, the Barron-Welsh Art Scale, the Thematic Apperception Test, and biographical inventories.

Educators need not be dependent upon tests for identifying creative potential among students, even though tests may make them aware of potentialities that would otherwise be missed. Non-test indicators may be obtained both in regular classroom activities and by creating classroom situations especially designed to evoke creative behavior. A great variety of suggestions concerning these non-test indicators has been offered by Taylor,²¹ Torrance,²² and others. One cannot identify even outstanding jumping ability if he depends solely upon observations of how high individuals just happen to jump in ordinary activities. In order to identify persons of outstand-

ing jumping ability, one must create situations that motivate and/or require jumping. The analogy seems appropriate regarding the identification of creative talent.

Factors Affecting Creative Growth

Many complain that we do not yet know enough about the factors affecting creative growth. In my opinion, we have known enough about these factors since the time of Socrates and Plato to do a far better job of creative education than is commonly done. Socrates knew that it was important to ask provocative questions and to encourage natural ways of learning. He knew that it was not enough to ask questions that call only for the reproduction of what has been learned. He knew that thinking is a skill that is developed through practice and that it is important to ask questions that require the learner to do something with what he learns—to evaluate it, produce new ideas from it, and recombine it in new ways. Plato knew that “what is honored in a country will be cultivated there.” He knew that it was important for educators to be aware of the potentialities of students and that potentialities are rarely discovered under a discipline that is excessively harsh and coercive. He said, “Do not train boys to learning by force or harshness; but direct them to it by what amuses their minds, so that you may be the better able to discover with accuracy the peculiar bent of the genius of each.”

Some readers may wonder why I have chosen to place so much emphasis on the identification of creative potentiality and the measurement of what I have called the creative thinking abilities. Scientific studies of factors that affect creative growth require measurement, and the rationale of the test tasks, test task instructions, and methods of assessing or scoring test responses helps to elaborate my definition of creativity and provides a wealth of clues concerning the factors that assess creative growth. More important, however, is the conviction that a teacher must usually recognize creative potentiality in a child or young person before he is willing to permit him to learn in a non-habitual or creative way. On one occasion, I asked a class of two hundred students, including many experienced teachers, to describe some instance in which they had permitted or encouraged a student to learn in a creative way and had then observed that the experience made an important difference in the achievement and behavior of the student. Eighty-two per cent of them were able to recall such an incident, and a content analysis of their responses showed that in eighty-six per cent of the incidents

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the recognition of a creative potentiality was crucial to the teacher's willingness to permit or encourage such activity.

Although there are certainly many gaps in knowledge concerning the factors that affect creative growth, there is a great variety of research findings that give useful guidance. It would be impossible here even to list these findings. I have collected about thirty related studies conducted by my associates and me in *Rewarding Creative Behavior: Experiments in Classroom Creativity*. These studies help to delineate the roles in creative growth of such factors as ways of rewarding creative behavior (for example, by being respectful of unusual and provocative questions and of unusual ideas), creative motivations or attitudes of the teacher, creative activities and opportunities for practicing skills in creative thinking, differential rewards for boys and girls, differential rewards for originality, competition, unevaluated practice, creative rather than critical peer-evaluated practice, evaluative discussions about creative productions, peer pressures in homogeneous and heterogeneous groups, trouble-shooting evaluation, and helping children and young people value their own ideas. Attention is also given to differences in the ways different cultures encourage and discourage characteristics associated with the creative personality.

I am asked frequently if these and other recent studies advance us any further in the direction of a more creative kind of education than did Progressive Education. Some observers even assert that there is no difference between what I have called creative ways of learning and Progressive Education. Progressive Education aroused so much controversy and still engenders such strong negative reactions that the label of Progressive Education is still used to condemn almost all educational innovations. If one examines what we have learned during the ten years since the dissolution of the Progressive Education Association in 1955, it should become evident that it is possible for us to advance beyond the major precepts of Progressive Education and to come closer to achieving the American dream of a kind of education that will give every child a chance to grow and to achieve his potentialities.

It is an oversimplification but it may be said that Progressive Education rested its case on the following six precepts:

1. Individual differences among children must be recognized.
2. We learn best by doing and by having a vital interest in what we are doing.

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3. Education is a continuous reconstruction of living experience that goes beyond the four walls of the classroom.
4. The classroom should be a laboratory for democracy.
5. Social goals, as well as intellectual goals, are important.
6. A child must be taught to think critically rather than to accept blindly.²³

On the basis of what we have learned during recent years about the human mind and its functioning, mental abilities and their development, and the interaction of mental abilities and ways of learning and teaching, all of these precepts seem valid as far as they go, but they do not go far enough. Let us take, for example, the precept that "individual differences among children must be recognized." This precept cannot be of great help unless we know *what* individual differences are important in individualizing instruction and *what* individual differences in mental functioning, motivation, and personality are brought into play in various ways of learning. What we have learned during the past ten years has enabled us to remove some of the uncertainty experienced by educational researchers of the 1920's and 1930's.

We need no longer be puzzled by McConnell's finding in 1934 that mental age as measured by an intelligence test is more highly related to achievement in second-grade arithmetic when taught by authoritative identification than when taught by the methods of discovery advocated by many Progressive Educators. Hutchinson in 1963 in a study involving learning in junior-high-school social studies also found that, under traditional authoritarian teaching, there is a statistically significant positive correlation between mental age and achievement but not between measures of creative thinking and achievement. In experimental conditions offering considerable opportunities for learning in creative ways the reverse was true. In another 1963 study involving fifth-grade children using programmed instruction in language arts, Gotkin and Massa found significant negative relationships between measures of creative thinking and achievement. A year earlier, Stolurow had found higher positive correlations between measures of originality and achievement than between mental age and achievement with programmed materials in mathematics and statistics. The difference was that Gotkin and Massa used programmed materials that permitted only tiny mental leaps and gave little opportunity for making, identifying, and correcting errors, while Stolurow's programmed materials emphasized a

trouble-shooting or hypothesizing approach that builds specific but multiple associations to a stimulus.

In 1964 MacDonald and Rathes found that highly creative children are more productive on frustrating tasks than are less creative children. Furthermore, they enjoy such tasks more than their less creative peers do. The least creative children are less productive in open tasks, and the most creative ones react less favorably to closed tasks. Thus, pupils of varying levels of creative thinking ability react differently to different kinds of curriculum tasks and are possibly best taught by varying procedures.

To me, by far the most exciting insight that has come from our research is that different kinds of children learn best when given opportunities to learn in ways best suited to their motivations and abilities. Whenever teachers change their ways of teaching in significant ways, a different group of learners become the stars or high achievers. This advance has far-reaching implications for educating a larger number of people to a higher level and for achieving a higher level of dignity and mental health in our society.

Regarding the second precept that "we learn best by doing and by having a vital interest in what we are doing," we recognize now that people do not learn automatically by doing no matter how interested they are. This type of learning requires sensitive and alert guidance and direction. Children must be taught the skills of inquiry and research—the spirit and skills of historiography, the concepts and skills of descriptive and experimental research. Curiosity and creative needs are strong enough and universal enough to make creative ways of learning useful for all individuals, but creative ways of learning should not be an exclusive way of learning for all children nor for any single child, even though he may prefer learning in creative ways and learn little when we insist that he learn exclusively by authority.

I see no real quarrel with the third precept that "education is a continuous reconstruction of living experience and goes beyond the four walls of the classroom." From an understanding of the creative process, we recognize that one thing must be permitted to lead to another. To accept such a precept requires a great deal of courage on the part of the teacher. Both teachers and pupils have to learn to think in terms of possible consequences of this "continuous reconstruction of living experiences beyond the four walls of the classroom." The same threats to security arise when schools accept the fourth and fifth precepts that the classroom should be a labora-

tory for democracy and that social goals, as well as intellectual goals, are important.

From the accumulated experiences of many teachers, it seems clear that when these precepts are accepted, learning becomes alive, much creative behavior occurs, and there is cooperation with parents and action by them. It is also clear that the acceptance of these precepts can be very threatening to the security of the teacher and calls not only for courage but for skills in group dynamics, creative problem-solving, and strategies for coping with change and stress. We have now accumulated enough knowledge about these areas to make these precepts more meaningful than they were in the heyday of Progressive Education.

We are also beginning to understand the inadequacies of the sixth precept that "a child must be taught to think critically rather than to accept blindly." We know now that it is not enough to be able to criticize the ideas of others. It is necessary that students be able to produce ideas of their own, to be critical of their own ideas, and to use tests that keep them from deceiving themselves. Furthermore, we have learned that in the production of ideas it is sometimes necessary to suspend judgment temporarily to avoid undue interruptions in our thinking. After ideas have accumulated, it is then necessary to formulate criteria for judging these ideas and making decisions. If knowledge is to be used constructively in solving problems creatively, the learner must have a constructive, though not altogether uncritical, attitude toward information. He must be willing to entertain and test the possibility that the information may be true and useful. In two different experiments,²⁴ I found that students who assumed a constructive rather than a critical attitude toward available information were able to produce a larger number of creative solutions and more original ones.

We have made enough advances in educational thinking to make a more creative kind of education possible. The major questions facing us now are: "Will we choose to use these advances in knowledge and thinking and will we choose in time?" I believe we have reached a stage in history when we must make such a choice. In the past, we have been able to survive with static goals and concepts. Change is occurring so rapidly that we cannot survive if we insist on thinking and living in static terms. We must accept the creative challenge.

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