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ABSTRACT

The history of divergent-thinking tests suggests that new approaches to creativity testing are needed. Research has focused on the relation of creativity to insight, divergent problem solving, problem finding, and intelligence. A proposed situational model of creativity defines creativity as a meaningful response to open-problem, open-solution situations. The model explains relationships between different types of thinking skills and explains why creativity and intelligence are not highly correlated. Based on this model, a new test of creativity is being developed, using the blank card of the Thematic Apperception Test and blank cards in divergent-thinking measures that use pattern and line meanings. No one current measure of creativity is adequate, but combinations of intelligence tests, problem-solving tests, personality tests, and occupational interest inventories can provide multiple criteria for decisions on special program admission. Psychometric data should not be the only data on which admissions decisions are based. Peer or teacher nominations or juried evaluations of creative performances need to be considered. A 57-item reference list is included. (JDD)

The Outlook for Creativity Tests

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Running head: CREATIVITY TESTS

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Abstract

The history of divergent-thinking tests suggests that in the future, new approaches to creativity testing need to be developed. This review proposes a situational theory of thinking skills that defines creativity as meaningful response to freedom to find a problem and solve it in one's own way. Recent progress towards eventual design of a creativity test based on this defintion is reviewed, as are currently available and valid alternatives for the selection of creative talent.

The Outlook for Creativity Tests

The future of creativity assessment promises to be one of continued innovation and research. Some general directions of development can be identified through a review of the history of divergent-thinking tests and a projection of current research into the future. It is this projection, based on current work, which leads me to believe that the outlook for creativity tests is bright.

The Development of Divergent-thinking Tests

Creativity assessment has never been just a fad any more than the assessment of intelligence has. In fact, Binet and Henri (1896) offered some of the first suggestions for techniques to assess creative imagination. They suggested that imagination be measured by asking a subject to give multiple interpretations for inkblots, to complete a theme or a drawing, or to construct sentences from given words. Some of these ideas -- such as the presentation of inkblots to evoke multiple interpretations -- imaginatively fueled significant research in the United States on the measurement of originality (e.g., Dearborn, 1898).

Barron and Harrington (1981) have traced the origin of divergent-thinking tests back to suggestions by Binet and Henri, although early researchers did not label them "divergent-thinking" tests. The inventor of that term was J. P. Guilford (1950), whose essay on creativity and whose work on the structure of intellect marked the beginning of a flood of research on divergent as opposed to convergent thinking (e.g., Getzels & Jackson, 1962; Torrance, 1962a; Wallach & Kogan, 1965). Today, most tests of creativity which call for problem solving call for divergent thinking, or coming up with as many solutions as possible to some open-ended problem (e.g., "how many uses can you think of for a brick?"). Although there is some consensus about what constitutes a divergent-thinking test, opinions differ about their validity, ranging from unqualified acceptance to unqualified rejection.

There seems to be a growing consensus about the limitations of divergent thinking tests, however, which signals that new directions in research are needed. The careful generalization in the review by Barron and Harrington (1981, p. 447) is probably accurate: "Some divergent-thinking tests, administered under some conditions and scored by some sets of criteria, do measure abilities related to creative achievement and behavior in some domains." Few if any psychologists have attempted to refute this statement, and there is considerable evidence to support it in studies which continue to utilize divergent-thinking tests as measures of a cognitive skill (e.g., McCrae, 1987). Divergent-thinking tests should not be dismissed as measures of creativity, but their validity as creativity measures is increasingly accepted by educational and psychological researchers as tenuous.

The tenuous relationship has been explained by some through a componential theory of creativity, which identifies divergent thinking as only one part of a process of creative thinking first outlined by Wallas (1926). This defense is theoretically coherent, and it implicitly encourages research along the lines of multiple regression. By assuming the Wallas model, we are led to search for a new solution to an old problem, but we are not led to search for a new solution to a new problem. In contrast, "What might a better creativity test be?" is a fundamental question, calling for a theoretical reformulation. This refomulation may begin through a reconsideration of the early suggestions for the measurement of creativity, particularly to discover their limitations.

Creativity, Insight and Divergent Thinking

The diverse suggestions by Binet and Henri for measuring imagination had in common at least one feature.

They all called for open-ended problem solving. In this tradition, Guilford (1975) distinguished the divergent problem from the convergent one by the relative lack of constraint or limitation on the answer. But what of the degree of constraint on the problem itself? None of the suggestions by Binet or Henri offered the subject the opportunity to find a new problem.

More than a decade before their suggestions were made, however, a French philosophy teacher named Paul Souriau (1881, p. 17) published a theory of "invention" in which he noted the importance of problem finding to originality:

> In the last case that we analyzed, we supposed that we had a problem to solve the statement of which had been given to us. But how had this same statement been found? We say that a question well put is half resolved. True invention thus consists in posing questions. There is something mechanical, as it were, in the art of finding solutions. The truly original mind is that which finds problems.

Later comments by Einstein and Infeld (1938, p. 95), Wertheimer (1945/1982, p. 123), and Getzels (1964); and later exploratory research on creativity by Guilford (1950), Roe (1953) and MacKinnon (1960) include mention of the importance of finding problems to scientific and artistic productivity, although "setting," "formulating," "sensing" or "discovering" problems were the terms that they used.

The term problem finding appears to have been introduced in the literature by Mackworth (1965), who invented it for a discussion of much of the thinking on scientific originality in the 1960's. Problem finding was a skill which was contrasted with problem solving. It was considered to be "close to the heart of originality in creative thinking in science" (p. 54) but somewhat removed from deductive logic, which was more closely related to problem solving. Equating problem finding with problem discovery, Getzels and Csikszentmihalyi (1967) became more specific about the skills involved in problem finding ("the imaginative, personal, intuitive phase of subconscious thought") as opposed to problem solving ("the controlled, consensual, analytic phase of conscious thought"). Both processes were and are seen as necessary to discovery in science or creative achievement in art (Wakefield, in press).

To date, the best study of problem finding remains the longitudinal study of problem finding among art students by Getzels and Csikszentmihalyi (1976). The authors devised techniques to study problem formulation by students at the

Art Institute in Chicago. They set up a problem situation in which students were asked to select from an array of objects those which would be useful for an experimental drawing that each student would do.

The authors found that expert ratings of the final drawings for aesthetic value and originality (but not craftsmanship) correlated highly with problem-finding variables such as 1) the number of objects manipulated, 2) the unusualness of the objects manipulated, and 3) the intensity of object exploration. In their follow-up six years later, Getzels and Csikszentmihalyi found that success as an artist was significantly correlated with scores on a problem-finding composite variable, and a recent summary (Getzels, 1985) of a second follow-up study suggests that this relationship persists even 20 years after the problem-finding measurements were made.

Problem finding is undoubtedly related to creativity, as is divergent problem solving. The task remains to coordinate the two perspectives on a single measure. To a large part, this task has been facilitated by the theoretical contributions of Getzels (1975) and Dillon (1982), which have placed problem finding on a continuum, along which problem-finding skills vary from problem recognition (closed) to problem invention (open). Similarly, problem-solving conditions may be arranged on a continuum from factual problem solving (closed) to expressive problem solving (open). The two continua may then be coordinated as in Figure 1. What the figure

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Insert Figure 1 about here

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identifies are four categories of problem finding and solving situations. This systematic arrangement of the two dimensions has intuitive appeal as an alternative to the Wallas model, which is process-oriented rather than situationally-oriented. More specifically, the situational model identifies combinations of conditions which must exist on tests to evoke different kinds of thinking skills.

In the first place, the closed-problem, closed-solution situation seems to call for evaluative or convergent thinking. A test of deductive logic presents such a situation, as would any test calling for analytical thinking. The open-problem, open-solution situation calls for creative thinking, combining problem invention and expressive problem solving skills. The open-problem, closed- lution situation calls for insightful problem solving, combining problem invention or discovery with factual problem solving. Finally, the closed-problem, open-solution situation calls for problem recognition and expressive problem solving, much as one would find on a divergent-thinking test.

If creative performance is defined as a meaningful response to the open-problem, open-solution situation, open-ended tests of cognitive skills (such as divergent-thinking tests) cannot assess creativity per se, although they may test a type of cognitive skill related to creativity. Similarly, tests of cognitive skill which focus on open problems and closed (or factual) solutions do not test creativity, although they may test insight, or the skills of selective information processing (cf. Sternberg & Davidson, 1983). Creativity is a meaningful response to situations that combine the invented problem with the expressive solution, and can be distinguished from both divergent thinking and insight using the proposed theory. This situational theory is not incompatible with the process model of Wallas, but if offers a new way to conceptualize the problem of creativity measurement.

The Model and Recent Research

Currently, the value of a situational model of thinking skills is largely heuristic. It is a tool which allows one to understand the rapid developments which are taking place in creativity research. For example, the measurement of insight is essentially the measurement of meaningful response to conditions which call for discovering a problem before it can be solved correctly. Such situations are found not only in ever-popular puzzle problems (Sternberg & Davidson, 1982) but in the task of inventing problems on an intelligence test (cf. Smilansky & Halberstadt, 1986).

The model also explains relationships between different types of thinking skills. First, the long-studied difference between divergent and convergent thinking translates into the distinction between the situations described by the lower two cells in the theory. This distinction, once thought to be the distinction between intelligence and creativity, is more accurately described as the difference between factual and expressive problem solving. One type of problem has a correct solution, while the other is solved in one's own way. In a psychometric perspective, the distinction is useful for describing the difference between convergent- and divergent-thinking tests. Torrance (1967) has found this relationship to be epresented by a correlation of .2, although it is also recognized to be highly variable (Butcher, 1973).

Second, the distinction between logic and insightful or productive thinking translates into the distinction between the upper and lower cells on the left. This distinction, which appears to have its origin in Wertheimer (e.g., 1945/1982, pp. 1-12), has been recently measured by Davidson and Sternberg (1984), who have found insight (as measured through the solution to puzzle problems) is only modestly (r = .4) related to logical deduction. Further theoretical work and a review of research on this distinction needs to be done before it can be decided whether this correlation is representative or not.

Third, the tenuous relationship between divergent thinking and creativity translates into the distinction between the upper and lower cells on the right. As numerous researchers have pointed out (Hocevar, 1980; Perkins, 1981; Sternberg, 1985), even though it may be related to creativity, divergent thinking need not be regarded as a significant component of the creative process. Alternatively, the situational model suggests that divergent thinking may be regarded as a thinking skill in its own right, with virtually unexplored applications as a measure of expressiveness in problem solving (Singer & Whiton, 1971; Hudiburg & Wakefield, 1986).

There is considerable research to support this interpretation, much of it recently reviewed by Wallach (1985). This interpretation explains the correlation of divergent thinking with suggestability, which as Wallach points out, is not a characteristic of creative individuals. The construct of expressive problem solving also explains the correlation of divergent thinking with customer sales, advertising ingenuity and creative writing (e.g., Wallace, 1961; Elliott, 1964; Torrance, 1972) as opposed to its lack of correlation with scientific discovery (Elliott, 1964; Torrance, 1972; Gough, 1975), which may be more a product of insight than divergent thinking or creativity.

Finally, the model permits one to understand why creativity and intelligence are not highly correlated, any more than are divergent thinking and insight. These are the relationships between responses to diagonally opposed situations in the theory, and therefore represent negative hypotheses, that is, no relationship is predicted. There is a lively controversy on this point, however, and the model does not account for the curvilinear relationship which may exist between intelligence and creativity (also known as the "threshold" hypothesis). The model does have limitations, but these limitations do not appear to be critical in light of the amount of information that can be organized based on a simple conception of two dimensions of problem finding and solving in relation to each other.

Current Research on a New Creativity Test

Research on a new test of creativity has completed its preliminary phase, calling for more intensive investigation. This phase has consisted of research by the author on responses to conditions which, according to the situational model of problem solving, have been identified as "creative." This research has gone through three subphases, each building on the discoveries of the last. The research is far from concluded, but some preliminary findings can be shared.

Although the "creative" situation has existed in experimental research (e.g., Amabile, 1979, 1985; Amabile & Gitomer, 1982), the first test measure of creativity which deliberately utilized the combined conditions of open-problem and open-solution was wordage of response to the blank card of the Thematic Apperception Test (Wakefield, 1986). Many people who use the TAT are unaware that it contains a blank card (No. 16), the instructions for which are to "See what you can see on this blank card. Imagine some picture there and describe it to me in detail; then tell me a story about it" (Murray, 1943). A great deal of research on creativity using the TAT has been conducted over the years, but somewhat surprisingly, the blank card has never been used.

Forty-seven female subjects were asked to respond individually to a ten-card set from the TAT, including the blank card. They were given two standard creativity tests (the Remote Associates Test and Unusual Uses for a Tin Can) as criterion measures. Wordage of response to the blank card correlated significantly with scores on both creativity tests, as opposed to wordage of response to the picture cards, which did not correlate as well with the creativity criteria. It was concluded that meaningful response to a situation which calls for imaginative problem finding and expressive problem solving is an indication of creativity.

From a psychometric perspective, the conclusions had to be very limited, largely because 1) the subjects were a relatively small sample of women; 2) the reliability of the dependent variable (wordage) was unknown; and 3) the validity criteria consisted of convergent and divergent tests of creativity. A smaller study (Wakefield, 1985b) was undertaken as a pilot project to respond to these potential problems, and further develop the blank card technique for assessing creativity. The subjects of this study were 23 fifth-grade boys and girls. Two blank cards were inserted in Pattern and Line Meanings of the Wallach and Kogan (1965) divergent-thinking measures, and subjects were asked to draw their own pattern (and line) before naming different things that their whole drawing could be.

The testing was done by two research assistants who were unaware of the hypotheses. The criterion measure of creativity was the Group Inventory for Finding Creative Talent (Rimm, 1980), a self-report measure for the identification of characteristics related to creativity (Wakefield, 1985a). The results indicated that response to the items invented by the children was adequately reliable (.82) and a stronger indicator of creativity than response to the presented patterns and lines (.46 vs. .33). These results confirmed and extended the conclusions of the earlier study.

In an as yet unpublished study, Runco and Okuda (1987) further confirmed these findings with talented adolescents. The researchers asked them in the course of standard divergent-thinking exercises to come up with three of their own divergent-thinking problems. Fluency of response to these self-set problems seemed to predict creative achievement (measured through self-report) independently of divergent thinking, which was controlled in the analyses through statistical procedures. Scores on "discovered" divergent-thinking problems correlated more highly with each other than with scores on the presented divergent- thinking problems, signaling the presence of a factor besides divergent thinking in the prediction of creative achievement.

The most recent evidence comes from an as yet unpublished study by the author (Wakefield, 1988) in an attempt to raise the reliability of responses to "blank card" exercises high enough (.90) for individual identification of talent. Sixty-three eighth graders were asked to respond divergently to two shapes and two lines much like those in Pattern and Line Meanings, but in the course of their exercises, they were also asked to 1) draw a shape, before interpreting it divergently; 2) combine it with another shape, before interpreting the combination divergently; 3) draw a line, before interpreting it divergently; and 4) combine it with another line, before interpreting the combination divergently.

The elaborate effort to assess creative response was a partial success. The four creative response items intercorrelated (.83) more highly than they correlated with four divergent thinking items (.67), signaling that they measured a factor other than divergent thinking. Divergent thinking was reliably (.84) assessed through four divergent thinking items. Although both creative and divergent scales correlated about equally (.40) with a creativity criterion measure (measured interest in the creative arts), neither had a reliability high enough for individual identification of talented students. The effort did not produce a creativity test suitable for talent selection, but creative response was found to be as reliable as divergent response, if the task varied. This finding in itself was significant. The situational model promises continuing usefulness in the future both to guide research and to interpret results.

Current Status of Creativity Assessment

The long-term future of problem solving approaches to creativity assessment should be clear, but what of the next few years? Educators need some guidance in the selection of measures available now, but what is glaringly apparent is that no current measure of creativity is adequate. What may be proposed, however, are combinations of measures to compensate for weaknesses or to provide multiple criteria for admission to programs for talented and gifted students. What follow are multiple criteria which any program can include in its admission standards should creativity tests be used. The interpretation of individual test scores remains in part a policy decision, based on program objectives.

Intelligence test scores

Most creativity researchers agree that creativity is related to intelligence, although the relationship is not linear. Some have adopted the threshold hypothesis, which implies a criterion of above-average intelligence for creative performance. There is very little systematic research to support this hypothesis, and research which does exist is often based on the divergent/convergent distinction instead of the creative/convergent distinction implied in the situational model of thinking skills.

Nevertheless, common sense suggests that some relationship exists, even if at the lower end of the range of IQ scores. An IQ cut-off score of 100 to 115 (average or one standard deviation above the norm) seems appropriate on the basis of the unlikelihood of effective problem solving in the lower IQ range. The specific cut-off score depends on the program objectives, not on psychometric evidence. Questions which need to be raised are matters of practicality and policy, such as what range of IQ can the teacher address in the gifted classroom? What other criteria for admission must the creative student satisfy? What is the relation of these criteria to IQ? etc.

Creativity test scores

Currently, there are a fair number of creativity tests on the market, but only a few have significant psychometric support, and most are recommended for research purposes only. These tests are basically of two types, problem solving and personality. The problem solving type has as its largest class divergent-thinking tests, such as those of Slosson, Torrance, and Williams. Of the divergent-thinking tests available, the figural forms of the Torrance Tests of Creative Thinking (TTCT) seem to have some merit (Torrance, 1962b, 1984). Wallach and Kogan (1965) have produced individually-administered divergent-thinking tests with a track record of success (Hocevar, 1980), but even these have encountered criticism and along with the verbal TTCT may be better thought of as measures of expressive problem solving than of creativity *per se*.

Of the increasing number of personality measures available, one which appears to me to have merit at the upper elementary level is the Group Inventory for Finding Creative Talent (Rimm, 1980). Also of interest is the Barron-Welsh Art Scale (BWAS) from the Welsh Figure Preference Test (Welsh, 1980). Although a test of aesthetic judgment, the BWAS may serve to select creative talent in young children as well as adolescents or adults (Fekken, 1985). Currently, it is recommended for research use only, but it presents an interesting perceptual test of creativity.

Unfortunately, most other creativity tests do not possess strong empirical support. Simple extension of divergent thinking tests across learning modalities does not automatically resolve their validity problems, and extension of personality tests to lower age groups reduces their reliability. The choice of test needs to be based on program objectives, but if the objectives do not allow for psychometrically sound creativity tests to be used consistently, it is perhaps better that they not be used. For this reason, another category of tests needs to be reviewed for their advantages in selecting creative talent for special educational programs.

<u>Occupational interest scores</u>

Several occupational interest inventories possess one characteristic that most creativity tests do not. They control for insincerity. The Kuder E, for example, has a fifth-grade reading level, is recommended for use beginning in the sixth grade (Williams & Williams, 1985), and contains a "V" or verification scale to detect an insincere response set (Kuder, 1975). Such an instrument administered along with a creativity test would control for glibness or lack of self-critical ability, one of the potential sources of contamination on a divergent-thinking test (Ausubel, 1978), and it would offer additional information on the interests of the student, whether or not the program admission decision used this information.

An informal study by the author found that 7 out of 76 college students taking divergent-thinking tests failed to meet the "V" cut-off score on the Kuder. The divergent-thinking scores of the "invalidated" group were higher and more variabile than those of the students meeting the cut-off, signaling that a few of the high divergent-thinking scores were contaminated. Controls for such contamination exist on most occupational interest surveys, some of which have acceptable reliability down to sixth or seventh grade. Since that is the age at which interests in scientific and artistic careers crystallize (Tyler, 1964), vocational interest scores might also have value in gifted program admissions decisions.

Psychometric data should not be the only data on which admissions decisions are reached. Other data sources, such as peer or teacher nomination, or juried evaluations of creative performances or portfolios, need to be considered. Still, we should not lose sight of the rationale for creativity testing in the first place. Early research on creativity found that teachers in particular were not adept at identifying creative students (Getzels & Jackson, 1962). Although these students kept pace with their peers, they were typically not outstanding academically. They were almost impossible to identify on the basis of information available to the standard classroom teacher through either standard tests or through performance on classroom exercises. They may have even created problems wherever they lacked freedom to find them. As educators, it is our responsibility to find these exceptional individuals and create for them an educational environment in which their talents can be developed, and sometimes the best way to find them is through tests.

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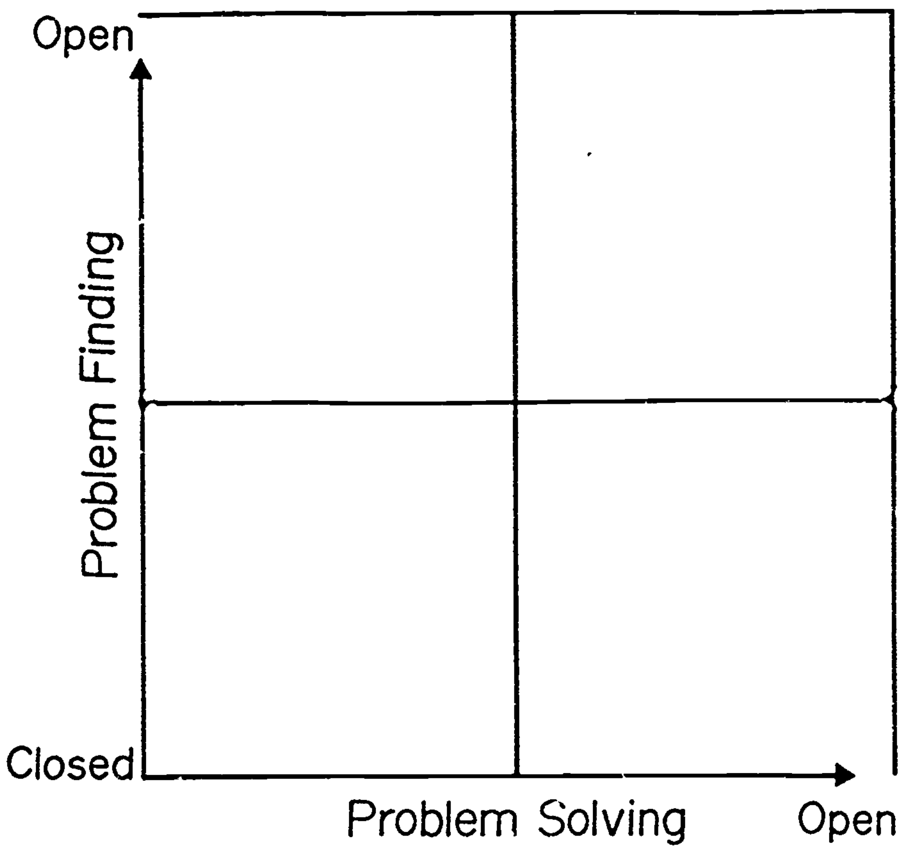
Open
Problem Finding
Closed
Problem Solving
Open

Figure Caption

Figure 1. A situational theory of thinking skills.