

## Creativity and critical / evaluative thinking

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### The creative process : Being creative

**What is creativity ?** Creativity applies both to the quality of particular outcomes and the thinking activity that led to them. Thought is creative when it produces something that is both novel and interesting or valuable, the birth of "imaginative new ideas" or "the imaginatively gifted recombination of known elements into something new". The ideas need to be appropriate or relevant in terms of an intended purpose.

Componential theory of creativity ( Amabile, 1996). Three components

domain-relevant skills (i.e., knowledge, technical skills)	task motivation	creativity-relevant, potential creativity skills, including <ul style="list-style-type: none"><li>• planning and exploring new pathways,</li><li>• keeping response options open for as long as possible</li><li>• suspending judgment.</li></ul>
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Theory of creative cognition features two central cognitive processes that contribute to creativity;

generative, in which an idea is initially created	exploratory; idea is examined/ interpreted in different ways
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### *The conditions most likely to lead to creativity*

Most models of creativity identify the following conditions

access to a body of knowledge that is relevant to the creative outcome	This knowledge needs to be sufficiently extensive, elaborated and differentiated, properly indexed and to be seen as expert
access to thinking skills that allow the generation of creative outcome	Two aspects; being able to <ul style="list-style-type: none"><li>• think in particular ways, know the value of this thinking,</li><li>• decide when to think in these ways, use them selectively.</li></ul> Metacognition is a key aspect of creativity, of planning.
the motivation to be creative	

**The types of thinking that lead to creative outcomes** Creative thinking is a subset of regular thinking, not a unique set of 'creative thinking strategies'. Creative and "ordinary" thinking are points along a continuum.

### *Activity 2 : Unpacking creative thinking*

- (1) Give as many unusual uses as you can for the items newspaper, knife, car tire, button, shoe
- (2) Find a remote fourth word that links moon, cheese, and grass
- (3) Below is listed three sets of items:
  - table, chair, lamp, bed
  - banana, pineapple, orange, peach
  - telephone book, search warrant, marriage certificate, map

Combine these categories to create a new, superordinate category and name the new category,

- (4) **Our experience of an event is more beneficial than our memory of it.**

Would you agree ? What reasons would you give to support your decision ? What thinking actions did you use ?

To decide how creative your responses are in each case, what criteria would you use ?

Identify the thinking strategies you used in each case.

### **Thinking actions**

- think about a domain; experiment with and modify, thought experiments, trial questions, search in new directions, entertain several possibilities, evaluate each in turn
- plan how to solve novel tasks, create a plan of action, evaluating and monitoring its effectiveness, revising or rejecting it as task demands change, managing the impulse to act without careful consideration
- synthesise ideas; integrate observations + feedback to possibilities with what is known in different ways (mental images, physical models, into a picture or theory that is gradually built, interpret, analyze, question, build on the creativity of those who have gone before and their own previous creativity.
- identify aspects that 'don't fit' or match what is expected, that violates educated expectations,
- involve an aspect of surprise; thinking and experiencing that arouses empathy, the "feelings" associated with experiences
- at the point of the creativity, thinking is not guided by an intact theory of the phenomenon; the discovery may be induced from the empirical evidence, may be based on intuitions
- think or act incrementally, develop an idea through small incremental steps.
- think divergently; creative thinking may involve divergent thinking.. Divergent tests predict potential for creative performance.
- use metaphor or analogy to transfer meaning from one domain to another.

### **Creativity and traditional intelligence**

- Traditional intelligence does not indicate creative potential
- Divergent thinking predicts creative activity better than measures of traditional intelligence.

creativity - how individuals decide how to use what they know, not what one knows (Sternberg)

To views of creativity

creativity is a fixed ability (Guilford)

Sternberg sees creativity as a modifiable ability rather than innate. He identifies ten decisions people can make to decide for creativity..

- redefining problems by looking at them from perspectives that are unusual or novel.
- being prepared to reflect on , critique and analyze repeatedly one's ideas and update or modify them to ensure that they are the best of which they are capable at that time.
- communicating their creative ideas to others and convincing others of their potential advantages and value; skills in persuading, aware that people may not recognize their value.
- being prepared to work to overcome opposition to their ideas because they are not understood.
- ensuring that one's knowledge of a topic, that may be well developed, does not impede or restrict thinking about it creatively, decide to think flexibly about what they know, discuss their understanding of a topic with others to ensure they see it from several perspectives.
- being prepared to take sensible risks about the ideas and to fail some of the time to succeed other times.

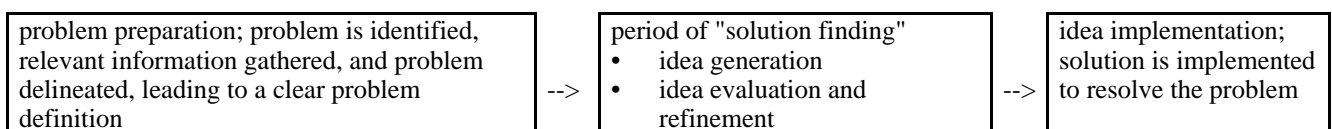
- being prepared to grow creative ideas by constantly looking for new problems and new solutions to challenge their thinking and in their creative production.
- having confidence in their ability to do creative work.
- being prepared to tolerate ambiguity, uncertainty and unanswered questions, tolerate ideas that do not quite fall into place so that they can develop, refine, and present the ideas.
- deciding what individuals are interested in and enjoy learning and thinking about, and pursuing this.

These decision-making skills can be developed or taught. Students can learn how to be creative by observing creativity at work in any field of endeavour.

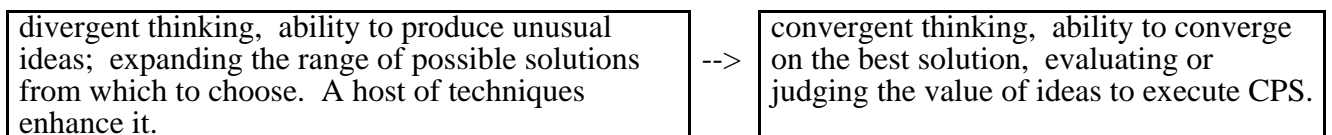
### ***Creative problem solving***

Creative problem solving (CPS) involves solving problems that may be ill-defined and are heuristic (or 'non-standard') and need to be solved without known algorithms. The solver develops solution pathways that are both novel and appropriate to the task at hand.

Systematic CPS frameworks can be broken down into distinct stages:



Most models explicitly note the role of divergent and convergent thinking in CPS process:



***Problem Identification.*** Ability to identify unresolved problems. Creative problem solvers are sensitive to problems and opportunities in the environment, can anticipate. They monitor their environment for changing trends that provide opportunities for innovation. These observations are "initiating factors" or problems that frequently catalyse creative outcomes.

***Problem Delineation*** Ability to understand and delineate the problem. How one defines the problem affects the path taken to solve it. Defining it broadly avoids focusing only on one aspect that solves part of the problem. Most problems are multi dimensional and require a "set of solutions".

***Information Gathering*** Gather information to get a better insight into the problem. The information collected can include

- data re the possible causes of the problem and
- data to better understand the relationship between variables.

Hypothesizing about the specific causes of the problem and generating many hypotheses provides allows further investigation and problem understanding.

Prior knowledge is also a component of effective CPS. Creative problem solvers need to develop a base of domain-specific knowledge. Sufficient prior knowledge allows better assessment and use of one's personal repertoire of problem-solving strategies.

***Idea Generation*** Generating novel ideas is often neglected and causes the greatest difficulty. Factors that make it difficult include

- inability to suspend judgment when first formulating them.

- "functional fixedness," or the inability to break out of the perceptual set.
- intrinsic motivation or persistence is essential.

Research suggests you need to produce more than a few ideas when initially generating ideas.

**Idea Evaluation and Refinement** .Critically examine or evaluate the quality of the ideas generated, how viable, novel and creative they are as solutions, limitations, by looking for their positive qualities and, if necessary, modifying them to overcome weaknesses. Ideas can also be placed on hold for further refinement.

**Idea Implementation** Implement the solution. You may need the ability to convince others of the value or appropriateness of proposed solutions. Idea implementation involves developing detailed plans for doing the activities to solve the problem; assigning tasks and activities, timing and sequencing them and assessing its impact on problem resolution.

**Different motivating conditions under which individuals display creativity.** Two motivating conditions;

- the reason for engaging in creative thinking (the driver behind the engagement) ; initiated either intrinsically by the person engaging in the creativity or by others, that is, extrinsically.
- the extent to which the target or problem is identified by the individual. Closed problems have known methods for solution. Open problems require thinkers to find, invent, or discover the problems.

problem type	
closed	
<b>Responsive Creativity</b> <ul style="list-style-type: none"> <li>• most prevalent form of creativity studied. Students are given a problem (creativity test) and external demands</li> <li>• externally driven, closed-problem field</li> <li>• individual has the least control over problem solving choice</li> <li>• example in organizations - focus groups to solve problems</li> </ul> <b>externally driven</b>	<b>Expected Creativity</b> <ul style="list-style-type: none"> <li>• external expectation with a self-discovered problem</li> <li>• examples : quality circles and in total quality management practices</li> </ul> <b>internally driven</b>
<b>Contributory creativity</b> <ul style="list-style-type: none"> <li>• self-determined and based upon a clearly formulated problem</li> <li>• an employee who chooses to engage in creativity to help solve a problem with which he or she is not directly involved</li> </ul>	<b>Proactive Creativity•</b> <ul style="list-style-type: none"> <li>• individuals, driven by internal motivators, actively search for problems to solve volunteer ways of improving a process, propose new products</li> <li>• difficult to assess but important</li> <li>• similar to the concept of personal initiative</li> </ul> <b>open</b>

Creativity will be stronger for those types requiring more effort (proactive and contributory creativity) than for those types requiring less effort (responsive and expected creativity).

Expected and proactive creativity involve more scanning and defining activities than responsive and contributory creativity, curiosity and training in problem finding.

**Psychological characteristics in childhood environments promote adult creative productive achievement ?**

Creative producers are more likely to have had environments that lead to the development of particular personality characteristics or coping strategies;

- prefer time alone, spent a lot of time alone as children.
- develop a rich fantasy life.

- able to cope with high levels of anxiety, tension, asynchrony, risk taking or discordance, dissatisfaction with the status quo, comfortable with tension.
- prefer neither a state of tension nor a tension free but seek the pleasure that results from reducing or anticipating tension. Challenging tasks provide greater reduction of tension and pleasure.
- free from, disinterested in societal conventions, follow their inner voice.
- highly motivated to achieve because their creative activities fulfil a basic emotional need that stems from childhood stresses.

These conditions often result from stress in the family, which is in part, due to characteristics of the family, the broader context surrounding the family, and characteristics of the child.

Personality and motivational attributes are more important than cognitive elements for differentiating creative achievement.

Characteristics of the child that create stress and determine the context for talent development

- birth order; creative individuals are more likely first borns.
- gender affects fostering of talent ; usually males.
- physical disabilities create dynamics which can develop talent .

Stress Eminent individuals had a variety of stressful circumstances as children:

- parental loss (3x more than average and equal to that of juvenile delinquents);
- stem discipline;
- rejection by parents or other children;
- overprotection;
- loneliness;
- loss of a cherished sibling;
- insecurity due to poverty, parental neglect, or dysfunction;
- physical disabilities or deformities and
- parental conflict .

How does stress in childhood affect the development of creativity?

disruptive dysfunctiona l parental relationships	childhood stress, anxiety	<ul style="list-style-type: none"> <li>• reduce parent - child bonds</li> <li>• withdraw, seek self sufficiency and independence in more controllable situations, solo intellectual activities, prefer time alone</li> <li>• give greater latitude to follow own destiny, free from conventionality, create an identity different from parent's, pursue unconventional paths</li> <li>• willing or tolerant to be different in adulthood</li> <li>• ability to cope with tension and marginality and seek it</li> </ul>	creative adults allow intense emotions, solace and relief to be expressed
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Stress in the childhoods of talented individuals does not always result in creative adults. Childhood stress and trauma are not necessary for creativity; a balance of support and tension within the family is conducive.

### ***The Primacy of Motivation in Creativity***

The theory of the motivated mind ---> roots of creativity are not in convergent or divergent thinking but in the motivational dynamics of the personality. It identifies two complementary aspects of achievement motivation, that activate and drive creativity; serious-mindedness and fun-mindedness. The more students experience the motivation of serious fun, the more they will develop the capacity of creative intelligence.

Students' motivated minds comprise two co-evolving ways of thinking:

cold-order thinking expressed as serious intelligence	hot-chaotic thinking expressed as fun creativity.
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<ul style="list-style-type: none"> <li>• Motivationally, cold-ordered thinking is serious, deliberate, calm (anxiety-avoidance), work-oriented, goal-directed</li> <li>• Mentally, it is convergent, literal, analytical, deductive, and critical .</li> <li>• serious-intelligent thinking enables students to clearly define, solve, and evaluate close-ended problems for single-best solutions.</li> <li>• Stimulates and provides the means for attaining mastery of fun challenges for talent-related activities.</li> <li>• People specialized in sciences such as physics, chemistry, engineering, and mathematics appear to prefer and excel it .</li> </ul>	<ul style="list-style-type: none"> <li>• Motivationally hot-chaotic thinking is fun, spontaneous, exciting, playful, and activity-involved .</li> <li>• Mentally, it is divergent, imaginative, holistic, inductive, and speculative.</li> <li>• fun-creative thinking, enabling students to find good problems and to explore multiple solutions for open-ended problems.</li> <li>• Stimulates and provides the means for seeking and exploring fun challenges for talent-related activities.</li> <li>• People specialized in arts such as poetry, acting, painting, and music appear to prefer and excel in this style of thinking.</li> </ul>
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When these sub systems become fully differentiated and integrated, students develop fluid-adaptive thinking, a serious-fun experience of creative intelligence. Students are playfully creative at times and seriously intelligent at others.

<b>motivational</b> aspect balance of the spontaneity of fun and the rigidity and purpose of seriousness.	<b>mental</b> aspect, creative intelligence intelligence <-balanced interplay--> creativity; it combines short-term adaptability of convergent processing + long-term adaptability of divergent processing. <ul style="list-style-type: none"> <li>• serious intelligence without fun creativity ---&gt; constricted thinking</li> <li>• fun creativity without serious intelligence ---&gt; unbridled speculation</li> </ul> Balanced interplay --> critical intelligence counterbalances creativity's unbridled speculation.
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**Teaching styles for influencing the motivated mind** A participatory teaching style that combines the directive work tasks and supportive play activities to help students learn to self-regulate their motivational controls to use fluid-adaptive thinking.

Participatory teachers create learning environments in which students have ample opportunities to playfully seek challenges and to seriously master them.

**challenge phase** : they do fun tasks such as creative designs, open-ended inquiries, dramatic productions, simulations, and field trips

--> **mastery phase** : they reflect on and discuss what they have learned from the challenging tasks.

They vary the openness of fun learning activities depending on the maturity of students:

**young students** have focused-fun activities, structured for serious mastery with explicit guidelines and ongoing direction so that they do not become excited or frustrated : educational rhymes and songs, review games, controlled simulations, guided discovery.

**older students** have open-fun unstructured activities (creative design or invention projects, open-ended inquiries or investigations, student-directed debates, student-planned field trips, etc.). They find their optimal levels of challenge and mastery. Matching and coordinating fun challenge and serious mastery --> students are likely to engage fluid- adaptive thinking

Without this balance in teaching:

<b>Directive style-conservative for developing talent</b>	<b>Supportive style- liberal for talent development.</b>
<ul style="list-style-type: none"> <li>• provides high expectations for serious mastery but low support for fun challenges,</li> <li>• is task oriented, encourages students to finish their work asap and to show their competency</li> <li>• in extreme, ---&gt; authoritarian leadership style.</li> <li>• a demanding authoritarian style that lacks support may ---&gt; talented students becoming excessive perfectionists who are driven compulsively to avoid failure, to look perfect and --&gt; burnout, apathy, and rebellion.</li> </ul>	<ul style="list-style-type: none"> <li>• provides high support for fun challenges but low expectation for serious mastery.</li> <li>• creates a safe and secure environment for exploration and risk-taking.</li> <li>• stresses giving a variety of exciting challenges. in extreme---&gt; permissive leadership style.</li> <li>• overly permissive style that lacks high expectations, may ---&gt; talented students becoming excitement seekers and dabblers who never finish what they start.</li> </ul>

Students differ in the direction and support they need. Ideally, teachers will adopt a participatory style that provides both high support and high expectations.

## Teaching creativity

Classroom teaching often ignores creativity. Systematic training can enhance creative thinking.

Attempts to train students to be more creative have produced mixed results:

- teaching divergent thinking increased the preference for generating new solutions but not performance.
- creativity training that emphasized deferment of judgement, brainstorming, incubation and idea-getting techniques ---> increase on "creativity" tests .
- the effects of short-term training on creativity may not persist over time or transfer to situations markedly different from the original training.

Aspects of successful courses: students

- learn about creativity in a domain area that gives a practical understanding of creativity that stresses cognitive, motivational, affective and social aspects of creating novelty such as image of the successful student, the need for courage, and tolerance of unusual or unexpected ideas.
- receive specific feedback on their performance, in the form of "creativity counselling" based on test scores on creativity tests.

Some programs work because they foster :

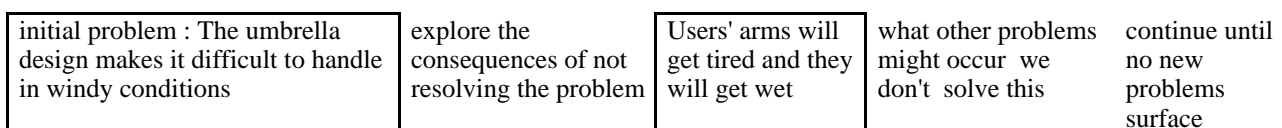
- developing appropriate thinking skills;
- acquiring positive attitudes to creativity and creative performance;
- motivation to be creative;
- perceiving oneself as capable of being creative. self-image ;
- reducing anxiety about creativity; and
- experience of positive mood in problem-solving situations reviewed possible mechanisms through which might occur

## The CPS process: pedagogical implications and classroom application

Educators can teach the creative problem-solving process. They have typically examined idea-generating techniques in isolation rather than having explored their combined effectiveness to enhance various stages of the CPS process.

**Problem Identification** Identifying needs and problems initiates the CPS process in a subject area. Current instruction provides few opportunities to learn through problem based learning. Many students believe that the subject areas has "thought of everything already."

**Problem Delineation** Students show difficulties adequately defining problems. Techniques to assist problem delineation involves redefining an initial problem as a set of problems at progressively higher levels of abstraction. This reveals the multi dimensional nature of the problem and expands the solution set.



It can reveal new problems that are sometimes easier to resolve than the initial one.

**Information Gathering** Individuals acquire the prerequisite knowledge and information necessary to understand the problem and facilitate idea generation. Students

- sometimes fail to fully identify and question the assumptions they bring to the CPS process.
- may overlook the need to identify and verify the range of possible factors contributing to the problem. This leads to incomplete or partial student solutions to the problem.
- sometimes lack the domain-specific knowledge necessary.

Techniques for enhancing the collection of information pertinent to the problem include

- use questions (e.g., who? what? where? when? why? how?) designed to assure that all relevant information about the problem is collected. This also facilitates hypothesizing about the possible causes contributing to the problem that require verification via data collection.
- questioning systematically the constraints surrounding a problem to see which assumptions to question or verify, to see what information needs to be collected. It proceeds as follows:

list the problem statement		identify, group assumptions re problem into related categories
The umbrella design makes it difficult to handle in windy condition	-->	<ul style="list-style-type: none"> <li>• the umbrella must have a pole,</li> <li>• the pole must be straight,</li> <li>• the top must be dome shaped, and</li> <li>• the only solution is to redesign the umbrella</li> </ul>

These assumptions constrain divergent thinking and lead to a limited set of possible solutions .

**Idea Generation** Students' idea generation abilities need to be developed. They

- need to be instructed to think divergently.
- can be exposed to divergent thinking heuristics and methods that enhance idea generation.
- need to reflect on and explicate the idea generation process.

Techniques to assist in the idea generation process include

- brainstorming,
- attribute rearrangement
- free-association techniques, brainstorming, categorizing and linking related ideas and solutions as they are generated. This helps students see the use of even the most outlandish ideas (i.e., why the idea solves the problem), which facilitates the production of more solutions that fall within that particular category. You need to suspend judgment until all ideas have been generated.

**Idea Evaluation and Refinement** Students need to

- develop and apply established criteria to judge the appropriateness and novelty of new ideas and
- be exposed to the notion that genuinely creative ideas need time to develop or evolve.

Idea refinement requires the ability to defer judgment, to recognize the possibility represented by every new idea generated. They may be assisted by recording the development of ideas as well as presenting their final solutions.

To assist you to evaluate and refine ideas and/or solutions

- use a checklist with questions that address criteria re the issues / topic and usefulness of the proposed solution to assess their viability.
- list the strengths and weaknesses of the proposed idea.
- "reverse brainstorming," to identify the possible weaknesses of an idea. Generate criticisms or weaknesses of an idea rather than solutions to a problem. After this, explore possible solutions to each of the weaknesses generated.

Reverse brainstorming uses divergent thinking in an evaluative capacity where convergent thinking approaches are traditionally employed.

**Idea Implementation** This provides the only opportunity for students to receive realistic feedback re the quality of their ideas. Students seldom see their ideas implemented. This may reduce student motivation and hamper student confidence in their abilities to successfully solve problems.

**Measuring creativity** Creativity tests



- measure specific cognitive processes such as thinking divergently, making associations, constructing and combining broad categories, or working on many ideas simultaneously.
- measure non cognitive aspects of creativity such as motivation (e.g., impulse expression, desire for novelty, risk-taking), and facilitatory personal properties like flexibility, tolerance for independence, or positive attitudes to difference.
- correlate with criteria of creativity such as teacher ratings and are useful predictors of adult behavior.

They measure creative potential; creative achievement depends on additional factors not measured by creativity tests, such as technical skill, knowledge of a field, mental health, or opportunity. Creativity is multi dimensional and should be based on several tests. Over 255 creativity tests.

## *Creative thinking*

The Creativity Tests for Children	<ul style="list-style-type: none"> <li>based on Structure of Intellect model of intelligence.</li> <li>suitable for Grades 4-6,</li> <li>10 tests from either the semantic or visual and figural content areas.</li> <li>assess "divergent production" of units, classes, relations, systems, transformations and implications.</li> <li>examples are "Names for stories," "Different letter groups," or "Making objects."</li> <li>tasks assess free production of a large number of ideas, not originality or effectiveness.</li> </ul>
Torrance Tests of Creative Thinking (TTCT)	<ul style="list-style-type: none"> <li>verbal section "Thinking Creatively with Words," 6 verbal activities (Asking, Guessing Causes, Guessing Consequences, Product Improvement, Unusual Uses, Unusual Questions and Just Suppose), scored on Fluency, Flexibility and Originality.</li> <li>nonverbal or figural section, "Thinking Creatively with Pictures" and three figural activities (Picture Construction, Picture Completion and Lines/Circles) scored on Fluency, Originality, Elaboration, Abstractness of Titles, and Resistance to Premature Closure. As well, figural tests can be scored for 13 creative strengths (e.g., Story telling Articulatness, Synthesis of Incomplete Figures, and Fantasy).</li> </ul> <p>Verbal creativity scores account for 50% of variance of scores on the criterion of publicly recognized creative achievements and participation in creative activities 20 years later and predicted three times as much of the criterion variance as IQs. TTCT scores differentiate well between students who later achieve public acclaim as creative and those who do not</p>
Modes of thinking in young children (Wallach & Kogan, 1965)	<p>uses a gamelike atmosphere without time limits. It contains</p> <ul style="list-style-type: none"> <li>three verbal subtests (Instances, Alternate Uses and Similarities) and</li> <li>two subtests consisting of ambiguous figural stimuli (Pattern Meanings, Line Meanings).</li> </ul> <p>The most used subtest, Alternate Uses, asks respondents to give as many unusual uses as they can for various common items (e.g., newspaper, knife, car tire, button, shoe, key). It was scored for</p> <ul style="list-style-type: none"> <li>fluency by counting the number of responses and</li> <li>uniqueness by identifying responses that were unique to a person within the group being tested .</li> </ul> <p>Users now also score it for</p> <ul style="list-style-type: none"> <li>flexibility by counting the number of responses,</li> <li>originality (statistical uncommonness); rate answers on 7-point scale (not original - very original).</li> <li>usefulness (practicality and relevance to reality); rate answers on a 7-point scale (not useful - very useful ).</li> </ul>
Remote Associates Test	<p>based on the fact that more creative people are better at finding remote associates to stimulus words. The 30 items, consists of apparently unrelated words (e.g., moon, cheese, and grass) and the task is to find a remote fourth word that links them (blue would be appropriate for the above ). 40 minutes are allowed</p>
Test of Creative Thinking (Divergent Production)	<p>assesses image production; respondents' productions are rated according to dimensions derived from a Gestalt-psychology theory of creativity. These include Boundary Breaking, New Elements, and Humor and Affectivity. Respondents are given a paper with incomplete figures and make a drawing or drawings containing the fragments in any way they wish.</p>
Process-based measures of creative problem-solving skills	<p>Tests of Problem Construction, Information Encoding, Category Selection, and Category Combination and Reorganization to assess creative thinking through problem solving. The category combination test involves problems consisting of sets of four exemplars of each of three categories, for example, a problem could consist of the following three sets of exemplars:</p> <ul style="list-style-type: none"> <li>table, chair, lamp, bed</li> <li>banana, pineapple, orange, peach</li> <li>telephone book, search warrant, marriage certificate, map</li> </ul> <p>The respondents' task is to</p> <ul style="list-style-type: none"> <li>name the categories defined by the exemplars;</li> <li>combine these categories to create a new, superordinate category;</li> <li>label the new category</li> <li>write a brief, one-sentence description of it;</li> <li>list as many additional exemplars of the supercategory as possible;</li> <li>list additional features linking the exemplars combined in the new category.</li> </ul>

## Biographical inventories

Biographical Inventory	consists of 165 items that focus on factual information, and measures five areas: <ul style="list-style-type: none"> <li>family background (eg parent education, level of public recognition of parents or siblings),</li> <li>intellectual and cultural orientation (e.g., interests and hobbies, frequency of visits to museums or art galleries),</li> <li>motivation (use of special equipment such as a microscope, willingness to skip meals to work on a project, jobs in a field of interest)-referred to as pervasive and continuing enthusiasm,</li> <li>breadth of interest (number of hobbies. number of favourite school subjects), and</li> <li>drive towards novelty and diversity (interest in unusual art forms, unconventional collections).</li> </ul>
The Creativity Checklist	rate people at all age levels on 5-point scale ranging from never to consistently on 8 dimensions: <p>the cognitive dimensions</p> <ul style="list-style-type: none"> <li>Fluency,</li> <li>Flexibility</li> <li>Constructional Skills</li> </ul> <p>personal properties such as</p> <ul style="list-style-type: none"> <li>Ingenuity,</li> <li>Resourcefulness</li> <li>Independence</li> <li>Positive Self-Referencing</li> <li>Preference for Complexity</li> </ul>
Creative Behavior Inventory i	observer rates Grades 1-6 and Grades 7-12 on 10 items on 1-10 point scale according to the frequency with which the child behaves in the way indicated: e.g., This child notices and remembers details. The ratings yield scores on five dimensions: <ul style="list-style-type: none"> <li>Contact,</li> <li>Consciousness</li> <li>Interest</li> <li>Fantasy</li> </ul> <p>These are aspects preparing for the process of creative thinking.</p>
Creativity Styles Questionnaire	measures seven dimensions: <ul style="list-style-type: none"> <li>Belief in Unconscious Processes;</li> <li>Use of Other People;</li> <li>Environmental Control;</li> <li>Use of Senses.</li> <li>Use of Techniques;</li> <li>Final Product Orientation;</li> <li>Superstition;</li> </ul> <p>Participants rate themselves on 76 items (e.g., "Creative ideas occur to me without even thinking about them," "When I get a new idea, I get completely absorbed by it," or "I typically create new ideas by combining existing ideas"), on a 5-point scale "Strongly agree" to "Strongly disagree."</p>
Creativity Assessment Packet	measures curiosity, imagination, risk-taking and preference for complexity with children in grades 3-12 and includes <ul style="list-style-type: none"> <li>incomplete figures are completed and scored for fluency, flexibility, originality and elaboration.</li> <li>a self-rating scale involving 50 multiple-choice items scored for divergent feelings (curiosity, risk-taking, desire for complexity, and imagination).</li> <li>a rating scale used by parents or teachers on which they rate the frequency of behaviors indicating the presence of the traits just mentioned.</li> </ul>
Adaptation-Innovation Inventory	distinguishes between two types of creative problem solving <ul style="list-style-type: none"> <li>adaptors; people who solve problems by using what they know and can do and</li> <li>innovators; people who try to reorganize and restructure the problem .</li> </ul> <p>The innovative style (accompanied by greater motivation to be creative, higher levels of risk taking, and greater self-confidence ) leads to higher productivity. The scale of 32 items (e.g., Will always think of something when stuck, Is methodical and systematic, Often risks doing things differently) with self rating on a 5-point scale(very easy - very hard). Scored on three subscales:</p> <ul style="list-style-type: none"> <li>Originality,</li> <li>Conformity, and</li> <li>Efficiency.</li> </ul>

## Procedures Based on the Adjective Check List

The Adjective Check List	<ul style="list-style-type: none"> <li>used for both self- and observer- ratings .</li> <li>27-item set of adjectives that discriminated between groups of high school students rated by teachers to be more or less creative and scientists vs engineers judged on biographical inventory to be more or less creative.</li> </ul>
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**To assess an outcome in terms of its creativity,** attributes or criteria are suggested by the following inventories:

- Taylor's (1975)'s Creative Product Inventory : Generation, Reformulation, Originality, Relevance, Hedonics, Complexity, and Condensation.
- Besemer and O'Quin's (1987)'s Creative Product Analysis Matrix, includes Novelty, Resolution, Elaboration and Synthesis.

Effectiveness	how well does it achieve its purpose, how functional is it ?
Novelty	how novel, original, unexpected and surprising ?
Elegance	how understandable, elegant, polished, finished, aesthetic is it ?

Germinality	how useful is it, how well does it open up new perspectives or opportunities, new creativity ?
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