Insights into the creativity process

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The Stage Models of Creativity

The stage models of creativity describe how a person needs to act on what they know in order to produce creative outcomes. They examine creativity in terms of the processes used to change or modify one's knowledge in order to generate creative outcomes. Most of these models propose the following stages of knowledge change:

problem preparation		period of "solution finding"		solution implementation
• a problem is identified • relevant information is gathered • the problem delineated, producing a clear problem definition	-->	• a novel idea or 'solution' is generated • solution is evaluated and refined	-->	the solution is administered or implemented to resolve the problem

Wallas' stages model In 1926 Wallas proposed that creativity involved a person detecting new information (the Information phase), thinking about it (Incubation), generating a novel interpretation (Illumination) and then testing it (Verification).

Cropley's stages model Cropley (1997) added various stages to Wallas' model:

(1) the need to engage in thinking creatively initially, that is, to recognise or 'find' a problem, challenge or issue about which the person can be creative (the Preparation stage);

(2) the need to communicate the creative outcome to others (the Communication stage) and

(3) the need to have the outcome judged by others in the culture (the Validation stage).

The Preparation stage makes the of problem finding more explicit. Without Communication and Validation a creative outcome may be produced but cannot receive 'socio-cultural validation' (Cropley & Urban, 2000). The stages in Cropley's model are as follows:

preparation	perceiving or identifying a problem
Information	learning more about the subject of the problem, accessing relevant information
Incubation	thinking divergently about the problem, making new links and associations
Illumination	becoming aware of a novel possibility, a solution or interpretation
Verification	checking and evaluating the novel outcome
Communication	displaying the novel outcome to others and getting feedback
Validation	the creative outcome is judged in terms of its relevance and effectiveness by judges

At each stage, psychological processes prepares the knowledge for the next stage of creativity (Cropley & Urban 2000, p. 493). The outcome at each stage is called a 'psychological 'configuration' (Simonton, 1988).

The processes at each stage are facilitated by particular motivational states and personality characteristics. Different stages require different types of motivation and personality traits. During the Information stage, for example, convergent thinking is important because the individual needs to learn what the her /his culture knows about the topic or problem. During the illumination stage on the other hand, divergent thinking, general knowledge and openness are more important because the outcome here is a novel interpretation.

The process, outcome, motivation and personality characteristics at each stage are shown in the following table.

stage	process	result	motivation	Personality
preparation	• identify problem • set goals • think convergently	• initial activity • general knowledge • special knowledge	• problem solving drive (extrinsic) • hope of gain (extrinsic)	• critical attitude • optimism
information	• perceive learning • remember • think convergently	• focused special knowledge • rich supply of cognitive elements	• curious • prefer complexity • willing to work hard • want gain	• knowledgeability • willing to judge and select
incubation	• think divergently • make associations • build networks	• configurations	• free from constraints • tolerate ambiguity	• relaxed • accept fantasy • non conform • adventurous
illumination	• recognise a promising new configuration	• novel configuration	• intuition • reduce tension	• sensitive • open • flexible
verification	• check relevance and effectiveness of novel configuration	• appropriate solution • display relevance and effectiveness	• desire closure • want to achieve quality	• hardnosed sense of reality • self-criticism
communication	• achieve closure • get feedback	• workable product • can be communicated to others	• desire recognition (intrinsic) • desire acclaim (extrinsic)	• self confidence • autonomy • courage of one's convictions
validation	• judge relevance and effectiveness	• product acclaimed by relevant judges	• drive for acclaim • mastery drive	• toughness • flexibility

The creative process will stop if the individual's metacognitive processes indicate the current configuration will fail. Similarly, it can start part of the way through the stages if an individual returns to a earlier abandoned configuration, restarting the process (Cropley &Urban, 2000).

Cropley's framework is particularly for teachers wanting to foster creative outcomes in students. It indicates the types of thinking, motivational style and personality features most likely to lead to creative outcomes. Teachers can use these to assist them in their interactions with students.

When a teacher has a group of students engaged in creative activities, the teacher can identify the stage achieved by a student or the group at any time. If students have reached a barrier to their creativity, the teacher can use the analysis above to identify the most appropriate motivation and

personality characteristics and assist students to put these into place. Use of a framework such as this is far superior to pursuit of a vaguely structured creativity activity.

Creative problem solving

Creative problem solving (CPS) is a special case of problem solving (Titus, 2000). It involves transforming one's knowledge through a number of stages of to get creative outcomes. It develops solutions to problems that may be ill-defined and are heuristic (that is, not 'standard' in nature) and need to be solved without using known algorithms. They include tasks such as writing a paper or solving a mystery. These problems allow creative expression in their resolution. The solver needs to develop solution pathways that are both novel and appropriate to the task at hand (Amabile 1983).

The CPS process requires methodical, disciplined and sustained thinking (Couger 1995; Gilbert, Prenshaw & Ivy 1996). Several systematic CPS frameworks have been advanced (Amabile 1983; Couger 1995; Finke, Ward, and Smith 1992; Guilford 1967; Isaksen and Treffinger 1985; Osborn 1963; Parnes 1988; VanGundy 1988). It can be broken down into distinct stages (Baer 1993)

problem preparation; problem is identified, relevant information gathered, and problem delineated, producing a clear problem definition	-->	period of "solution finding" • idea generation • idea evaluation and refinement	-->	idea implementation; solution is administered or implemented to resolve the problem

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

- divergent thinking, the ability to produce unusual ideas (Guilford 1967; Torrance 1999); leads to expanding the range of possible solutions from which to choose. A host of techniques enhance it (Finke, Ward, and Smith 1992).

- convergent thinking, the ability to converge on the best possible solution refers to the need to evaluate or judge the value of ideas to execute CPS.

The stages of CPS, the activities individuals do at each stage and how the stages match with Cropley's model, are shown in the following table.

	The individual	
Problem Identification	identifies a problem	preparation
Problem Delineation	Specifies, clarifies, and delineate the problem.	
Information Gathering	Gathers additional knowledge about the problem	Information
Idea Generation	generates new ideas about the problem.	Incubation Illumination
Idea Evaluation and Refinement	critically examines or evaluates the quality of the ideas generated.	Verification
Idea Implementation	Implements the solution and communicates it to others	Communication Validation

Characteristics of each stage is as follows:

Problem Identification. Ability to identify important, unresolved problems. Creative problem solvers are sensitive to problems and opportunities in the environment, can anticipate and be sensitive to problems, are

- observant and naturally curious about their world.

- able to see areas for improvement in how things are done or have a novel message to say. They see these by constantly monitoring their environment for changing trends that provide opportunities for innovation. These observations are "initiating factors" or problems that frequently catalyse creative outcomes.

Problem Delineation Thinkers need to specify the nature and intensity of the problems in context. The CPS process requires the problem solver to thoroughly understand and delineate the problem. Individuals often spend insufficient time and effort defining problems and don't grasp fully their scope (Couger 1995). How one defines the problem affects the path taken to solve it. Parnes (1988) favors delineation approaches that expand the scope of the problem. Defining the problem broadly avoids viewing it as one-dimensional and focusing only on one aspect. Narrow perspectives often lead to singular solutions that solve only part the problem. Most problems are multidimensional, caused by numerous factors and require a "set of solutions," rather than one (Couger 1995).

Information Gathering The CPS process often requires the gathering of information to provide better insight into the problem Fogler and LeBlanc 1995;Osborn, 1963). The information collected can include

- data re the possible causes that fuel the problem and
- date to better understand the relationship between variables .

Hypothesizing about the specific causes of the problem and generating as many hypotheses as possible (Fogler & LeBlanc, 1995) provides the opportunity for further investigation and problem understanding. Success at this stage requires a working knowledge of what information to gather, how to gather it, and from what sources.

Prior knowledge is also a component of effective CPS (Amabile 1983). The information gathering activity is an ongoing process, rather than a discrete one. Creative problem solvers acquire knowledge continually. They need to develop a base of domain-specific knowledge. Sufficient prior knowledge and experience allows better assessment and use of one's personal repertoire of problem-solving strategies.

Idea Generation Idea generation, generating novel ideas, is the activity most commonly associated with creative problem solving. It is the part of the CPS process that is most likely to be neglected and causes the greatest difficulty (Osborn 1963).

Several factors contribute to difficulties in generating new ideas:

- inability to suspend judgment during the initial act of formulating ideas (Amabile 1983). One can generate twice as many good ideas if judgment is deferred until after an adequate listing of possibilities is compiled (Osborn, 1963).

- "functional fixedness," or the inability to break out of the perceptual set, can inhibit creative problem solving (Adamson 1952; Duncker 1945). Overcoming this requires considering ideas that may violate previously held assumptions, rules, and conventions, breaking free from habitual mental associations and patterns of thought (Parnes 1988).

- intrinsic motivation or persistence is essential to idea generation (Amabile 1983; Couger 1995). Creative individuals have been found to display an almost dogged determination to resolve problems even in the face of repeated failure.

Research suggests the need to produce more than a few ideas when initially generating ideas (Osborn 1963).Various heuristic stimulate the divergent thinking process, that help generate more ideas and expand the solution space or the range of alternatives to be considered (Finke, Ward, and Smith 1992; Mattimore 1993; Parnes 1988) and improve creative output (Parnes 1988).

Idea Evaluation and Refinement Deferring judgment during idea generation is an essential part of successful ideation. In contrast, idea evaluation and refinement require the problem solver to critically examine or evaluate the quality of the ideas generated. The purpose is to assess their strengths as viable and creative solutions. Ideas can also be placed on hold for further refinement.

Any judgment of idea quality requires that evaluative criteria be developed and applied in the judgment process. Ideas are evaluated re their appropriateness for solving the problem. Are they novel or creative? A variety of systematic approaches have been developed to assess idea novelty (e.g., Finke, Ward, and Smith 1992; Gilbert, Prenshaw, and Ivy 1996). Many call for the subjective assessment of idea quality by independent judges (Finke, Ward, and Smith 1992). Ideas may be both novel and effective but have limitations that preclude them being viable options, for example, be effective but too costly or time-consuming. Idea evaluation is a critical part of the CPS process.

Truly innovative outcomes rarely surface in their final form. Like genuinely creative ideas, they may take years of thought and testing to perfect. When first conceived, these initial solutions may require refinement to become creative breakthroughs. The aim of idea evaluation is to critically examine their strengths and weaknesses by looking for their positive qualities and, if necessary, modifying them to overcome their weaknesses. Promising ideas can be killed off during this stage by misguided criticism, particularly by discouraging the problem solver. Many advocates of CPS advise shielding initial ideas from outside critics until they can be further refined (Conger 1995).

Idea Implementation Implementing the solution can be as challenging as generating a genuinely creative solution. Idea implementation is an essential part of the CPS process but has been given less attention by CPS researchers (Couger 1995). It is at the heart of the idea implementation stage of the CPS process. A problem isn't solved until the solution has been implemented.

Gaining acceptance and support for ideas requires the ability to convince others of the value or appropriateness of proposed solutions (Fogler and LeBlanc 1995). This requires anticipation of potential roadblocks to idea acceptance, identification of individuals likely to support or resist the idea, and development of strategic initiatives to gain support and resources necessary for successful implementation. Idea implementation involves the development of detailed plans for the performance of tasks and activities to resolve the problem. This involves the assignment of tasks and activities along with the timing and sequencing of those activities.

Finally, idea implementation would not be complete without a mechanism to assess its impact on problem resolution.

What does the CPS process look like in teaching : pedagogical and classroom application

The classroom lacks creativity (Gilbert, Prenshaw, and Ivy 1996; Ramocki 1994; Titus, 2000) Systematic creativity training can enhance creative thinking (e.g., Dodds 1998; Gilbert, Prenshaw, and Ivy 1992, 1996; Ramocki 1994). Research has been limited to the effectiveness of specific

idea-generating techniques and courses (Gilbert, Prenshaw, and Ivy 1992,1996) designed to enhance creative thinking. Educators need to address the teaching of the creative problem-solving (CPS) 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. If creativity can be taught, educational emphasis should be given to increasing knowledge of the CPS process.

Educators need to explore ways to integrate the CPS process and techniques into traditional problem-solving activities.

Problem Identification Identifying needs and problems initiates both the CPS process and ideas in particular subject areas. Current instruction provides few opportunities to develop problem sensitivity. Students are rarely required to learn though problem based learning. Many students have the mind-set that the subject areas has "thought of everything already."

Problem Delineation Students show difficulties adequately defining problems. Many students continue to confuse symptoms and problems, or fail to fully grasp the scope of problems, viewing them as unidimensional rather than multidimensional.

CPS techniques shown to facilitate problem delineation (e.g., Parnes 1988; VanGundy 1988): a variation of the "why?" method (Parnes, 1988), referred to as the "progressive abstraction" technique, redefines an initial problem as a set of problems requiring a set of solutions. It expands the scope of a problem by redefining it at progressively higher levels of abstraction. This helps to reveal the multidimensional nature of the problem and expands the solution set. It begins with an initial problem (e.g., The umbrella design makes it difficult to handle in windy conditions) and progresses by exploring the consequences of not resolving the problem. In essence, what other problems will surface if one is unable to find an acceptable solution to the initial problem (e.g., Consumers' arms will experience fatigue and they will get wet). The procedure is then applied to the new resulting problems) and continues until no new problems surface. It can reveal new problems that are sometimes easier to resolve than the initial one.

Information Gathering Effective CPS requires individuals to acquire the prerequisite knowledge and information necessary to thoroughly 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 full range of possible factors contributing to the problem. They may gloss over the information gathering stage and go to the idea/solution-generation phase without full knowledge of what causes the problem. This leads to incomplete or partial student solutions to the problem.
- sometimes don't appreciate the theoretical concepts and frameworks covered by traditional marketing instruction. Lacking domain-specific knowledge can lead to an anemic CPS process.

The CPS literature suggests a number of techniques for enhancing creative expression through the collection of information pertinent to the problem, for example

- use checklists for gathering data (Morrison 1991; VanGundy 1988),
- 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.

- the Lotus Blossom technique to question systematically the basic assumptions and constraints surrounding a problem, to see which assumptions to question or verify, thereby directing 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	-->	• the umbrella must have a pole, • the pole must be straight, • the top must be dome shaped, and • the only solution is to redesign the umbrella

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

Idea Generation Students' idea generation abilities need to be developed and refined. They
- need to be encouraged and 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. Students need to recognize that genuinely creative ideas do not typically surface via some mystical process but rather are the result of disciplined, systematic, sustained thought.

Techniques to assist in the idea generation process include
- brainstorming,
- attribute rearrangement
- the "radial diagram" technique, a free-association technique, a structured version of brainstorming approach. It categorizes and maps or links related ideas and solutions as they are generated. It focuses on the category of solution generated. This helps students see the usefulness 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.

Approaches to assist in the evaluation and refinement of ideas and/or solutions include
- using a comprehensive checklist to assess the viability of ideas (Isaksen and Treffinger, 1985). Their checklist has questions that address criteria re the issues / topic and usefulness of the proposed solution.
- developing a list of the strengths and weaknesses of the proposed idea in much the same way as traditionally has been recommended for student case analyses.
- "reverse brainstorming," (Couger, 1995), developed to identify the possible weaknesses of an idea. It focuses on generating criticisms or weaknesses of an idea rather than solutions to a problem. After generating criticisms, the group explores 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 Students seldom see their ideas implemented. Idea implementation provides the only real opportunity for students to receive realistic feedback concerning the quality of their

ideas. This may reduce student motivation and hamper student confidence in their abilities to successfully resolve such problems.

Most of the techniques used to assist in the idea implementation phase of the CPS process focus on the use of checklists and questioning techniques designed to identify important issues and barriers to idea implementation (e.g., resources, timing). These techniques fall short of providing students with realistic feedback concerning the quality of their ideas.

Environments conducive to creative scientific research are characterised by (Hewish,2001):

- freedom and encouragement to follow new leads spurred by one's curiosity,
- lively interactions within the group to test out new ideas,
- the courage to abandon fashionable theories and paradigms,
- the provision of adequate resources for the necessary work.

References

Adamson, R. E. 1952. Functional fixedness as related to problem solving. Journal of Experimental Psychology 44:281-91.

Amabile, T. M. (1983). Social psychology of creativity: A componential conceptualization. Journal of Personality and Social Psychology, 45, 357-377.

Baer, J. (1998). The case for domain specificity of creativity. Creativity Research Journal, 11,173-178.

Couger, J. D. 1995. Creative problem solving and opportunity finding. Danvers, MA: Boyd

Cropley (1997) added various stages to Wallas' model:

Cropley, A. J. & Urban, K. K. (2000). Programs and strategies for nurturing creativity. in K. A. Heller, f. J. Monks, R. J. Sternberg & R. F. Subotnik (Eds.), International handbook of research and development of giftedness and talent. Oxford, UK: Pergamon.

Duncker, K. 1945. On problem solving. Westport, CT: Greenwood. Fernald, Lloyd Jr. 1989. A new trend: Creative and innovative corporate environments. Journal of Creative Behavior 26 (3): 208-12.

Finke, R. A., Ward, T. B., & Smith, S. M. (1992). Creative cognition. Cambridge, MA: MIT Press.

Fogler, H. S., and S. E. LeBlanc. 1995. Strategies for creative problem solving.Englewood Cliffs, NJ: Prentice Hall.

Gilbert, F. W., P. J. Prenshaw, and T. T. Ivy. 1992. Creativity through education: A process for enhancing students' self-perceptions. Journal ofMarketing Education 14 (spring): 35-40.

Guilford, J. P. 1967. The nature of human intelligence. New York: McGraw-Hill. Grossman, J. 1997. Jump start your business. Inc., May, 36-54.

Hewish, A. (2001). Prelude to discovery The Kenyon Review 23 2 147-157.

Isaksen, S. G., and D. J. Treffinger. 1985. Creative problem solving: The basic course. Buffalo, NY: Bearly.

Morrison, D. 1991. Creative problem solving. Dallas, TX: Involvement Systems Incorporated.

Osborn, A. F. (1963). Applied imagination. New York: Scribner's.

Parnes, S. J. 1988. Visioning. East Aurora, NY: D.O.K. Ramocki, S. P. 1994. Is it time to teach creativity throughout the marketing curriculum. Journal of Marketing Education 16 (summer): 15-25.

Ramocki, S. P. (1994). Is it time to teach creativity throughout the marketing curriculum ? Journal of Marketing Education 16 (summer): 15-25.

Simon H. A. (2001). Creativity in the arts and the sciences The Kenyon Review 23 2 203-220. Simonton, 1988).
Simonton, D. (1984). Genius, creativity and leadership. Cambridge, MA: Harvard University Press.

Titus, Philip A (2000). Marketing and the creative problem-solving process Journal of Marketing Education 22, 3, 225-235.

Torrance, E.P. (1999). Torrance Test of Creative Thinking: Norms and technical manual. Beaconville, IL: Scholastic Testing Services.

Torrance, E. P. (1982). Hemisphericity and creative functioning. Journal of Research and Development in Education, 15, 29-37.

VanGundy, A. B. 1988. Techniques of structured problem solving. 2d ed. New York: Van Nostrand Reinhold.