

Review on Creativity Techniques for Product Development

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Abstract

Today, the market became competitive. Each and every day we need to provide something new that helps to link the consumer to gain their focus and lead to success and profit. The concept of providing something new which is useful can be termed as “Creative Product Development”. The individual’s perception for creative development of product may differ. The selection of creativity technique depends on the type of product. This paper contains the review of various few selected creativity techniques that can be applied to solve the problems and challenges faced during the product development stage where the multiple dimensions are taken in to consideration.

Keywords: Creative Problem Solving, Conceptual Design, Creativity Techniques, Innovation, Product Development

1. Introduction

In a previous era design of new product was an isolated activity, but in a modern industrial company the design of a new product is not an isolated activity. Product design is embedded in a larger process, which is called = product development’. Product development includes the development of a new product integrated

with the plans for its production, distribution and sales. Product development is primary part of the product innovation process (Refer Fig.1). Product innovation encompasses all activities that finally lead to acceptance of a new product in a market⁵.

The first part of the innovation process is called =product planning⁶. In this phase it is decided what product(s) will be developed and when. Product planning has two parts:

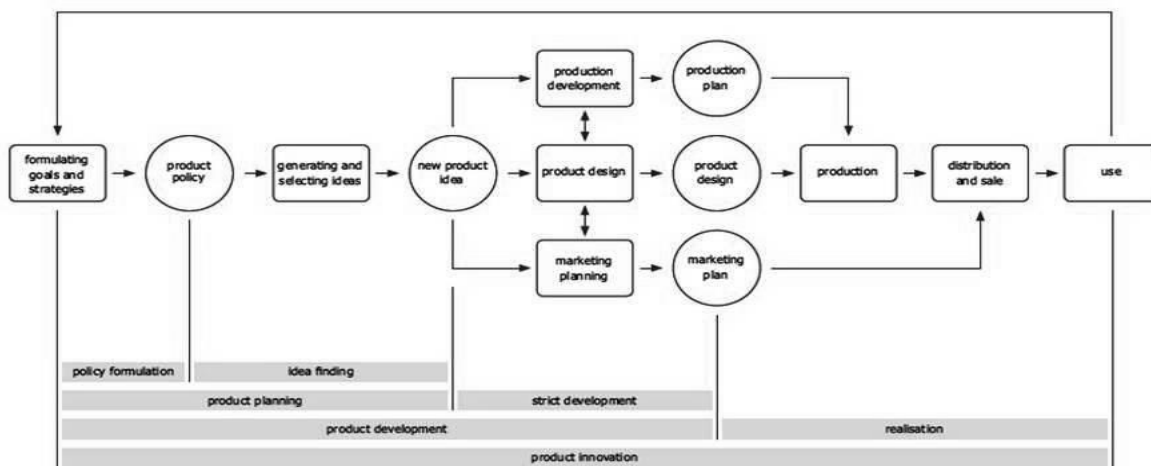


Figure 1. The Phases of the Product Innovation Process.

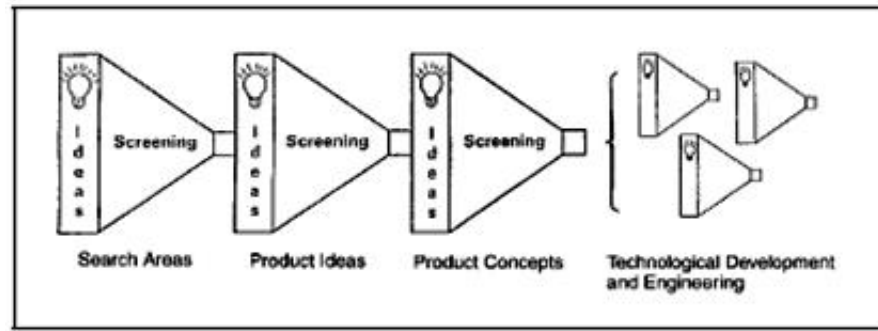


Figure 2. Creative Inputs in the Product Innovation Process.

=Policy formulation’ and = Idea finding’

When the process of product design starts, multiple problems that require creative solutions are triggered. These problems comprises of recognizing customer needs, generating innovative ideas for new product and its applications, development of concepts, altering various manufacturing processes, finding solutions for technical problems and developing new launching concepts². Main objectives of a creative thinking process is to think beyond limitations, to build interest, to drop normal, conventional ideas and procedures, to rely on the imagination, and to consider multiple solutions and alternatives generated through the divergent and random selections¹. In this way each problem ends with number of solutions. Through number of solutions achieved by creative inputs, one can be selected through screening and evaluation during product innovation process (Refer Fig.2). Each solution can be further checked technically as well, by experience or by applying creativity techniques systematically.

New product ideas are developed through the brilliant ideas generated by the efforts of highly creative individual. Although this method of new product ideas development is successful still an organization can not depend on a few highly creative individuals because of following reasons:

Within an organization only few people, approximately 10% of total, can be labeled as=highly creative’.

Because of limited resource, the productions of useful ideas are also limited.

2. Basics of Creativity and Innovation

The knowledge and experience are set in a fixed lines and paths in a human brain. The human brain follows these structured paths in a normal logical mode. Due to this conventional mode of thinking, original ideas or novel solutions to a given problem cannot be generated. When people leave these structured paths and start to merge their previous knowledge and experience that have no obvious relationship results into creative thinking.

Creative thinking can be stimulated by Heuristic Principles (i.e., searching, investigative or examining) such as association, generalization, integration, separation, deviation, and transfer of structures between problems which are not interconnected. Creativity techniques are based on these specific heuristic principles, which are integrated into the rules of the techniques and must be properly applied².

2.1 Creativity

Creativity is the process of generating something new that has value. There are many original ideas and concepts, but many of them are may not have value and hence may not be considered creative. Hence, creativity is a learned skill that enables us to define new relationships between concepts or events, which seemed actually isolated before, and which results in a new entity of knowledge.

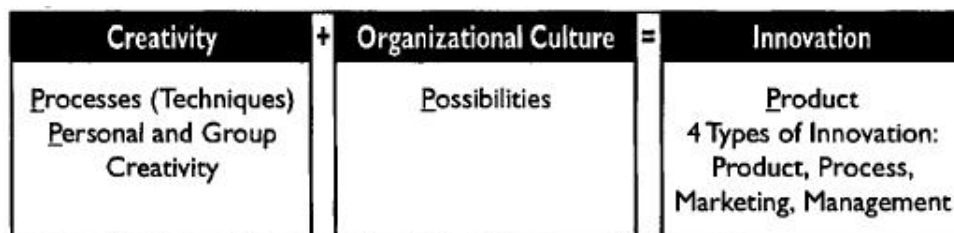


Figure 3. Relation of Four P’s.

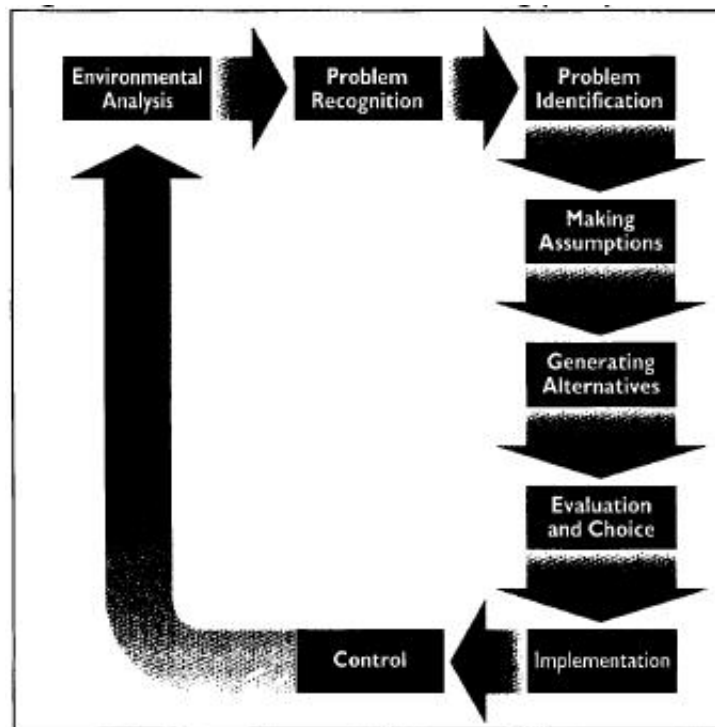


Figure 4. Creative Problem Solving (CPS) Processes.

There are two ways to increase the creativity, either by learning techniques/ processes or by increasing personal and group creativity. If these techniques are followed with the right possibilities and in appropriate culture than it results into innovation.

The levels of creativity and innovation can be raised by understanding of four P's:

- Product
- Possibilities
- Processes/ Techniques
- Personal & Group Creativity

The first P- Product is achieved only after achieving the remaining 3 P's (Refer Fig.3). The product is the result of the creation/innovation process. Creative product doesn't mean only originality, but it should have value. The possibilities for creativity and innovation must exist for innovation. To increase the creativity of problem solving, several techniques can be used within an organization, which requires time as well as efforts to learn. These processes are aimed to increase creativity in all stages of the problem-solving process. Personal creativity can be increased by following bilateral efforts³:

- Increasing the use of the right brain (if right handed) or vice versa
- Raise Level of perceptions and cross the restricted boundaries (freeing from socialization)

2.2 Innovation and its Types

The process of change in organizations and its market contribution to win customers through the development of sustainable competitive advantage is termed as—Innovation⁴. There are four principal types of innovation:

1. Product Innovation: It results in new products/ services, or increasing the quality of existing products/ services.
2. Process Innovation: It results in enhanced processes (operations, finance etc.) within the organization to improve effectiveness and efficiency.
3. Marketing Innovation: It is related to the marketing functions of promotion, cost and distribution, product functions like packaging or advertising.
4. Management Innovation: It improves the way of management within the organization.

3. Creative Problem-Solving (CPS) Process

Fundamental part of organizational life is problem solving. Every time problems are raised when a person starts to produce a product/ service and decisions are made to solve these problems. Some member of an organization thinks of a new way every time to reduce costs invents a new product/ service to improve the

function of an organization. To achieve this, problem solving is taking place, but it's not creative always. Following are the basic eight stages in the creative problem solving process (Refer Fig.4)³:

- Analyzing the environment
- Recognizing a problem
- Identifying the problem
- Making assumptions
- Generating alternatives
- Choosing among alternatives
- Implementing the chosen solution
- Control

Some expected results of the creativity process are:

- New product and process ideas innovation
- Continuous improvement of products or services
- Increase in productivity
- Increase efficiency
- Rapidity and flexibility
- Improved quality of products or services
- High performance

4. Creativity Techniques

Once the problem is analyzed, the conceptual design (creative act of finding new ideas and concept) phase begins. Product ideas and concepts have to be generated after formulation of design problem, product vision and listing of product requirements. An Idea is a first thought that comes to mind, in form of simple drawing usually, without any properties, shape, specification, materials etc. whereas concepts are more developed, have all the details and technical solution principles.

The process of developing initial ideas into concepts and offering realistic solutions to the design problem through creative thinking is termed as —Conceptual Design]. It is a divergent and convergent process in which ideas are generated, sorted, tested, evaluated and developed into concepts (Refer Fig. 5).

Ideas are generated through creative techniques. The techniques which encourage creative action and gives solutions to problems are called 'creativity techniques'. Creativity techniques are very useful in the design process as it gives huge quantity of ideas within a short period of time. Most of these techniques are general and valid to wide variety of problems. Creativity techniques are classified as follows:

1. Inventorying Techniques: All kind of information around an issue in terms of ideas or data etc are collected and recalled using these techniques.
2. Associative Techniques: Huge amount of ideas and options are generated through association within short period of time as it encourages spontaneous reactions to ideas expressed earlier.
3. Confrontational Techniques: Ideas are generated thinking outside the references and boundaries. This leads to completely new, unexpected viewpoints which bring the solution of a problem.
4. Provocative Techniques: Assumptions and preconceptions are identified and broken within the references and boundaries. Ideas will appear strange at first, but when forcefully fitted within the set boundaries it gives new ideas. It contains the principle of making the strange familiar and the familiar strange.
5. Intuitive Techniques: Formation of a new perspective on the original issue can be done using these techniques. It has great influence on motivation and enthusiasm of the team members.
6. Analytic-Systematic Techniques: It is based on the analysis and systematic description of a problem, sub problems, and the systematic varying and combining of these solution variants.

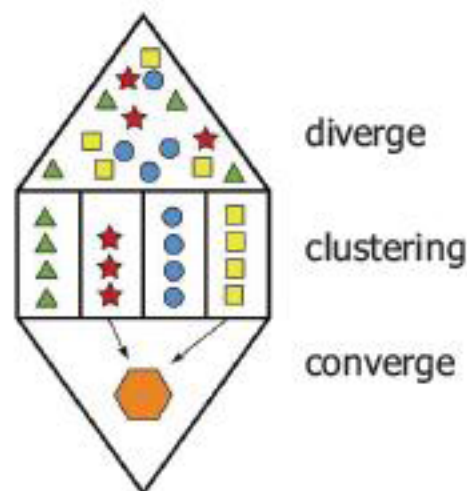


Figure 5. Creative Diamond.

There are approximately 189 creativity techniques (Refer Annexure I) under the above various categories. But the major question arises is when and how to process with these techniques in an organization for finding the solution for the raised problem. The following few techniques are explained further.

- Assumption Busting
- Brainstorming
- Browsing
- Creative Problem Solving
- Dimensional Analysis
- Flow charts
- Gap analysis
- Laddering
- Listing
- Simplex
- Six Thinking Hats
- SWOT Analysis
- Trigger Method
- Using Experts
- Value Engineering
- Visualizing a Goal

4.1 Assumption Busting

- List all the obvious assumptions which is not much challenging.
- Examine each assumption by asking under what conditions it would not be true.
- Start to make assumptions as you challenge some assumptions
- Add these to the list, and challenge them later.
- Force the assumption to be true through finding several ways.

4.2 Brainstorming

- The basis of Brainstorming (Introduced by Alex Osborn) is to increase the volume of possible ideas by sharing a problem across 5-10 members to obtain a wider array of different ideas within short time.
- With a group of people brainstorming is a powerful technique as it helps to create new ideas for solving problems through motivation of team members.
- Brainstorming is not a random activity but it needs to be structured and must require to follow brainstorming rules.
- Prepare a group
- Present the problem
- Guide the discussion

5. Browsing

The browsing technique is normally used to find the creative literature which can be further utilized for product development.

Basically following are the three types of browsing:

- Purposive browsing: Seeking a defined piece of information intentionally.
- Capricious browsing: Observing material randomly without a definite goal.

- Exploratory browsing: Looking for creativeness significantly.

5.1 Creative Problem Solving (CPS)

- It is a thoughtful or measurable creativity technique.
- CPS is the well-structured process of finding creative solutions beyond the conventional thinking for a problem raised in an organization.
- Following are the stages of CPS suggested by Van Gundy (1988's)
 - Mess Finding
 - Data Finding
 - Problem Finding
 - Idea Finding
 - Solution Finding
 - Acceptance Finding

5.2 Dimensional Analysis

The process of exploring the problem or evaluating options through checklist that relates to Five Ws and H.

- The technique is associated more with human relations rather than a technical nature.
- Following checklist are the types of dimensions for this technique:
 - Substantive Dimension (=What?)
 - Spatial Dimension (=Where?)
 - Temporal (=When?)
 - Quantitative (=How much?)
 - Qualitative (=How serious?)

6. Flow Charts

- A flowchart is a type of diagram that represents an algorithm, workflow or process, set of rules, methodology and their order by connecting them with arrows.
- This diagrammatic representation explains a solution model to a given problem.
- During decision phase, action planning where chains of events are likely to change dynamically, the flow diagrams is required.

6.1 Gap Analysis

- It is a systematic analysis throughout the whole area of a given technology for remained or generated 'gaps'.
- It is used to highlight insufficient areas in existing technology that are open for creative inputs and improvements.

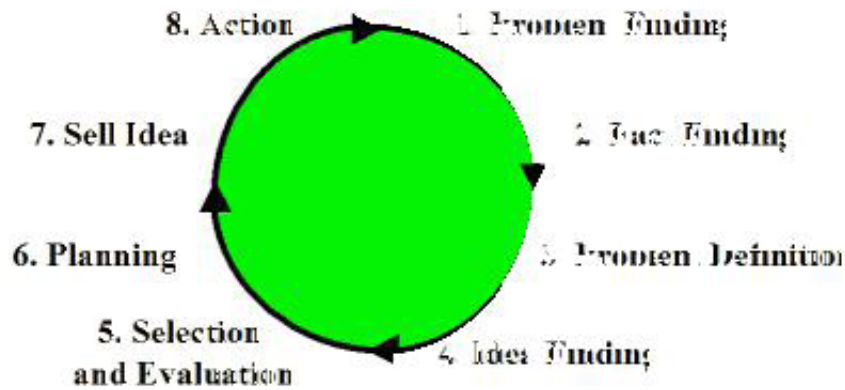


Figure 6. Simplex Process.

6.2 Laddering

Laddering is the technique to create ideas by switching to and from between different levels of abstraction.

Following are the sequential steps to apply this technique:







- Define the existing ideas
- Ladder UP
- Ladder Down again
- Ladder UP again
- Ask Why? Or So What?

- Construct-triad method

6.3 Listing

- Listing is a derivative of the attribute listing technique.
- Writers use this simplest strategy to generate ideas initially.
- During this phase the ideas and experiences are listed within a described time limit.
- Then write down as many ideas as you can without stopping to analyze any of them

Table 1. 1 Six Thinking Hats

| | |
|---|---|
|  | <i>White Hat thinking</i> This covers facts, figures, information needs and gaps. |
|  | <i>Red Hat thinking</i> This covers intuition, feelings and emotions. |
|  | <i>Black Hat thinking</i> This is the hat of judgment and caution. It is a most valuable hat. |
|  | <i>Yellow Hat thinking</i> This is the logical positive. Why something will work & offer benefits. |
|  | <i>Green Hat thinking</i> This is the hat of creativity, alternatives, proposals, interesting & changes. |
|  | <i>Blue Hat thinking</i> This is the overview or process control hat. |

6.4 Simplex

- The industrial-strength creativity tool which takes the DO IT method to next level of sophistication.
- Simplex is a continuous cycle (Refer Fig. 6) rather than a straight line process.

Figure 6. Simplex Process.

6.5 Six Thinking Hats

- There are six metaphorical hats.
- The thinker can put on or take off, which is essential, one of these hats to indicate the type of thinking being used.
- When done in group, everybody wear the same hat at the same time.

6.6 SWOT Analysis

- Technique used to find the Strength and Weakness (Internal Factors) of an individual and to study various Opportunities and Threats (External Factors) attached along with individual/ activity.

- Strengths: Check Advantages – Be Realistic – List Characteristics.
- Weaknesses: Check Limitations – Be Realistic – List Unpleasant.
- Opportunities: Look For Interesting Trends, Available Useful Opportunities.
 - Changes in the market, Social Patterns, Lifestyle changes, new technologies, Government Policies etc.
 - Alterations in government policies.
- Threats: Think For Obstacles, Competitors, and Changes in Technology, bad debt or cash-flow problems.

6.7 Trigger Method

- It is an analysis based on repetition. One idea triggers another and another and so on. The process is repeated unless and until possible thoughts are generated.
- Problem is defined, debated and ideas noted
- A selection of these ideas are collected

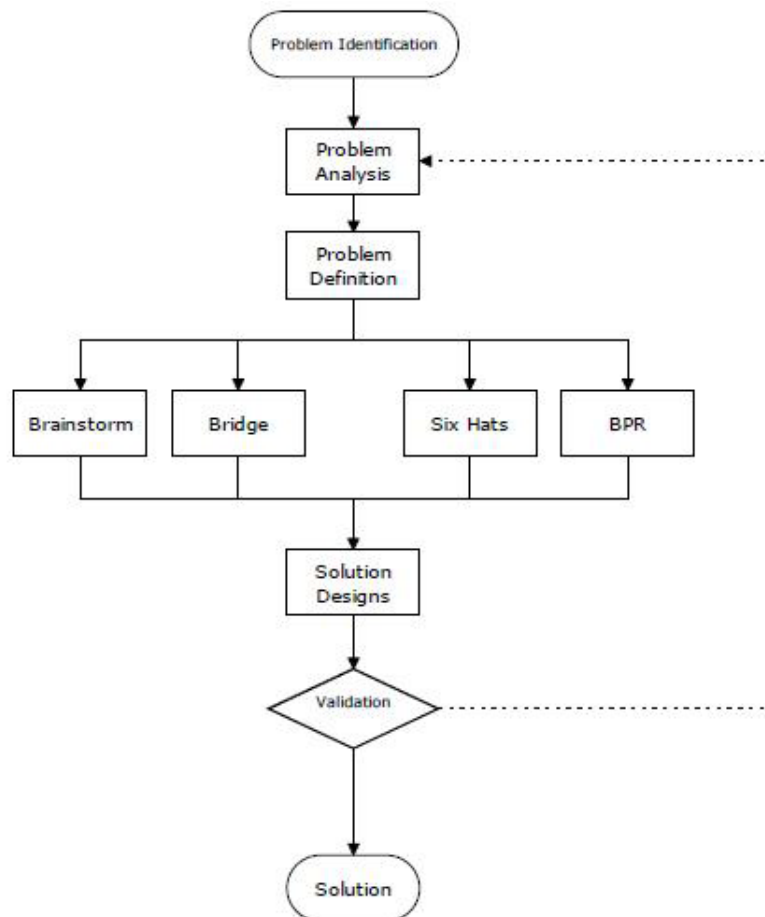


Figure 7. Creative Thinking Generic Process Model.

- Then few are randomly gets selected and displayed which are used as 'triggers' to generate more ideas

6.8 Using Experts

- When the project / activity / product will reach in its final stage at that time various parameters which are crucial are discussed or solved by taking opinions from the experts.
- This includes factors like cost, technical feasibility, and technical development etc.
- The process is carried out by expert to expert questionnaire or by expert survey method.

6.9 Value Engineering

- The technique by use of which, the usefulness of a product will be maximized via the most cost effective means:
 - Identify its Basic Function - Secondary Function - Supporting Functions
 - Cost-Effectiveness
 - Ideas to improve each Function Systematically

6.10 Visualizing A Goal

- Set your goal by settling on the aim – Collect Details – Think Positive – Work Regularly – Pursue the goal, until it is achieved – once the goal attained, move onto the next goal.

7. Conclusion

Creativity is the process of diverging, sorting and then converging to the definite ideas. Further the creative techniques are used to solve the problem raised during the process of product development. The various types of techniques are reviewed and mostly used techniques are summarized together. These techniques may be followed in a random sequence without any comparison as per the requirements for development of the product.

Development of product receives a lot of interest within industry. Their business success depends on their capability to continuously develop products using creative and innovative product development in terms of many parameters of product like aesthetics, ergonomics and its functionality. Creativity is a complex human phenomenon that is widely believed to be difficult to analyze and inaccessible to precise measurement. The product value entirely depends on the aspect of creativity. More the creative product more will be its value in market. The techniques which are listed above are further used to develop a prototype in future.

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Annexure I

| | | | | | |
|--|-------------------------------------|------------------------------|----------------------------------|----------------------------------|--------------------------------|
| 7 Step Model | Circle Time | False Faces | Laddering | Problem Inventory Analysis - PIA | Sticking Dots |
| Adaptive Reasoning | Clarification | Fishbone Diagram | Lateral Thinking | Problem Reversal | Stimulus Analysis |
| AIDA | Classic Brainstorming | Five Ws and H | Listing | Productive Thinking Model | Story Writing |
| Algorithm of Inventive Problem Solving | Cognitive Acceleration | Flow charts | Listing Pros and Cons | Progressive Hurdles | Strategic Assumption Testing |
| Alternative Scenarios | Collective Notebook | Focus Groups | Metaplan Information Market | Progressive Revelation | Strategic Choice Approach |
| Analogies | Comparison tables | Focusing | Mind Mapping | Provocation | Strategic Management Process |
| Anonymous Voting | Component Detailing | Force-Field Analysis | Morphological Analysis | Q-Sort | Successive Element Integration |
| ARIZ | Concept Fan | Force-Fit Game | Morphological Forced Connections | Quality Circles | Super Group |
| Assumption Busting | Consensus Mapping | Free Association | Multiple Redefinition | Random Stimuli | Super Heroes |
| Assumption Surfacing | Constrained Brain Writing | Fresh eye | NAF | Rawlinson Brainstorming | SWOT Analysis |
| Attribute Listing | Contradiction Analysis | Gallery method | Negative Brainstorming | Receptivity to Ideas | Synectics |
| Backwards Forwards Planning | Controlling Imagery | Gap Analysis | NLP | Reciprocal Model | Systematic Inventive Thinking |
| Body storming | Crawford Slip Writing | Goal Orientation | Nominal Group Technique | Reframing Values | Talking Pictures |
| Boundary Examination | Creative Problem Solving | Greetings Cards | Nominal-Interacting Technique | Relational Words | Technology Monitoring |
| Boundary Relaxation | Criteria for idea-finding potential | Help-Hinder | Notebook | Relaxation | Think Tank |
| Brain Sketching | Critical Path Diagrams | Heuristic Ideation Technique | Observer and Merged Viewpoints | Reversals | Thinkx |
| Brainstorming | Decision seminar | Hexagon Modelling | Osborn's Checklist | Role Storming | Thrill |
| Brain writing | Delphi | Highlighting | Other Peoples Definitions | SCAMMPERR | TILMAG |
| Browsing | Dialectical Approaches | Idea Advocate | Other Peoples Viewpoints | SCAMPER | Transactional Planning |
| Brute think | Dimensional Analysis | Idea Box | Paired Comparison | Sculptures | Trigger Method |

| | | | | | |
|-----------------------|----------------------------|----------------------------------|--------------------------------|------------------------------|---------------------------------------|
| Bug Listing | Disney Creativity Strategy | Ideal Final Result | Panel Consensus | SDI | Trigger Sessions |
| Bullet Proofing | DO IT | Imagery for Answering Questions | Paraphrasing Key Words | Search Conference | TRIZ |
| Bunches of Bananas | Do Nothing | Imagery Manipulation | PDCA | Sequential-Attributes Matrix | Tug of War |
| Card Story Boards | Drawing | Imaginary Brainstorming | Personal Balance Sheet | Similarities and Differences | Unified Structured Inventive Thinking |
| Cartoon Story Board | Escape Thinking | Implementation Checklists | Pictures as Idea Triggers | Simple Rating Methods | Using Crazy Ideas |
| CATWOE | Essay Writing | Improved Nominal Group Technique | Pin Cards | Simplex | Using Experts |
| Causal Mapping | Estimate-Discuss-Estimate | Interpretive structural Modeling | PIPS | Six Thinking Hats | Value Brainstorming |
| Charrette | Exaggeration | Ishikawa Diagram | Pluses Potentials and Concerns | Slice and Dice | Value Engineering |
| Cherry Split | Excursions | Keeping a Dream Diary | PMI | Snowball Technique | Visual Brainstorming |
| Chunking | F-R-E-E-Writing | Kepner and Tregoe method | Potential Problem Analysis | SODA | Visualizing a Goal |
| Circle of Opportunity | Factors in selling ideas | KJ-Method | Preliminary Questions | Soft Systems Method | Who Are You |
| | | | Problem Centred Leadership | Stakeholder Analysis | Working with Dreams and Images |

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