

# Creativity Methods for Automation Specialists

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*Abstract:* - This paper discusses the importance of creativity and presents creativity-related facts and figures along with a total of ten methods for use by automation specialists to generate new ideas.

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## 1. Introduction

Today, creativity is playing an important role than ever before in the success or failure of an organization in the global competitive economy. Thus, innovation for many companies is not an issue, but it is the only issue. A recent survey of 500 Chief Executive Officers (CEOs) in the United States put creativity and innovation as the most important factor for survival and only 6% firmly believed that they were in effective position to achieving it [1].

More specifically, in regard to engineering organizations, a recent study revealed that 71% of the United Kingdom (UK) engineering companies believe that creativity is very important for the success of their business [2].

Each day engineers, automation specialists, and others are faced with various types of problems and they try to overcome these problems through various means including the use of creativity methods. Many of these methods are presented below, subsequently.

## 2. Creativity-Related Facts and Figures

Some of the United States, directly or indirectly, creativity-related facts and figures are as follows [2, 3]:

- Sysco Corporation, a \$23 billion food distributing company, reported that employees who took part in creativity training increased their sales between 25 – 30% on the average.
- APL/NOL, a major ocean shipping company, reported an impact of \$46.6 million from cost reduction and avoidance, improved asset management, and revenue increase early into a creativity change program.
- Snack-food giant Frito-Lay reported more than \$100 million in cost reductions due to creativity training sessions to its employees.
- Guidant, a medical equipment manufacturer leaped into Fortune's list of the top 100 companies to work for and came thirty-first in its first try because of its creativity-related efforts.
- 3M, a diversified technology company that aggressively pursues innovation, reported that it has generated over \$4 billion annually from new product introductions over the past four years.
- During the period 2000 – 2001, after the addition of Islands of Adventure,

attendance at Universal Studios' two Florida theme parks climbed 11% and crowds at Disney's four Florida parks dropped 6%.

### 3. Creativity Methods

There are many creativity methods used in various sectors of economy and they can be classified under six categories: brainstorming methods, methods of creative orientation, systematic structuring, creative confrontation, systematic problem specification, and brain-writing methods [4-6]. Twenty of these methods considered useful for automation specialists or engineers are presented below [2, 5, 7].

#### 3.1 Crawford Slip Method (CSM)

This creativity method was developed by C.C. Crawford in the 1920's [7]. It is quite useful to address complex problems by using a group of people. Although, CSM allows using a group of large number of individuals, but usually the group is comprised of twenty or thirty people.

In this method, the group leader devises a detailed set of target statements for eliciting responses from the group members. The members are provided with a pile of slips and are asked to write down as many ideas as possible to the set of target statements. In turn, they spend a short time in writing down their ideas using a fresh slip for each idea. At the end of this process all slips are collected and then all the ideas are incorporated into a final report.

Some of the useful guidelines for the group participants to follow, for the purpose of making the ideas clear and concise and easy to use at later stages, are listed below [7, 8].

- Avoid using jargon.
- Use simple words and short sentences.
- Write in note form.
- Do not write more than one sentence on each slip.

- Write all acronyms in full.
- Write on the top edge of each slip.
- If an explanation is considered essential for an idea, write it on a separate slip.

Additional information on the method is available in Ref. [7].

#### 3.2 CNB Method

This is a group-based technique and it assumes that all the group participants clearly understand the objective of the problem and are willing to cooperate fully. The following steps are associated with this method [8, 9]:

- Provide each participant of the group with a package that contains items such as problem description, a notebook, preparation material, and all relevant creative aids.
- Allow each group participant some time (e.g., one week) for finding a solution to the given problem and request that during the allotted time period all ideas must be recorded each and every day. At the end of the allotted time period, require all participants to choose their best ideas and summarize the remaining ones. In addition, request them to write their thoughts in the notebook for further exploration.
- Collect all the notebooks and study them and then prepare a report on the issue under consideration.
- Invite all group members to review the collected notebooks.
- Schedule a meeting of all involved parties for reviewing the proposed solutions and at the end choose the most promising solution.

This method is described in detail in Ref. [8].

#### 3.3 Force-Field Analysis Method

This method was devised by Kurt Lewin as a model for managing change [7]. Lewin argued that a change occurs when the change driving forces exert greater pressure than the restraining forces that resist it. The tendency of people wanting the change is to push for it, in turn, this usually generates resistance. Needless to say, as per Lewin [7] a better way to bring about change is to lower the resistance to change rather than increasing the pressure. The force-field analysis method is quite useful for identifying ways to do this. More specifically, defining the challenge, identifying strengths and weaknesses, and then doing something about it.

The following three steps are associated with the force-field analysis method [5-9]:

- Prepare two lists: one containing all the positive forces and the other all the negative forces.
- Develop a diagram that shows the above two lists in columns either side of a central divide. More specifically, these lists show the tug-of-war between them.
- Utilize the diagram to determine the ways and means for reducing the divide.

### 3.4 Attribute Listing Method

This is a single-person use (i.e., for problem solving/idea generation) method and it was developed by Robert P. Crawford [7, 10]. The method is fairly simple and straightforward and requires the listing of attributes of an item or idea and then examining each attribute in turn with the intention of making improvements on the item/idea.

Attribute listing is particularly useful for making improvements in complex products and service procedures. For example, here one can list the stages in a service process for solving a specific problem with quality, speed, or cost. In turn, generate ideas to improve quality or speed, or reduce cost.

Finally, it is added that in this approach the physical attributes are not the only ones

that one can list but it also allows you to examine the subject under consideration from all sorts of angles. For example, one can list social attributes (e.g., responsibilities, politics, and taboos), price attributes (e.g., cost to manufacturer, customer, and supplier), process attributes (e.g., marketing, manufacturing, and distributing time), and psychological attributes (e.g., needs and image).

This method is described in detail in Refs. [7, 10].

### 3.5 The Seven by Seven Method

This method was developed by Carl Gregory for evaluating and prioritizing a large number of ideas generated in response to a particular objective [7]. These ideas may have been generated through brainstorming or noted over a period of time as they may have come along. The name of the method is derived from the fact that one begins by setting out his/her idea slips on a seven by seven racking board (i.e., the one with seven columns and seven rows).

However, one can start this method/process as soon as he/she has exhausted his/her pile of idea slips. The method is composed of the following nine steps [7-9]:

- Combine similar ideas.
- Discard all irrelevant ideas.
- Modify the ideas as considered appropriate.
- Defer all ideas considered untimely.
- Review all combined, excluded, modified, or deferred ideas with the aim of gaining any additional ideas or insights into the remaining slips/ideas.
- Classify ideas by dissimilar columns (i.e., put the ideas into related groups)
- Rank ideas in each and every group.
- Generalize columns by giving little to each column.
- Rank columns.

All in all, this process/method results in fewer ideas and a structured order of priority.

### 3.6 Mind Mapping Method

This method was originally developed by Tony Buzan in the mid-1970's for note taking [7]. Also, it works extremely well for generating new ideas. Mind mapping is a visual and a free-form method of developing ideas using right-brain thinking. Mind maps make use of association literally to draw connections between ideas and develop a map of a subject. Some of the useful guidelines associated with this method are as follows:

- Make use of just key words or if possible images.
- Begin from the center of the page and work out.
- Ensure that the center depicts a strong and clear visual image of the general theme of the map.
- Develop/create sub-centers for sub-themes.
- Put important/key words on lines for reinforcing structure of notes.
- Print rather than writing in scripts.
- Make use of appropriate colours to depict themes and associations for making things stand out.
- Think in the term of three dimensions.
- Make use of icons, arrows, or any other visual aids for showing links between different elements.
- Avoid getting stuck in one specific area.
- Put all ideas down as they occur.

Additional information on this method can be found in Refs. [6-8].

### 3.7 Rice Storm Method

This method is also known as TKJ method and it was originally developed in Japan. The method focuses on the objective of the group rather than the group participants.

Furthermore, the method preserves the anonymity of the person generating each idea. This method can be very useful in circumstances when group commitment and cohesion is required. Another main advantage of the process of identifying the problem and then looks for solutions. This aspect is extremely useful because misunderstanding or disagreement about the problem can be one of the causes of failure or friction in a creative group. Nonetheless, the rice storm method is divided into two stages as shown in Fig. 1 [7].

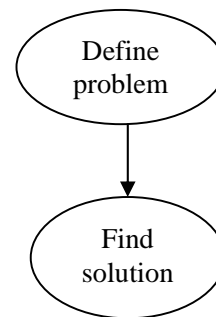


Fig. 1 Rice storm method stages

The stage “define problem” is composed of the following actions [5, 7]:

- The group leader outlines the general theme to the group that covers the areas of the problem. In turn, the group members write down all relevant facts on index cards (i.e., one fact per card).
- The group leader collects all the cards by ensuring their anonymity and then redistributes them to group participants.
- The group leader reads a randomly chosen card aloud.
- Group members review their stack of cards and then choose the ones that relate to the card that was read. In turn, they read out these cards to group members and at the end they form a set of all related cards. Also, they assign a name to the set.

- This process is repeated until the grouping of all the cards into named sets.
- The same process is repeated to these sets until the creation of a single set with a name. In fact, this named set is group members' consensus definition of the problem.

Similarly, the stage "find solution" is composed of the following six actions [5, 7]:

- Group participants write down each possible solution to the defined problem on a fresh index card.
- The group leader collects all the cards and redistributes them to all group members.
- The group leader selects a card at random and reads it out to the members of the group.
- The group members review all their cards and select the ones that relate to the card that was read. At the end, they form a set of all cards or ideas and then assign a name to it.
- The process is repeated until the sorting of all cards into sets with assigned names.
- A resulting solution set is generated and named from these sets. The group leader with the help of group participants turn the resulting solution set into a statement that expresses the consensus solution.

Additional information on this method is available in Refs [5, 7].

### 3.8 Delphi Method

Its name is derived from a city of ancient Greece called "Delphi", home to the Delphi Oracle. Here, the Oracle was approached to get information about future. Nonetheless, the Delphi method was originally developed at the RAND Corporation by Olaf Helmer and Norman Dalkey in 1969 for technical forecasting.

This method may simply be described as a group decision process about the likelihood that certain events will occur. More specifically, this is a non-interactive method that generates creative input from a disparate group of individuals. Furthermore, the Delphi method is quite specialized and is used when one wants to call on the ideas of a group of experts (who are probability geographically separated) for generating a forecast [4-8].

Questionnaires are sent to each group member (i.e., expert) their inputs/responses combined and refined, and then sent back to them. This process is repeated till reaching the consensus.

### 3.9 Six Thinking Hats Method

This is a quite useful method and it was developed by Edward deBono in the early 1980's [7]. The method sets out a framework for thinking that considers six different modes of thinking and enhances thought clarity by utilizing only one at a time. More specifically, this is a method of thinking about any problem which separates an individual's or a group's thoughts into six different types of thinking (e.g., logical, emotional, creative, etc.).

DeBono used six different colours to identify six different types of thinking (i.e., white hat thinking, red hat thinking, yellow hat thinking, black hat thinking, green hat thinking, and blue hat thinking). Each of these thinking hats is described below [5, 7]:

- **White hat thinking.** This is concerned with pure facts and figures (i.e., looking at data without passing any judgments).
- **Red hat thinking.** This is associated with expressing feelings, intuitive responses, and hunches.
- **Yellow hat thinking.** This is a positive and optimistic thinking hat. More specifically, this is the hat of constructive thinking that examines advantages and reasons why the project/plan will work.

- **Black hat thinking.** This is the most negative hat and it examines obstacles and reasons why the item/plan/project would not work.
- **Green hat thinking.** This hat is used for the most creative thinking and it may be said that it is the hat of change, provocative ideas, and alternatives.
- **Blue hat thinking.** This hat is used when one is standing back and taking an overview. More specifically, in this case one looks not so much at the subject but at the thinking itself.

This method is described in detail in Refs [5, 7].

### 3.10 Storyboarding Method

This method was originally developed by Walt Disney for planning animated films and it was refined further by Mike Vance, one of Walt Disney's executives. Walt Disney developed series of illustrations depicting important scenes in the film, and then developed a story around each one for the purpose of fleshing out the plan. In its business use, the storyboarding method entails creating a board for setting out important concepts and then linking them together.

Storyboarding is a very creative process for project management and problem solving and some of its benefits are as follows [4, 7]:

- A useful tool for immersing into a project/problem, piggy-backing on ideas, and seeing new areas for attention.
- Permits the visualization of the entire picture because of putting the ideas up on a board. More specifically, this allows to see how the ideas interconnect and fit together.
- The storyboard can be kept in place on the wall throughout the life of the project or the problem-solving process.

This method is described in detail in Refs. [5, 7].

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