

Evaluation of "classic" creativity tools and TRIZ tools in ideation workshops

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Abstract

For a number of years we have consistently used TRIZ in our innovation process for Philips as well as for external clients, and particularly in workshop settings. To better be able to determine which creative technique is best suited to solve a given problem, we have started to systematically investigate how the workshop participants experience the various creative techniques that we employ. Based on this investigation first conclusions will be shown on how selected TRIZ tools are experienced in comparison to other creative techniques.

Keywords

TRIZ, creative techniques, workshop, experience, comparison

1 INTRODUCTION

1.1 Pertinent Questions

For more than ten years now we are employing ideation workshops on a regular basis to support our clients in finding suitable solutions and new ideas for the problems they face. For most of this time TRIZ tools have been part of the creative techniques we use in those settings.

We have recently started to systematically investigate how workshop participants experience the various creative techniques that we employ. We are doing this for a variety of reasons:

A first key issue that we are confronted with every time we are starting an ideation project is that of determining which creative technique is best suited to solve a given problem. A number of aspects come into play here.

- Firstly we face limited resources available for such projects. Typically there is time for one ideation session, and therefore our aim is to use this time as efficiently as possible to create the right ideas. Within this short time available, we may use a number of different tools, to ensure that the problem at hand is investigated from different promising vantage points. From the seemingly endless list of possible tools and approaches that can be employed to solve a given problem, and as explained in another paper published a year ago [1], we use the insights from our experience to judge the suitability of those tools to solve the problem at hand – a qualitative judgement.
- Secondly, we have to balance the effectiveness of any tool employed in finding the right ideas with the natural exhaustion that the participants experience throughout the session. Using a variety of different tools throughout one session is, in our experience, one way of keeping interest, and this may be linked to how well the participants are inspired and feel energized by using any specific technique.
- Furthermore, how well the participants are acquainted with the use of a specific tool may further influence the way they perceive its use. In general we have little time to train the participants, and the tools are introduced – within a maximum timeframe of 5 minutes. This restriction also means that only a limited number of TRIZ tools are suitable to be employed in our workshops.

The issue of matching a given technique to a problem at hand is also frequently addressed in literature: Darrell

Mann for example proposes a "Select Tool" in which TRIZ-related techniques are prioritised according to a number of problem / opportunity scenarios [2]. Gijs van Wulfen explains to some extent "twenty-five brainstorm techniques" [3] including a number of TRIZ-related ones, explaining in which cases these techniques should be used. It is our intention to create an overview that helps matching problems to creative tools based on the feedback from participants of our creative sessions.

A second key issue that we see is that of measuring the success and impact that our services have on the business of our clients. On some aspects such measurement can easily be provided, for example:

- Cost savings realised in production
- Number of patents applied for
- The amount of times saved by shortening the duration of certain development activities

Very often, however, measurements such as these are not available – or even predictable - at the end of our workshop or ideation project. This, for example, due to the fact that the results from the ideation session may well be influenced by other decisions later in the ideation or development project, so such measurements are not always a reliable indicator for the effectiveness of a workshop or tool employed.

A third key issue is that of improving our skills and the application of our techniques. The feedback we gain through our investigations help us to see critical issues that are otherwise easily overlooked, refine our approach and the use of the different creative techniques, and generally become more sensitive to the needs of our clients.

Finally, we often see that such workshops have secondary objectives, such as involving certain people and stake holders in a creation process or creating a team-spirit.

For the purpose of this paper we use the data that we collected to focus on the question how two specific TRIZ related tools compare to two other idea creation techniques on a set of criteria (described later).

1.2 The structure of Ideation

Before diving into the approach of our investigation, it is worthwhile to define the context of ideation as we use it, and the limiting factors within which creative techniques such as those from the TRIZ toolbox are used.

Our organization is mainly focussing on contract R&D work and supports the development of products, applications and technical solutions. Many of our clients are based around physical products but we also work with customers in the service sectors, such as energy provision, finance and for societal issues needing input from different profit and not for profit organisations. Typical problems we are solving with our ideation approach include questions such as:

- In our factory we have a production machine for a certain process and we constantly experience problems there. Can you help us find a good solution?
- We have a new product idea, but to get it manufactured appears to be very difficult. Can you help us to find a way to manufacture this product?
- We know we have to start a number of projects in the area of xyz. Can you help us to create and identify the most suitable projects?
- We have developed a certain technology, and would like to investigate if it can be utilised in other applications. Can you help us to find those application fields?

It is apparent that the potential answers to these questions are on different levels, from solving specific technical problems via the creation of new product concepts to more conceptual solutions. So we initially pay particular attention to the definition of the objective. The environment of the product or service at hand needs to be well investigated so that the individual elements of the problem are known and understood, and the scope and requirements are clear.

Depending on this first phase, and based on our experience, we decide on the most suitable tool to create solutions for the problem. The use of these tools is then prepared, often with the aid of technical or marketing specialists from our and our client's organisation.

After the definition of the objective and the choice of tools follows the creative session in which focused and relevant ideas are developed in a team based approach – the focus also of the present paper. We prefer a facilitated brainstorm-like setting to other ways of ideation for a number of reasons:

- We experience a true enrichment of the results due to the interactions possible in such a setting.
- Team-building and buy-in is increased.
- The facilitation allows for a strict focus and a clear structuring, leading to better solutions.

After the ideation session we converge step by step towards a smaller, final set of solutions, through a structured process involving screening, combining and enriching of the ideas.

2 APPROACH

2.1 Purpose of the investigation

In order to match a given tool to a specific problem or circumstance, we would like to create a profile of how well a tool performs on a given set of measurement criteria.

The hypothesis is that each tool has its specific characteristics – strengths and weaknesses – in other words the tools are “spiky”. Figure 1 illustrates such a “spikiness” using a fictitious tool.

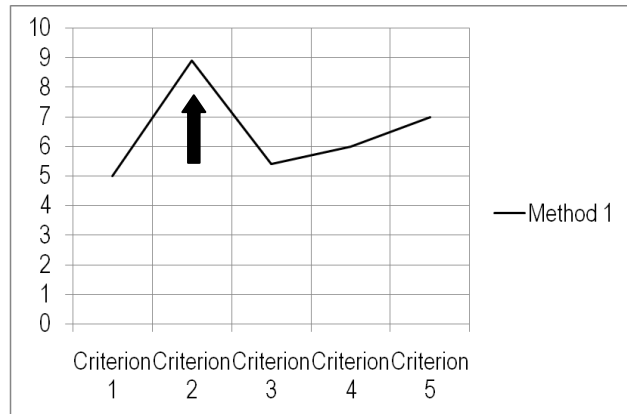


Figure 1: A spiky tool is shown. Whereas it scores average on most criteria, but excels particularly on Criterion 2.

While the current use of different tools is based on experience, the specific perceived characteristics as seen by our workshop participants, and documented in our questionnaires, could help to balance the use of different tools throughout a creative workshop even better.

2.2 Explaining the questionnaire

As a starting point for the investigation we defined a set of five characteristics that are measured, and which are detailed below. For each of the measurements, we ask the participants how they would rate the tool used in the workshop on a scale of one to ten, whereby one represents the lowest value and ten the highest value. This measurement scale is the same for all five measurement criteria.

Quantity of ideas

The quantity of ideas is the primary and classical measurement by which ideation tools and particularly brainstorm results are judged [4]. There are different schools of thought on this [5]; however, within the scope of this investigation quantity will remain one of the measurements employed in comparing different ideation tools.

We expect that different tools have a differing impact on the amount of ideas that are created in a workshop. In other words, some tools are more suited to create many ideas than others.

In addition to this subjective measurement, the amount of ideas actually created was measured, as well as the duration of use of this tool, and the number of participants. This additional information should enable to compare subjective and objective results of the investigation.

• Depth of ideas

The second main measurement of ideas in workshops should be the quality of ideas. Quality is multifaceted however, and not easy to define or to measure. So we ask the participants how they rate the “depth of the ideas” created with the respective ideation tools. In other words: how well, and in how much detail is any idea described.

For example, if the objective of a workshop would be to improve the performance of a kitchen-blender for chopping nuts, an idea such as “making the knife of a harder material” may score relatively low, as it is rather generic. In contrast an idea describing a particular knife-shape that would be better suited for chopping nuts would score relatively higher.

We expect that the ideas created, depending on the tool used, exhibit varying degrees of depth.

- Diversity of ideas

A further important aspect of the quality of ideas, as well as of the results from an ideation session, is the diversity of ideas created. Generally the higher the diversity the better, as there are more differing starting points to answer the objective, thus more flexibility in the project, and furthermore also more ways to combine ideas and thus improve the end-result.

A typical example from a recent project in the medical field had the objective to remove dirt from a particular part. At the end of the workshop we had come up with ideas that covered not only tens of different mechanical means, but also included chemical, electrical and biological means. This allowed our client to keep many options open at this early stage in the process, and avoided a too early focus on a – possibly faulty – technology.

We expect that some of the tools we use increase the ability of our workshop participants to come up with ideas of varying diversity whereas other tools are less suited to facilitate diversity of ideas.

- Covers all aspects

The success of an ideation workshop also depends on whether all aspects of the objective have been covered well.

We are often approached by clients to identify new uses for a certain technology they have developed. This is a typical question that may be defined in lateral thinking terms as: “an area focus” [6]. The tools employed in such a workshop should enable the creation of ideas covering the entire area. But also for questions concerning the solving of a specific technical problem, care should be taken that all of the aspects of the problem are addressed in the ideation process.

We believe that our workshop participants experience differences in the various tools we use and how well these tools cover all aspects of a given workshop objective.

- (re-) energizes

Participation in creative workshops can be quite exhausting - especially mentally. In addition, prolonged sessions, or extended use of a single tool may also cause lack of concentration of the participants. Exhaustion as well as boredom does not constitute a fertile breeding ground for ideas.

Many different factors contribute to these effects such as:

- The animation skills of the facilitator
- The quality and atmosphere of the room
- The time of day
- The rhythm of the ideation session

We believe the ideation tools employed influence the level of exhaustion as well as the level of concentration to a

significant degree. If the tool employed engages the participants and they experience success and fun in the process, they are likely to come up with more and better ideas.

Our fifth question therefore asks the participant how they rate the employed tools as to its ability to (re-)energise them.

We are fully aware that these 5 measurement criteria may, in an ideal world, not be the best possible measurements. Altshuller for example defined in his work the level of inventiveness of a solution according to how well they solve a contradiction in 5 levels [7]. An implementation of this measurement criteria would involve, however a detailed study of all solutions from the creative sessions, an impractical proposition given the setting of the workshops. In addition we needed to provide criteria that can be easily understood and applied by the workshop participants immediately following the creative sessions. Furthermore they need to be applicable not only for TRIZ related tools, but in addition to the other creative techniques that we frequently employ.

2.3 Tools used

For the purpose of this paper we investigate two tools from the TRIZ toolbox and two other ideation tools using the feedback from our questionnaire.

The TRIZ related tools that were investigated are:

- “Inventive Principles” and
- “Trends of Evolution”

Other ideation tools investigated are:

- “Guided Brainstorm” and
- “Ludic Thinking”

- “Inventive Principles”

One of the basic tools from the TRIZ toolbox, it has been chosen as a typical representative of TRIZ tools. The “Inventive Principles” are a set of 40 rules or recommendations that describe how a product or system can be modified in order to improve it. An example of such a Principle would be “Segmentation”. By dividing a product or system into separate parts or sections they may improve such as a folding rule that becomes easier to transport, or a chain mail that is strong but flexible.

The inventive principles and how to use them are relatively easy to explain and to employ, even if the participants have never seen them or heard of them before.

The facilitator, possibly with the help of some technical specialists prepares the use of this tool by selecting a set of inventive principles that are suitable to solve the problem at hand. Various tools, such as the contradiction matrix, may be employed for this purpose [8].

In the workshop the participants are presented with a brief introduction what this tool is, and how to use it, ideally using graphic examples [9]. After the introduction a first inventive principle is explained, using examples and images, and the participants are asked to write down any ideas. This is then repeated using the second and the following chosen inventive principles.

- Trends of Evolution

The “Trends of Evolution”, like the “Inventive Principles”, are seen as one of the easier to understand tools from the TRIZ toolbox. They are based on the idea that systems develop towards an “ideal final result” [10], and that the development exhibits occurs along specific lines or trends of evolution. One of the trends, for example, is the “Trend of harmonizing the rhythm of the parts of a system” or “Action coordination” [11]. It states that the frequencies of vibration or the periodicity of parts, or movements or actions within or of a system develops over time towards a better synchronization with each other. An evolution of such a system would move from uncoordinated to partially coordinated to fully coordinated actions. In practical terms one would first determine the current status of one’s system and from there think in line with the trend towards a fully coordinated system how it could look like and what advantages such a move would bring.

Before the ideation session, the facilitator prepares a set of “Trends of Evolution” that are suitably matching the problem at hand.

During the workshop, the participants are presented with a brief introduction about this tool, using examples. They discuss in how far potential for improvement exists along the line of a selected trend. During the discussions participants develop ideas, which are noted down, and the process is repeated using the next trend.

- “Guided Brainstorm”

This technique has been chosen because it is a representative of the classic brainstorm technique, and is well-known and widely used. It thus could even be seen as a benchmark.

In preparation for a creative session, a list of questions is drawn up by the facilitator focusing on solving the problems inherent in the objective.

During the workshop the facilitator goes through the list of questions, asking the participants for ideas. The participants in the workshop call out their ideas one at a time, and write them down.

- “Ludic Thinking”

This technique has been chosen as it is situated in the intuitive corner of creative techniques. In a sense it resides at the other end of the spectrum of problem solving techniques from TRIZ. It is closely related to the lateral thinking techniques for example to the “Deliberate introduction of discontinuity” or “Random Entry Idea Generating Tool” described by de Bono [12] or the “gekke dingen” technique [13].

The facilitator prepares this tool by taking with him to the workshop a collection of objects, pictures or random words, which are not specifically related to the objective.

During the workshop the items of the collection are individually presented to the participants. The participants note the characteristics they see in, or associations they have with the objects. These serve as starting point to develop ideas around the objective. The ideas are noted down and collected.

2.4 Setup for the Studies

All data relate to real-life projects conducted for our clients. The advantage of this approach lies in the fact that all data relate to the reality of innovation and no “role-play” or simulation is involved. On the other hand not all scenarios of the use of the tools can be explored, as the

result for our clients has to take priority over academic interests.

The dataset used for this paper is based on a total of 7 workshops for as many different projects. The projects covered a wide range of subjects, ranging from a search to apply emerging technologies in the area of consumer electronics, via the use of customer insights to create new product ideas to creating new ideas for a furniture company. In total 52 participants were involved in these workshops. Table 1 gives an overview of the number of participants involved in the sessions

Not all tools were used in all workshops. An overview of which tools were employed is given in Table 2. The number given indicates the position of the tool in the workshop. Other tools, not discussed in this paper are summarised under the heading “others”. The first tool used in any brainstorm will consciously or unconsciously serve as a sort of brain dump for any ideas that participants may already have. This will influence some measurement criteria, particularly on “quantity of ideas”. Therefore only measurements on tools that were not used as the first tool in an ideation session were taken into account.

2.5 Results of the Questionnaires

The results of the questionnaire show clearly that differences exist in the perception of how well the different tools fare with respect to quantity of ideas. Table 3 summarises the results of the questionnaire responses.

- Comparison on “quantity of ideas”

There are some differences how the participants experience the different tools to work. The best ranked tool is “Ludic Thinking” with a mean score of 6.76, closely followed by “Guided Brainstorm” with a mean of 6.59 and the TRIZ tool “Inventive Principles” with a mean of 6.30. “Trends of Evolution” are the lowest ranked tool with a mean of 4.80.

Surprisingly though, this does not at all correspond, with the actual measurement of the number of ideas per time unit per participant, also shown in Table 4.

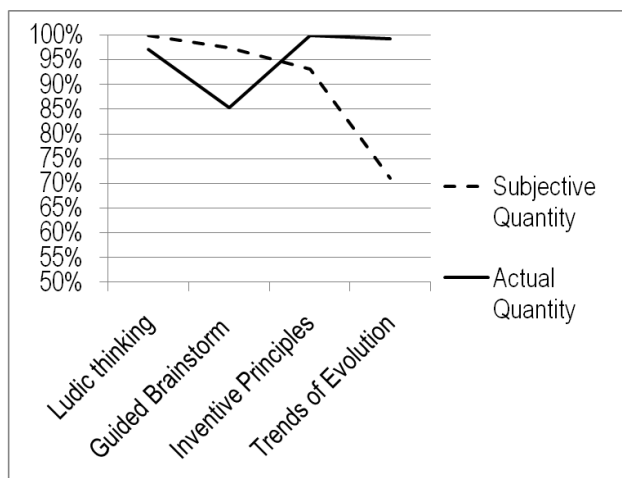


Figure 2: Comparison of subjective with quantitative measurement on “quantity of ideas”. Both, subjective and quantitative data is shown in % with the respective highest-scoring tool set at 100%.

Here the “Inventive Principles” is the best performing tool and is set at 100 %, closely followed by “Trends of Evolution” (99%) and “Ludic Thinking” (97%), “Guided Brainstorm” closes with 85%. Figure 2 visually compares the results of the two measurements.

- Comparison on “depth of ideas”

Again, some differences can be seen from the results. Highest scores are for “guided Brainstorm” (7.34), and “Inventive Principles” (7.13) with “Ludic thinking” (6.34) somewhere in the middle and “Trends of Evolution” (5.80) scoring lowest.

- Comparison on “diversity of ideas”

“Inventive Principles” scores highest with 7.22, closely followed by “Ludic Thinking” and “Guided Brainstorm” with 7.17 and 7.09 respectively. “Trends of Evolution” trails with a score of 6.0.

- Comparison on “covers all aspects”

“Guided Brainstorm” has the highest scores, with a score of 7.16, followed by “Ludic Thinking” (6.77) and “Inventive Principles” (6.27). “Trends of Evolution” follows as last with a score of 5.30.

- Comparison on “(re)-energises”

Here “Inventive Principles” scores highest with 7.27, followed by “Guided Brainstorm” with 7.09. “Ludic Thinking” is, with a score of 6.66 in third place, and “Trends of Evolution” trails with a score of 5.90.

3 DISCUSSION

Based on the current results of our investigations it is shown that the various ideation tools are experienced differently by the participants, although the differences are not always very pronounced. It was expected that the different tools would exhibit a performance characteristic that would indicate a particular good performance with respect to one or two of the measurement criteria (spikiness). This is most strongly pronounced with the tool “Ludic Thinking”, but could not be clearly observed for all tools.

The TRIZ tool “Inventive Principles” and the tool “Guided Brainstorm” appear to be performing equally good on most counts, with no apparent performance spikes on any of the five criteria.

The “Inventive Principles” is seen as a good performer on all counts. It seems to particularly well guide the imagination of the participants and allows them to come up with surprising and imaginative solutions to the problems at hand, an impression that is corroborated by verbal testimony of the workshop participants.

Also the tool “Guided Brainstorm” is seen to perform well. This is probably supported by the brainstorm character of the investigated ideation sessions, and thus the tool worked in its “natural environment”. Also, as the facilitator guides the participants through the session with questions adding focus there is no need by the participants to learn or understand the workings of the tool. Furthermore the facilitator can easily adapt the questions during the session to better cover any issues coming up.

The tool “Ludic thinking” exhibits a particular good response with respect to the criteria “Diversity of ideas”.

This matches with expectations as the tool is designed to create “out of the box ideas”. “Ludic Thinking” to a lesser extend also performs well in the perception for “Quantity of ideas”.

Finally, the TRIZ tool “Trends of Evolution” seems to be performing relatively well on the criteria of “Depth of ideas”, “Diversity of ideas” and “(re)-energizes”. The results here also show that it trails the other tools on every subjective measurement criteria. A possible explanation could be the fact that this tool requires more preparation and possibly insight and training by the participants to be used well – thus requiring time that is not always available in the settings of the sample workshops.

When looking at the actual measurements of ideas per participant per time unit, the TRIZ tools lead the field, however. This is the more surprising when one takes into account that, in a strict sense, the purpose of these tools is that of helping innovators to increase the quality of their innovative solutions to a higher level, level 3 to 4 of inventiveness as defined by Altshuller [14], whereas the other tools they compare with, and particularly the “Guided Brainstorm” tool are designed with the “Quantity breeds Quality” thinking in mind - although they actually perform worse on that count!

A number research questions remain:

- Firstly, the sample sizes of the investigation are relatively small, particularly with respect to the use of the tool “Trends of Evolution”. The collection of more data over time may be necessary to deepen our understanding of the above results.
- Secondly, not all factors affecting the measurement criteria are, or can be taken into account, or are even well understood. These factors include:
 - The composition and mood of the participants
 - The nature and definition of the objective
 - The setting of the workshop
 - The preparation for the workshop
 - The number of participants in a workshop
 - The way the participants chose to fill in the questionnaire

This may also indicate the need for additional measurements in a more controlled environment.

- A further question that may warrant further study is the sequence in which ideation tools are used. This for example due to the fact that, in the beginning of a creative session the solutions space is “empty”, so every idea finds its place. After a while, however, the solution space is getting fuller, and it is more difficult to create and place new ideas. So the tools employed towards the beginning will account for a relatively higher number of ideas than a tool used later in the session.

4 SUMMARY AND OUTLOOK

Overall, the verbal testimony of many participants is quite positive towards all tools. The change of viewpoint that is experienced while trying to solve a problem first with one tool, then with another, is widely appreciated and seen as creating better results. In this respect the mix of the highly structured TRIZ based tools with other creativity tools are seen as a valuable way of working.

The expectation that the investigated tools show “spikiness” in the eyes of the participants is partially supported, but the emergent picture is not very clear, as illustrated in Figure 3.

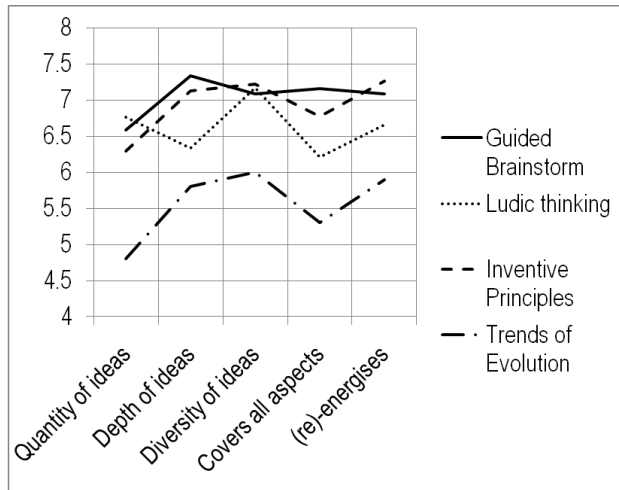


Figure 3: Graphical comparison of the four ideation tools on the 5 criteria in a spider diagram.

Finally, our research is still in a relatively early stage, and, with the gathering of more data over time, the interpretation of the results will become more granular.

ACKNOWLEDGMENTS

I like to extend my sincere thanks to my clients and colleagues who, through their contributions and patience made this research possible.

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Workshop #	“Guided“ Brainstorm	“Ludic Thinking”	Inventive Principles	Trends of Evolution
1		6		
2	10			
3			4	4
4	7	7		
5	9	11	11	
6	6	5		6
7			8	
Total respondents	32	29	23	10

Table 1: overview of the number of respondents participating in the workshops

Workshop #	“Guided“ Brainstorm	“Ludic Thinking”	Inventive Principles	Trends of Evolution	Other tools
1		2			1/3
2	2				1
3			4	3	1/2
4	3	4			1/2
5	4	3	2		1
6	2	4		3	1
7			2		1/3
Total instances	4	4	3	2	-

Table 2: overview of tools employed during the workshops

<i>Scale: 1 = low, 10 = high</i>	Inventive Principles	Trends of Evolution	Guided Brainstorm	Ludic Thinking
Quantity of ideas	6.30	4.80	6.59	6.76
Depth of ideas	7.13	5.80	7.34	6.34
Diversity of ideas	7.22	6.00	7.09	7.17
Covers all aspects	6.77	5.30	7.16	6.21
(re)-energises	7.27	5.90	7.09	6.66

Table 3: The mean values of the participants' responses to the questionnaire are shown

	Inventive Principles	Trends of Evolution	Guided Brainstorm	Ludic Thinking
Subjective # of ideas in %	93%	71%	97%	100%
Actual # of ideas in %	100%	99%	85%	97%

Table 4: The subjective amount of ideas and the actual average amount of ideas produced within the workshops per participant per time unit is shown. In each case, the score of the best performing tool is set at 100%