ELEMENTS TO THE DEVELOPMENT OF A CREATIVITY TECHNIQUE

Medeiros Leopoldino, Kleidson; Aguirre González, Mario; de Oliveira Ferreira, Paula; de Melo, David; de Vasconcelos, Rafael
UFRN Federal University of Rio Grande do Norte, Brazil

Abstract

Understood as a skill, and present at different levels in the human being, creativity can be developed spontaneously and not spontaneously. Spontaneously from the interaction between endogenous and exogenous factors. And already in its induced form, through creative techniques that aim to generate ideas to solve problems through the systematization of the creative process. The article aims to point out elements to the development of a creativity technique. To accomplish this goal, a literature review was carried out. After the analysis of the articles and with the use of affinity diagrams, fourteen elements were obtained that should be considered in the elaboration of a creativity technique. The elements identified were: time, colors, multidisciplinarity, collaborative work, playfulness, creative profiles, positive humor, intrinsic motivation, convergent and divergent thinking, incubation, nonverbal language, qualification of ideas, intergroup competition and size of groups. For future research, it is recommended the construction of controlled experiments to measure and understand the influence of each factor, indicated in this article, to stimulate non-spontaneous creativity.

Keywords: Creativity, Training, Research methodologies and methods, Innovation

Contact:
Kleidson Medeiros Leopoldino
UFRN Federal University of Rio Grande do Norte
Production Engineering
Brazil
leopoldinodaniel@gmail.com

Please cite this paper as:
Surnames, Initials: *Title of paper*. In: Proceedings of the 21st International Conference on Engineering Design (ICED17), Vol. 8: Human Behaviour in Design, Vancouver, Canada, 21.-25.08.2017.

1 INTRODUCTION

Scientific research on creativity shows that this theme has been widely discussed in recent decades. According to Cropley (2000) and Simonton (2007), there are at least 225 ways to define and measure creativity. Among its various definitions and metrics, some treat it as an individual characteristic, and others identify it as a process (Amabile, 1988). For Chang (2013), creativity is understood from the perspective of confluence, that is, it is approached as a multidimensional construct that requires the consideration of several individuals, environmental and cultural factors for its investigation. This perspective implies the integration of several theories to account for the specificities of the phenomenon of creativity with the aim of producing more comprehensive and therefore a realistic understanding of this construct. This new direction of research points to the fact that literature has sought not to restrict its investigations only to individuals, but rather to how to develop human creative potential, making it sustainable over time, as Torrance (1977), points out, creativity is a skill that can be developed when stimulated and practiced.

According to Amabile (1996), there is a strong relationship between creativity and innovation. Mechanisms to develop and support new ideas contribute to better organizational performance, lead faster to innovative products and services with greater economic impact. In this article, the guiding concept of creativity is the one proposed by Amabile (1996), which says that a product or response will be evaluated as creative in so far as (a) it is original, appropriate and useful, as well as assertive and valuable to the task at hand; and (b) the task is heuristic rather than algorithmic.

However, it is important to consider that there is a subtle but crucial difference between creativity and innovation. In the creative process, ideas are the products (results) of creative sessions, while innovation according to Amabile (1988), is the successful implementation of creative ideas within the organization. Other authors also agree with this view as Sawyer (2012), defines creativity as the ideas or products generated by individuals or teams, and innovation as the successful execution of a new product or service by a company. Thus, Amabile (1996), cites that creativity in individuals or groups is the starting point for product innovation; this is a necessary but not sufficient condition. Successful innovation requires other factors, such as ideas originated not only within an organization but also elsewhere, such as the transfer of technology.

Thus, for the needs of the market to be met and implemented, another field arises in which creativity is an important component of the design because the design is a process that transforms a briefing or a request into a finished product or into a design solution. New product development involves a high degree of creativity but in a controlled and process-driven way. Thus, creativity is channelled to create a practical and feasible solution to the problem of design that meets or exceeds the objectives set by the briefing (Ambrose and Harris, 2009).

To enhance non-spontaneous creativity, it is possible to use creative techniques, tools that facilitate the creative process, and according to Mansfield et al. (1978), can be used for the development of creativity, since they involve planning and designing situations for problem-solving. Conceptually, creativity techniques are methods that generally seek to foster original and creative thinking to solve problems. Herrmann and Felfe (2012), define them as the behaviour that the leader must take, through a sequence of steps, to promote creativity in a specific situation and are an important strategy to stimulate the creativity of the individuals and the groups (Mumford et al. 2002).

To understand the workings of creativity techniques it is important to consider the cognitive aspects involved in the operation of these tools. This fact can be justified, according to Beaudot (1979), by the existence of two fundamental concepts as to the types of intelligence (in terms of creativity): that of convergent intelligence and that of divergent intelligence.

The first is simply, called intelligence, and is measured with IQ tests (standards-based intelligence, such as what is taught in schools); allows us to recognize the present; convergent thinking involves the reorganization and integration of ideas within a domain to form a coherent whole (Mumford et al. 1997). The second is the one that makes us think outside standardized ways, which makes us doubt that 2 plus 2 are 4; helps us to perceive the uncertain delimitations of the future. Divergent thinking involves opening up to unusual memory categories to use as the basis for the idea of development (Mumford et al. 1997). From this context, it is questioned: what are the elements to the development of a creativity technique?

2 RESEARCH METHOD

This research is characterized, as far as its objectives, exploratory, because it allows to expose the theme discovering the elements to develop a creativity technique. As for the technical procedures applied, the research is classified as a review of the literature. Literature review is a reliable research approach because it is comprehensive and explicitly presents the means used and the results obtained. Regarding its approach, it is considered qualitative, since it seeks to establish meaning and significance to the object of study.

The study was conducted in four steps. In the first stage, the research problem was defined as: "what are the elements to the development of a creativity technique?". For the definition of the problem, in a second stage, the database CAPES was used, in which articles were selected from the key word: "Creativity Techniques", obtaining as a return 50 articles that contained in their titles this term. No selection mechanism was used to limit the reference year of the articles, thus, all publications up to December 2016 were considered in this research. In addition to this portal, an investigation was carried out in the Google Scholar database through the terms "creativity techniques" and "thesis". After the application of this filter, six theses were selected.

In the third stage of the research, from the complete reading of the texts, the classification of the same ones in terms of its structure and content was carried out, through the elaboration of a affinity diagram in the program Microsoft excel with the following elements: title of the article, author (s), year of the article, aim of the study, periodic, method of the study, research country, research results, variables, concept of creativity, characteristics of a creativity technique. Through this, it was possible to gather the data, so that their analysis was facilitated. After the classification phase, the considerations in the texts were analysed, in the fourth stage, in order to verify the most cited elements in a creativity technique (see table 2).

3 CREATIVITY AND INNOVATION: A SYMBIOTIC RELATIONSHIP

According to the definitions cited in Table 1, creativity is an inherent human ability (Vygotsky, 1978) and refers to an action, idea or product that modifies an existing domain or transforms the existing domain into a new domain (Csikszentmihalyi, 2014), from a combination of elements from one or more areas of knowledge (Hilgard and Hadamard, 1939).

Table 1. Definitions about creativity

AUTHORS	CONCEPTS OF CREATIVITY
Hilgard and Hadamard (1939)	An invention or discovery by combining ideas independently of the area of knowledge.
Guilford (1950)	Divergent mental process by which the person produces information that he did not possess and which, like intelligence, follows a normal distribution, so that all people are creative, albeit to varying degrees.
Torrance (1963)	Process of detection of problems or information gaps, forming ideas of hypotheses, tests and modification of these hypotheses, communicating their results. This process can lead to any of the many types of products - verbal and nonverbal, concrete and abstract.
Vygotsky (1978)	Quality inherent in human essence, as each person becomes a flexible creator of their personal future and potentially contributes to the future of their culture through its development.
Sternberg and Lubart (1991)	A complex, multifaceted process that involves defining and redefining problems.
Csikszentmihalyi (2014)	Any act, idea, or product that changes an existing domain or that transforms an existing domain into a new domain.

The result of the process, therefore, created according to Amabile (1996), a product or response with an adjusted degree of novelty. It's this originality that represents a source for the design of a new product. In addition, creativity can also be used during the design process in its developmental stages to solve the problems or constraints inherent in the process (Cooper, 2005; Morgan and Liker, 2006; Ulrich and Eppinger, 2008; Wheelwright and Clark, 1994).

3.1 Creativity techniques: support tools for generating ideas and problem solving

In a study conducted by Torrance (1972), on the use of creative classroom training, based on the analysis of 142 studies, the results showed that, on average, 72% of these training programs were successful. Even in this study, Torrance (1972), points out that the most successful approaches seem to be those involving cognitive aspects and emotional functioning, as they provide adequate structure and motivation for involvement, practice, and mutual interaction. Among creativity researchers, the publicist Alex Osborn is considered by literature as the father of one of the most widespread strategies to promote divergent thinking, brainstorming, still widely used around the world. This technique was remarkable since it allowed to develop the creative thought through a specific strategy and of easy replication. Also from Osborn is the most successful facilitation model of the creative process, known as Creative Problem Solving (CPS).

According to Schlicksupp (1989), there are over 100 different creativity techniques. In addition to Schlicksupp (1989), there is a study developed by Smith (1998), of which there are 172 creativity techniques, 72 more than in the previous study, divided into 50 groups of techniques. As for the classification of creativity techniques, Roozenburg and Eekeles (1995) and Schlicksupp (1989), propose their stratification into two types: associative and provocative. The techniques of provocation are based on the works developed by De Bono (1970) and are widely used to foster creativity. They differ from associative techniques since they seek to break with the preconceived elements, while associative techniques seek in the recombination of elements to generate new ideas.

For Couger (1998), techniques can be classified as analytical or intuitive. Analytical techniques generate logical patterns of thinking that tend to follow a linear pattern or sequence of steps. These techniques take advantage of different ways of organizing information known to approach problems from new angles, by means of a linear pattern or a sequence of steps. Intuitive techniques rely on a single image or symbol to provide a one-time response and jump-start solutions. In general, they skip steps of a sequence (Miller, 1988).

Coney and Serna (1995), conclude that the process of creative thinking involves merging different mental elements to produce an original and appropriate solution. For Mumford et al. (1997), the ability to combine and reorganize memories is related to individual creative success. Therefore, research on the process of creative thinking has focused on the generation, synthesis, and modification of ideas (Engle et al. 1997). Figure 1 shows the divergent and convergent thinking model. The closer to the side tips, the more divergent the thought will be, and the closer it will come to the so-called "discovery area". On the other hand, the closer to the horizontal points of the more convergent square will be the thought and the more it will approach the "area of familiarity". From the balance between these two opposing thoughts is that you can come up with new and creative ideas.

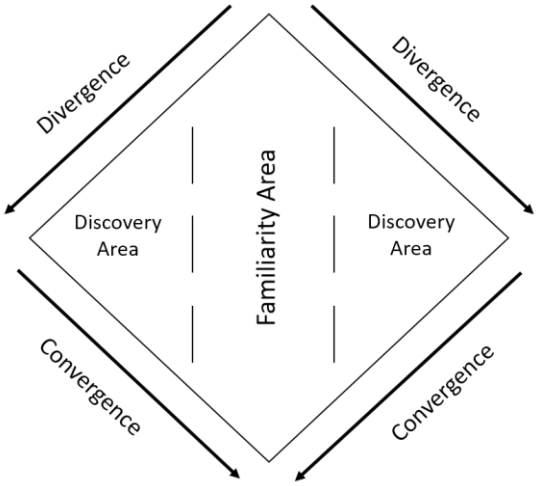

Figure 1. Divergent and convergent model of the generation of ideas

Source: Adapted from Puccio et al. (2005)

3.2 Elements for the development of a creativity technique

From the literary mapping were listed fourteen guidelines positively associated with the development of a creativity technique. The elements identified were: time, colors, multidisciplinarity, collaborative work, creative profile, positive humor, playfulness, intrinsic motivation, convergent and divergent thinking, incubation, non-verbal language, criticism of the ideas generated, group's size and intergroup competition. It is proposed that when developing a new technique to stimulate creativity these elements are considered in their systemic and inseparable character.

For Amabile (2012), the techniques of creativity are specific strategies for the promotion of creative thinking. In her studies, it is recommended that there be no incisive pressures for its execution in a shorter time. However, participants should be imbued with a sense of urgency at decisive moments and/or deadlock. Concern about environmental factors such as the influence of color in the creative session should also be considered. According to Lichtenfeld et al. (2012), colors influence the perception of emotions, cognition, and behavior. As far as creativity is concerned, there is evidence of the influence of green color on its stimulus - from four experiments it has been shown that a brief glimpse of this tonality, before engaging in a task, stimulates creativity.

Another element to be considered according to Jaoui (1970), is multidisciplinarity. This element, also endorsed by Amabile et al. (1996), in his componential model of creativity, and reiterated by Strouse (2013), is positively associated with collective creativity and deals with the various levels of expertise and types of knowledge of individuals as facilitators of the creative process in teams. In addition, as Csikszentmihalyi (2014), Feldman (1974), Murray and John-Steiner (1985), proposes people tend to be creative in a particular domain, which reinforces their importance in creativity techniques.

Collaborative work is another element to consider, as there is evidence that it is beneficial to creativity. In a study by Benison and Zuckerman (1978), he found that approximately two-thirds of 286 of the Nobel Prize-winning scientists, between 1901 and 1972, worked collaboratively. By way of comparison, only a small percentage of unrewarded scientists were involved in some collaborative engagement activity. Benison and Zuckerman (1978), also demonstrated that, during the first 25 years of the Nobel Prize, 41% of the winners worked collaboratively and in 1972 the proportion of 79% of the winners were honoured because of collaborative work. When working collaboratively, it is important to consider the creative profile of the participants. According to Puccio (2011), psychological diversity represents the differences in how people organize themselves, process information, express their cognitive styles and personality traits. In this sense, forming teams with very similar characteristics among their participants may negatively affect the creative process.

In addition to these elements already addressed, there is evidence that induction to positive emotions contributes to creativity. In one of his experiments Isen et al. (1987), demonstrated the positively correlated effects between humor and creativity. The essay was as follows: a humorous five-minute video was introduced to induce positive emotions, five minutes of a video about Nazi concentration camps to induce negative emotions. In the other three groups, in the neutral condition of the experiment, the following ways were taken: one group watched a video about mathematics, another group exercised for two minutes (up and down one block of cement) and another group received no stimulus. Subsequently, the five groups of 33 men and 83 women in total were asked to work together to solve the following problem: to attach a candle in a corkboard to the wall in ten minutes so that the candle was lit without dripping wax on the floor. For that, a box full of tacks, a candle and a box of matches was provided. According to Isen (1987), it was verified that: the students who had watched the humorous video obtained a better performance in solving the problem of the study.

This relaxation and playfulness sum up the role of playfulness which, according to Amabile (1996), means being positively present, open to possibilities, curious and willing to use the time to have fun and create. According to Piaget (1951), play is a source of creative imagination. Other theorists of the play effect propose that activity with play increases flexibility and adaptation to novelty (Bruner, 1972; Lieberman, 1977). For Gordon (1961), who started the popular Synectics creative training program, not every joke is creative, but all creativity contains the joke. Play within the creative process is the means for the floating activity of the creative process and the consideration of associations seemingly irrelevant to the problem at hand. Rogers and Sluss (1999), analysed Einstein's creativity and inventiveness and concluded that his playful manner in childhood was related to his general character and creative capacity. Several recent studies have observed that play plays an important role at work. For the individual, play can enhance personal learning (Liberman, 1977), has a positive impact on emotions, the degree of

involvement and satisfaction (Webster and Martocchoio, 1992), and promotes the ability to adapt and react to the environment (Starbuck and Webster, 1991).
In developing her componential model Amabile (1996), pointed to the need to activate the intrinsic motivation to stimulate creativity. This element has a high correlation with the development of individual and collective creativity, as demonstrated in her model. Her research on motivational synergy presents robust results in that the intrinsic motivation is positively correlated to creativity, whereas extrinsic motivation, generated by concrete gains such as fame and money, negatively affects creativity.
Another element is convergent and divergent thinking. These styles of thinking are a way to stimulate divergence of thinking and can be used in a balanced way, according to the objectives that are being outlined throughout the application of a creativity technique. To encourage divergent thinking there are some possibilities, among them: (I) when everything fails, try something counter-intuitive (Newell et al. 1958); (II) make the strange familiar (Gordon, 1961); (III) generate hypotheses from the analysis of case studies, use analogies, take into account the exceptions and investigate paradoxes (Mcguire, 1973); (IV) play with ideas; dipping into a "mental gymnastics" (Wickelgren, 1980); (V) generate as many ideas as possible; (VI) do not judge the ideas generated and (VII) build new ideas from others (Osborn, 1957).
In addition to encouraging divergence, it is important to consider for Amabile et al. (2005), the incubation. This is a process of unconscious recombination of thought elements that have been stimulated through conscious work at one point in time, resulting in new and useful ideas at some later time. There are numerous accounts of the effects of incubation on creativity ranging from Kekule, when he dreamed of the structure of the benzene ring, to Poincaré, who on boarding a train during his vacation obtained a sudden mathematical intuition, now widely known as the Poincaré conjecture. Therefore, it is important to consider this element in the development of a creativity technique, allowing pauses and sufficient time for the participants to elaborate and re-elaborate information, as previously mentioned.
The way ideas can be expressed is also a relevant element, as Koestler (1965), shows although verbal thinking is the clearest, this kind of thinking can be an obstacle between thinking and reality. Hence, very often, true creation ends where language begins. In this way, it is recommended to use non-verbal language designs to express some of the ideas generated in the creative session.
As for the criticism of the ideas generated, according to Osborn (1957), the creative process, and more specifically, its creative technique: brainstorming, must follow four rules: (I) generate as many ideas as possible; (II) not judge the ideas generated; (III) to generate "wild" ideas and (IV) to construct new ideas from others. By complying with this guideline, the author believed that the teams could get better results. However, new research developed by Nemeth et al. (2004), demonstrate the exact opposite. Nemeth et al. (2004), constructed an experiment in which participants were asked to generate ideas to solve the following challenge: how to reduce congestion in the Bay Area, San Francisco? In order to analyse if the ideas debate contributes to creativity, the author divided the groups into three conditions: (I) minimal interference in the team: no instructions were given on how to proceed, but were asked to generate as many possible ideas; (II) the classic brainstorming instructions were communicated, as advocated by Osborn (1957), and (III) the team was guided by the classic guidelines of brainstorming but with one important and crucial difference: they were asked to debate and criticize the ideas generated by the other participants. After the conclusion of the experiment, the result was calculated and a clear advantage of the third group was identified over the other two groups.
According to Nishii and Goncalo (2008), the equality in the group's size contributes to increasing the level of conflicts, a fact that favours the development of disruptive ideas. Still according to the authors, previously cited, when one group is relatively smaller than the other the potential for conflict decreases, because this group is not perceived as a threat to the status quo. Thus, this equality is recommended so that the generated subgroups perceive that there is a concrete threat to their dominance, thus contributing to the increase of healthy competition between groups and to the selection and implementation of ideas with greater value generation. Finally, as Gross (2016) demonstrated, intergroup competition is necessary to achieve high performance, provided it is not excessive because in this case, it can discourage the group. However, this factor should only be stimulated in the final stage (when the participants are divided into groups and working each one in solving the problem proposed in the application of the creativity technique). In this way, the effect of intrinsic motivation (stimulated at the beginning of the application of the creativity technique) will not be annulled. Table 2 lists the elements to be considered in the elaboration of a creativity technique, in addition to the authors who endorse them.

Table 2. Elements to develop a creativity technique

ELEMENTS	AUTHORS
TIME	Amabile (2012)
COLORS	Lichtenfeld (2012)
MULTIDISCIPLINARITY	Jaoui (1970), Amabile et al. (1996), Strouse (2013)
COLLABORATIVE WORK	Benison and Zuckerman (1978)
CREATIVE PROFILE	Puccio (2011), Gelade (2002), West (1997), Sternberg e Grigorenko (1997), Amabile (1996), Von Oech (1994), Kirton (1976)
POSITIVE HUMOR	Hirt et al. (2008), Amabile et al. (2005), Vosburg (1998), Estrada et al. (1994), Abele-brehm (1992), Carnevale and Isen (1986), Isen et al. (1985)
PLAYFULNESS	Chang (2013), Rogers (1999), Amabile (1996), Glynn (1992), Webster (1992), Barnett (1990), Lieberman (1977)
INTRINSIC MOTIVATION	Crutchfield (1962), Amabile (1996), Amabile (2012)
CONVERGENT AND DIVERGENT THINKING	Osborn (1957), Newell et al. (1958), Gordon (1961), Mcguire (1973), Wickelgren (1980), Puccio et al. (2005), Puccio (2011)
INCUBATION	Amabile et al. (2005), Simonton (1999), Amabile (1996), Wallas (1926)
NON-VERBAL LANGUAGE	Koestler (1965)
CRITICISM OF THE IDEAS GENERATED	Osborn (1957), Nemeth et al. (2004)
GROUP'S SIZE	Nishii e Goncalo (2008)
INTERGROUP COMPETITION	Gross (2016)

4 DISCUSSION

The development of creative techniques needs to be thought based on their cultural/environmental contextualization and the use of elements - listed in the literature on creativity - that contribute to their effectiveness. Science and design, as a driving forces for the development of new technologies increasingly, demands collaborative work, provided that the problems to be solved are complex and multifactorial. Therefore, they need high creative performance to be explored and solved. However, it is not observed in the creativity techniques literature the consideration of the systemic and inseparable character of the multiple elements indispensable for the stimulation of creativity, as was proposed by the various models for this investigation (Rhodes, 1961; Gardner, 1988; Sternberg and Lubart, 1991; Woodman et al., 1993; Amabile, 1996 and Csikszentmihalyi, 2014).

To do this is necessary to use the theoretical framework on individual and collective creativity. In this sense, only considering the multidisciplinarity as a relevant factor for the initial guidelines of a creativity technique is a reductionist view. Diversity in a creative session relates not only to participant's knowledge but also to multiple psychological (or creative) profiles and multicultural experiences.

To develop creativity techniques is necessary to know the elements. The diverse techniques were proposed in past time in which one the cultural environment and the access to information was very low. Today the context is different, everyone has access to information and the creativity techniques could be considered new elements. So, the value of this research is: collective creativity is fundamental to generate novel ideas for design of new products and to obtain solutions in the design process. To incentive collective creativity is through creative technique. Thus, to know the elements of a creativity technique are fundamentals to project a new creativity technique in consonance with the current reality.

5 FINAL CONSIDERATIONS

Creativity techniques should be understood as punctual tools to stimulate collective creativity and consequently apply in development of novel products. However, for its elaboration, the theoretical framework developed, over the last decades, on creativity needs to be considered. Multidisciplinarity is an important element, but not sufficient for the success of a creative session. In this sense, it is

recommended to use the thirteen other elements mapped for the development of a creativity technique. In addition, it is recommended that such techniques be developed not only in a procedural logic but human, in considering participants in the creative session as well as the elements related to creativity that can help in activating their creative potential.

The contribution of this research, therefore, is to frame collective creativity as a fundamental resource to generate ideas with a high degree of novelty for the design of new products and the overcoming of procedural restrictions inherent to the process of product development. From the identification of the necessary elements to develop a creativity technique, it is possible to create more value through creative sessions induced by techniques that will activate it, considering the particularities of each context. For future research, it is suggested the construction of controlled experiments to measure and understand the influence of each variable, indicated in this research, to stimulate non-spontaneous creativity.

REFERENCES

Abele-brehm, A. (1992), "Positive and negative mood influences on creativity: Evidence for asymmetrical effects". *Polish Psychological Bulletin*, Vol. 23, pp. 203–221.

Amabile, T. M. (1988), "A model of creativity and innovation in organizations", In B. M. Staw, & L. L. Cummings (Eds.), *Research in organizational behavior*, Vol. 10, pp. 123-167.

Amabile, T. M.(1996), *Creativity in Context*, Westview Press, Boulder Colorado.

Amabile, T.M., Barsade, S.G., Mueller, J.S. and Staw, B.M, (2005), "Affect and Creativity at Work", *Administrative Science Quarterly*, Vol.50, pp. 367–403.

Amabile, T. M (2012), "Componential Theory of Creativity". *Harvard Business School Working paper*. No 12-096.

Ambrose, G., and Harris, P. (2009), *Design Thinking*, Bloomsbury Academic. ISBN-13:9782940411177

Barnett, L. A. (1990), "Playfulness: Definition, design and measurement". *Play & Culture*, Vol.31, pp.319-336.

Benison, S. and Zuckerman, H. (1978), "Scientific Elite: Nobel Laureates in the United States". *The American Historical Review*, Vol. 83 No. 3, pp. 690. http://dx.doi.org/10.2307/1861854.

Bruner, J. S. (1972), "The Nature and Uses of Immaturity", *American Psychologist*, Vol. 27, pp. 687-708. https://doi.org/10.1037/h0033144

Beaudot, A. (1979), "Vers Une Pédagogie de la Créativité", Les éditions ESF, Paris.

Carnevale, P.J. and Isen, A.M. (1986), "The influence of positive affect and visual access on the discovery of integrative solutions in bilateral negotiation", *Organizational Behavior and Human Decision Processes*, Vol. 37, pp.1–13. https://doi.org/10.1016/0749-5978(86)90041-5.

Chang, C.P.(2013), "Relationships between Playfulness and Creativity among Students Gifted in Mathematics and Science", *Creative Education*, Vol.4 No 2, pp. 101–109. https://doi.org/10.4236/ce.2013.42015.

Coney, J. and Serna, P.(1995), "Creative Thinking from an Information Processing Perspective: a New Approach to Mednick's Theory of Associative Hierarchies", *Journal of Creative Behavior*, Vol. 29 pp.109–130. https://doi.org/10.1002/j.2162-6057.1995.tb00740.x.

Cooper, R (2005), "New products: what separates the winners from the losers and what drive success". In: KAHN, K. *The PMDA handbook of new product development*, New Jersey: John Wiley & Sons, pp. 3-28.

Couger, J.D.(1998), *Creative Problem Solving and Opportunity Finding*, Boyd and Fraser, Danvers, MA, pp. 45–64. https://doi.org/10.1002/j.2162-6057.1998.tb00818.x

Cropley, A. J.(2000), "Defining and measuring creativity: Are creativity tests worth using?", *Roeper Review*, Vol.23 No 2, pp. 72-79. http://dx.doi.org/10.1080/02783190009554069

Crutchfield, R.S. (1962),"Conformity and creative thinking", In: Gruber, H, Terrell, G. And Wertheimer, H. (Eds.), *Contemporary approaches to creative thinking*, Atherton, New York. https://doi.org/10.1037/13117-004

Csikszentmihalyi, M. (2014), "Society, culture, person: A systems view of creativity". In R.J. Sternberg (Ed.) *The Nature of Creativity*, Cambridge: Cambridge University Press, pp. 325–339. https://doi.org/10.1007/978-94-017-9085-7_4

De Bono, E.(1970), "Lateral Thinking: Creativity Step by Step". In Harper & Row Goldenberg, J. and Mazursky D. (Ed) *Creativity in Product Innovation*. Cambridge: Cambridge University Press

Engle, D.E., Mah, J.J. and Sadri, G., (1997), "An Empirical Comparison of Entrepreneurs and Employees: Implications for Innovation", *Creativity Research Journal*, Vol.10 No 1, pp.45–49. http://dx.doi.org/10.1207/s15326934crj1001_5

Estrada, C.A., Isen, A., and M. J. Young (1994), "Positive affect improves creative problem solving and influences reported source of practice satisfaction in physicians", *Motivation and Emotion*, Vol. 18, pp. 285–299. https://doi.org/10.1007/bf02856470.

Feldman, D. H.(1974), "Universal to Unique: A developmental view of creativity and education". In. Rosner, S. and Abt ,L. E. (Eds.), *Essays in Creativity*, Croton-on-Hudson, NY: North River Press, pp. 45-85.

Gardner, H. (1988), “Creativity: An interdisciplinary perspective”. *Creativity Research Journal*, Vol 1 No. 1, pp. 8–26. http://dx.doi.org/10.1080/10400418809534284.
Gelade, G. (2002). “Creative style, personality and artistic endeavor”. *Genetic, Social and General Psychology Monographs*, Vol. 128, pp. 213–234.
Glynn, M.A. and Webster, J. (1992), “The adult playfulness scale: An initial assessment”, *Psychological Reports*, Vol. 71 No. 1, pp. 83–103. http://dx.doi.org/10.2466/pr0.1992.71.1.83
Gordon, W.(1961), *Synetics, the development of creative capacity*, Harper and Row, New York
Gross, D.P. (2016), “Creativity Under Fire: The Effects of Competition on Innovation and the Creative Process”, *SSRN Electronic Journal*. http://dx.doi.org/10.2139/ssrn.2520123
Guilford, J. P. (1950), “Creativity”. *American Psychologist*, Vol. 5 No 9, pp. 444-454. http://dx.doi.org/10.1037/h0063487
Herrmann, D. and Felfe, J. (2012), “Effects of Leadership Style, Creativity Technique and Personal Initiative on Employee Creativity”. *British Journal of Management*, Vol 25 No. 2, pp.209–227. http://dx.doi.org/10.1111/j.1467-8551.2012.00849.x
Hilgard, E. R. and Hadamard, J. (1939), *The Psychology of Invention in the Mathematical*
Field, NJ: Princeton University Press, Princeton, https://doi.org/10.2307/1417625
Hirt, E. R. Devers, E. E. and McCrea, S. M. (2008), “I want to be creative: exploring the role of hedonic contingency theory in the positive mood-cognitive flexibility link”. *Journal of Personality and Social Psychology*, Vol. 94 No. 2, pp. 213–230. https://doi.org/10.1037/0022-3514.94.2.94.2.214.
Isen, A.M., K.A., Daubman and Nowicki, G.P. (1987), “Positive Affect Facilitates Creative Problem Solving”. *Journal of Personality and Social Psychology* , Vol. 52, pp. 1122-1131. https://doi.org/10.1037//0022-3514.52.6.1122
Isen, A.M., Johnson, M.S., Mertz ,E. and Robinson, G.F (1985), “The influence of positive affect on the unusualness of word associations”. *Journal of Personality and Social Psychology*, Vol. 48, pp. 1413–1426. https://doi.org/10.1037//0022-3514.48.6.1413
Jaoui, H. (1970), “Creativity methods in technological forecasting”. *Futures*. Vol. 2 No. 4, pp. 373-375. https://doi.org/10.1016/0016-3287(70)90051-0
Murray, Donald M. and John-Steiner, V. (1985), *Notebooks of the Mind: Explorations of Thinking*, NM: University of New Mexico Press, Albuquerque. https://doi.org/10.2307/357724
Kirton, M. J. (1976), “Adaptors and innovators: A description and measure”. *Journal of Applied Psychology*, Vol. 61 No. 5, pp.622-629. http://dx.doi.org/10.1037/0021-9010.61.5.622
Koestler, A. (1965), Génie et folie de l’homme: le cri d’Archimède, Calmann-Lévy, Paris.
Lichtenfeld, S., Elliot, A. J., Maier, M. A. and Pekrun, R. (2012), “Fertile Green Green Facilitates Creative Performance”. *Personality and Social Psychology Bulletin*, Vol.38 No. 6, pp.784-797. https://doi.org/10.1177/0146167212436611
Lieberman, J. N. (1977), “The Role of Playfulness in a Theoretical Framework for a Relationship among Play, Imagination, and Creativity”, In: Lieberman, J. N. and Edwards, A.J., *Playfulness*, Academic Press, pp.107–122. http://dx.doi.org/10.1016/b978-0-12-449450-3.50012-6
Mcguire, W. (1973), “The Yin and Yang of Progress in Social Psychology: Seven Koan”, *Journal of Personality and Social Psychology*, Vol. 26, pp.446-456. https://doi.org/10.1037/h0034345
Mansfield, R. S., Busse, T. V. and Kreplka, E. J. (1978), “The effectiveness of creativity training”. *Review of Educational Research*, Vol.48, pp.517–536. https://doi.org/10.2307/1170047
Miller, W. C. (1988), “The Creative Edge: Fostering Innovation Where You Work”. *Reading, MA: Addison-Wesley*, pp. 252 , ISBN 0–201–15405-X.
Morgan, Liker (2006) *The toyota product development system: integrating people, process, and technology*. New york: productivity press.
Mumford, M. D. Whetzel, D. L., and Reiter-Palmon, R. (1997), “Thinking creatively at work: Organization influences on creative problem solving”, *The Journal of Creative Behavior*, Vol. 31 No1, pp. 7–17. https://doi.org/10.1002/j.2162-6057.1997.tb00777.x
Mumford, M. D. Scott,G. M. Gaddis, B. and Strange, J. M. (2002), “Leading creative people: orchestrating expertise and relationships”, *Leadership Quarterly*, Vol.13, pp. 705–750. https://doi.org/10.1016/s1048-9843(02)00158-3
Nemeth, C., Personaz, M and Goncalo, J. J. (2004),“The Liberating Role of Conflict in Group Creativity: A Study in Two Countries”, *European Journal of Social Psychology*, Vol.34, pp. 365-374. https://doi.org/10.1002/ejsp.210
Newell, A. Shaw, J. and Simon, H. (1958), “The Process os Creative Thinking”. *Contemporary approaches to creative thinking: A symposium held at the University of Colorado*., pp.63–119. http://dx.doi.org/10.1037/13117-003
Nishii, L. H. and Goncalo, J. A. (2008), “Demographic faultlines and creativity in diverse groups”, *Diversity and Groups*, pp.1–26. http://dx.doi.org/10.1016/s1534-0856(08)11001-5
Osborn, A. (1957), *Applied Imagination: Principles and Procedures of Creative Problem Solving*, Charles Scribner’s Sons, New York.

Piaget, J. (1951), *Play, Dreams and Imitation in Childhood*. New York: Norton.
Puccio, G. J., Murdock, M. C., and Mance, M. (2005). "Current developments in creative problem solving for organizations: A focus on thinking skills and styles". *The Korean Journal of Thinking and Problem Solving*, Vol. 15 No. 2, pp. 43-76.
Puccio, G., Mance, M., and Murdock, M. (2011), *Creative leadership: Skills that drive change*, CA: Sage Publications, Thousand Oaks.
Rhodes, M. (1961), "Analysis of Creativity", *Phi Delta Kappan*, Vol. 42 No. 7, pp. 305–310.
Rogers, C. S. and Sluss, D. J. (1999), "Play and inventiveness: Revisiting Erikson's views on Einstein's 36 playfulness", *Play and Cultural Studies: Play Contexts Revisited*, Vol. 2, pp. 3-24
Roozenburg, N. F. M. and Eekeles, J (1995), *Product Design: Fundamentals and Methods*. Chichester: Wiley.
Sawyer, R. K. (2012). *Explaining creativity: The science of human innovation*. Oxford: Oxford University Press.
Schlicksupp, H. (1989), *Innovation*, Kreativität und Ideenfindung. Würzburg: Vogel.
Simonton, D. K .(1999), *Origins of genius: Darwinian perspectives on creativit*, Oxford University Press.
Simonton, D.K. (2007). "Review of Creativity: Theories and themes: Research, development, and practice". *Psychology of Aesthetics, Creativity, and the Arts*, Vol. 1 No. 4, pp. 251–252. http://dx.doi.org/10.1037/1931-3896.1.4.251
Smith, G. F. (1998). "Idea-Generation Techniques: A Formulary of Active Ingredients", *Journal of Creative Behavior*, Vol. 32 No. 2, pp. 107-133. https://doi.org/10.1002/j.2162-6057.1998.tb00810.x.
Sternberg, R.J. and Grigorenko, E. L. (1997), "Are Cognitive Styles Still in Style?", *American Psychologist*, Vol. 52 No7, pp.700-712. https://doi.org/10.1037//0003-066x.52.7.700
Sternberg, R. J. and Lubart, T. I. (1991), "An investment theory of creativity and its development". *Human Development*, Vol.34, No 1, pp.1-31. http://dx.doi.org/10.1159/000277029
Starbuck, W. H. and Webster, J.(1991), "When is play productive?", *Accounting, Management, and Information Technology*, Vol.1, pp.71-90. https://doi.org/10.2139/ssrn.2708169
Strouse, E. (2013), *Collective Creativity through Enacting: A Comparison of Generative Design Research Methods*. (Electronic Thesis or Dissertation), Retrieved from https://etd.ohiolink.edu/
Torrance, E. P. (1977), *Encouraging Creativity in the Classroom, National Education Association*, Washington, D.C. https://doi.org/10.2307/4443233
Torrance, E. P. (1972), "Can we teach children to think creatively?", *Journal of Creative Behavior*, Vol.6, pp.114–143. https://doi.org/10.1002/j.2162-6057.1972.tb00923.x
Torrance, E. P. (1963), "Adventuring in Creativity", *Childhood Education*, Vol. 40 No. 2, pp. 79–87. https://doi.org/10.1080/00094056.1963.10727098
Ulrich, K. T.; Eppinger, S.D. (2008) *Product Design and Development*, New York: McGrawn Hill,
Von Oech, R. (1994), *Um chute na rotina: os quatro papéis essenciais do processo criativo*, Cultura, São Paulo.
Vosburg, S. K. (1998), "The Effects of Positive and Negative Mood on Divergent-Thinking Performance", *Creativity Research Journal*, Vol. 11 No. 2. https://doi.org/10.1207/s15326934crj1102_6
Vygotsky, L. S. (1978), *Mind in society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press.
Wallas, G. (1926), *The Art of Thought*. New York: Harcourt-Brace.
Webster, J. and Martocchoio, J. J. (1992), "Microcomputer playfulness: Development of a measure with workplace implications", *MIS quarterly*, Vol.16, pp.201-227. https://doi.org/10.2307/249576
West, M.A. (1997), "Developing Creativity in Organizations". *UK: British Psychological Society*, Leicester.
Wheelwright, S.C. & Clark, K.B., 1994. "Accelerating the Design-build-test Cycle for Effective Product Development", *International Marketing Review*, Vol. No.1, pp.32–46. http://dx.doi.org/10.1108/02651339410057509
Wickelgren, W.A. (1980), "Cognitive Psychology", *The American Journal of Psychology*, Vol. 93 No 2, pp.381. http://dx.doi.org/10.2307/1422248
Woodman, R. W., Sawyer, J. E. and Griffin, R. W.(1993), "Toward a theory of organizational creativity". *Academy of Management Review*, Vol.18, pp. 293-321. https://doi.org/10.2307/258761