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Choosing a Creativity Technique for Requirements Elicitation

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Abstract

Creativity and creativity techniques are relevant for requirements elicitation. There are many different creativity techniques, but these techniques are not used as widely as expected. To investigate the reasons for this situation, we assumed the viewpoint of a requirements engineer looking for decision-making guidelines to facilitate the choice among the considerable number of available creativity techniques. The results of the search highlighted the gap between existing information and what is needed. To this end, we propose a logical framework based on two matrices for choosing creativity techniques and methods in view of their application in requirements elicitation.

Keywords[1]

Creativity technique, creativity method, creativity process, requirements elicitation, classification framework

1. Introduction

Creativity plays an important role in requirements elicitation. This fact is confirmed by the large number of papers, books – textbooks, handbooks, proceedings, scientific books – illustrating the need for creativity to support requirements elicitation. The CreaRE workshop itself – dedicated to creativity in requirements engineering – celebrates its 10th edition (https://creare.iese.de); in addition to this there are many other conferences covering requirements elicitation topics (among them, Requirements engineering https://requirements-engineering.org). Literature illustrates the large variety of creativity techniques in general [1], [2], [3], and their application in software engineering [4], in requirements engineering [5], and in requirements elicitation, in particular (e.g., [6]; see also the proceedings of the above cited workshop and conference).

In such a context, one would expect that companies would adopt creativity techniques and tools for requirements elicitation in their software and information system projects. However, that is not always the case [7]. Even the most well-known creativity technique, i. e. brainstorming, is used in group requirements elicitation sessions in less than 50% of the projects; and, though it may seem counterintuitive, other creativity techniques altogether are used even less [8].

Subsequently the question arises as to: "Why companies do not apply creativity techniques in their requirements elicitation activities?" and also: "How can we promote creativity techniques in requirements elicitations"?

Answering these questions in full requires systematic investigations and surveys.

As a first contribution towards that goal, this paper aims to address the following sub-question: "If a requirements engineer (or analyst, or systems engineer or project manager), wants to adopt a creativity technique for requirements elicitation activities, are there recommendations or guidelines to support the choice among the different possibilities".

The paper goes on to offer a preliminary answer to that sub-question. Then, to solve the paradox between theory and practice of the use of creativity techniques in requirements elicitation, we propose

In: F.B. Aydemir, C. Gralha, S. Abualhaija, T. Breaux, M. Daneva, N. Ernst, A. Ferrari, X. Franch, S. Ghanavati, E. Groen, R. Guizzardi, J. Guo, A. Herrmann, J. Horkoff, P. Mennig, E. Paja, A. Perini, N. Seyff, A. Susi, A. Vogelsang (eds.): Joint Proceedings of REFSQ-2021 Workshops, OpenRE, Posters and Tools Track, and Doctoral Symposium, Essen, Germany, 12-04-2021

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CEUR Workshop Proceedings (CEUR-WS.org)

CEUR-WS.org/Vol-2857/creare3.pdf

a logical framework for describing existing creativity techniques. The framework elaborates a preliminary classification (technique vs. method) described in a technical report [9] which I co-authored and that has been read approximately 6,000 times since being uploaded on ResearchGate in 2017.

The classification proposed in this paper is grounded in two matrices – including information at different levels of detail – whose content is suggested by requirements elicitation and project management practices. The goal is to help a requirements engineer in identifying the most suitable technique for a given project.

2. Towards a framework for choosing a creativity technique

2.1. Looking for creativity techniques

Searching in the literature, a requirements engineer will find a considerable number of books focusing on the origin and the factors of creativity (a well-known handbook is [1]), or on creativity as a driver for innovation in companies [10], [11]. There are also handbooks [12], [13] and websites (e.g., http://creatingminds.org/tools/tools_all.htm) listing a number of creativity techniques (in some cases up to 100!).

Focusing on requirement engineering activities, many papers illustrate a specific creativity technique, but there are also papers describing general issues. For example, [14], [15] investigate how creativity is perceived by software engineers. Surveys or review papers are probably more useful for choosing a creativity technique to be adopted in a software or information system project. Among these surveys and reviews, [16], [17] describe a systematic literature review, however the given results cannot be directly applied in a real project. The first review focuses on approaches leveraging creativity in requirements elicitation within agile software development. The second one investigates the role of creativity techniques in requirements engineering and does not aim to identify nor to describe such techniques.

A schema to classify creativity techniques is proposed in [18] and some of the classification criteria are included in this paper's proposals. In [7] design patterns have been used to describe creativity techniques in order to promote their adoption in requirements engineering. The difference with the framework proposed in this paper is that our framework is based on a two-step description: the first one very light, to maximize the number of creativity techniques in a to-build comprehensive knowledge base; the second, more detailed, to offer a requirements engineer an effective schema to choose among a sub-set of candidate techniques for the given project. Other studies compare a (usually) limited number of creativity techniques; for example, [19] illustrates 4 creativity techniques; finally, some papers compare a creativity technique and a traditional requirements elicitation technique, e. g., brainstorming versus a scenario-based approach [20]. The 'creative engine', available at https://becreative.city.ac.uk, includes 23 problem solving techniques. The engine enables techniques to be looked for (a) to be applied in a given step of the creative process, or (b) based on different problem-solving approaches (exploratory, combinational, transformational). Some of the parameters used to describe the techniques are also included in our framework, namely stages (steps) and the indication of the number of participants in a problem-solving session. As regards requirements engineering textbooks and professional books, often they describe a very limited number of existing creativity techniques from the plethora of possibilities, or just one, usually brainstorming. A schema for *applying* a creativity technique in requirements elicitation is given by Pohl in his textbook [21]; however, such a schema is of little help to *choose* among existing techniques. Expanding the scope of search, problem-solving approaches also propose creativity techniques (see for example [22], [23], [24]), but their descriptions are possibly (logically and practically) too distant to support requirements engineers in choosing one of them. On the whole, the search for, and in turn, the decision-making scenario for one or more creativity techniques to adopt in requirements elicitation is quite complex.

2.2. A framework to describe creativity techniques

One of the reasons that could explain why creativity techniques are not a common practice in requirements elicitation is that available information is not adequate for choosing between different techniques.

For a practical classification, we propose initially checking if a given creativity technique also suggests a creativity process. We then call such creativity techniques 'methods', to distinguish them from simpler ones. Examples of creativity methods are brainstorming [25], or the 6 Hats [26]. A classical process for a creativity method includes 4 steps: Preparation, Incubation, Illumination, Verification [27]. Most of the creativity enhancement techniques are focused on the illumination step only. Creativity methods cover, albeit in a different way, all the steps. Distinguishing creativity methods is relevant to understand if, and to what extent, the requirements elicitation process has to be adapted to adopt a given creativity technique.

A common criterion used to classify creativity techniques is the individual vs group techniques [28], [29], [30]. In fact, there are many techniques that have been designed for group session use (e.g., brainstorming [25]), while others have been introduced for individual application (e.g., creativity pause [31]). However, this classification has been challenged by practical applications, as individual techniques can be applied also in group-work and vice-versa (see for example the experiment for individual brainstorming [32]; or for variations of the more recent EPMcreate [33], [34]). It is subsequently important to know if a creativity technique is an individual or group technique or if it can be applied in both ways.

Furthermore, there are many different parameters and information that could be useful in selecting a creativity technique for requirements elicitation. Given the ample variety, the framework illustrates their main advantages and disadvantages as an effective and succinct description. Finally, references to scientific papers, documents and websites, useful for finding more information, have be added; other contacts could also be included, as for example for research groups that defined the technique, or consultants, or experts in its application.

The result is a matrix with the fields given in Table 1, partially filled-in to give an idea of its use. The names of the columns define a logical record to create a knowledge base documenting all the available creativity techniques.

Table 1
Matrix to describe creativity techniques for requirements elicitation

Name	Process	Group vs Individual	Advantages	Disadvantages	Sources
Brainstorming	yes	both	Well known High number of new ideas	Disregarded principles	[25] [brainstorming.co.uk]
Creative pauses	no	no	Simple to apply	Unstructured	[31]
Six thinking hats	yes	yes	Force to consider different moods and viewpoints	Requires high abstraction skills	[debono.com] [25] available in 5 languages
(...)					

The knowledge base supports the selection of a subset of candidate techniques to be compared in a candidate techniques matrix, as illustrated in Table 2. The matrix includes parameters based on requirements elicitation and project management practices [35]. In the example, the parameters are listed in alphabetical order. *Costs* comprise all costs included in running the requirements elicitation

session when applying the creativity technique; these costs depend on the other parameters: for example, costs for an external expert to act as a facilitator for a group technique, for new equipment (e.g., an interactive whiteboard), software to support the activities included in the technique, training for the analysts, etc. *Documentation* is useful to know if there is adequate material for the creativity technique (content, languages). *Domain* is necessary to know if the technique is domain-independent and/or if it has to be adapted to be applied to a specific project domain. *Equipment* specifies if the candidate creativity technique requires furniture or spaces or instruments. *Facilitator* indicates the role that is foreseen by many group techniques to guide requirements elicitation sessions. *Learning curve* indicates the training effort required to be able to apply the creativity technique. *Maturity* is useful to evaluate the level of risk involved in the adoption of the candidate technique: some creativity techniques have been introduced more recently than others and could be more innovative, but also pose more risk; more importantly, a given technique may have never been applied to elicit requirements. *Popularity* helps to evaluate requirements engineering commitment in applying a creativity technique: renowned techniques should be more readily accepted, even though in some companies very new techniques could possibly challenge requirements engineering in a positive way. *Steps* allows specification of which activities may be supported by the candidate creativity techniques adding details relevant for its adoption. For example, a simple technique could be adopted in a pilot project in companies where creativity had never previously been considered; while a fully-fledged creativity method could be more suitable for challenging projects in which new requirements are a must (e.g., a software system for a highly competitive sector). Finally, *tool* indicates potential software systems supporting the creativity technique candidate's application.

Table 2
Candidate creativity techniques matrix

	A	B	C
Costs	High	Medium	Low
Documentation	Also in Italian	Only in English	Only offline
Domain	Similar	Finance only	
Equipment		Available	
Facilitator	Yes		
Learning curve	Medium		
Maturity	Medium		
Popularity	Low		
Steps	Illumination	All	
Tool	No	Yes	No

The candidate creativity techniques matrix can be used to attribute value of increasing precision to the listed parameters: Boolean (to specify if a candidate technique satisfy the attributes); using a Likert scale (giving a numerical score to each attribute in a defined range); giving a textual description of the specific characteristics for, e.g., a list of the equipment, the name of the tools available, number or types of projects where a candidate technique has been applied, etc.

3. Conclusion

The goal of this paper is to propose a framework based on two matrices to describe available – although often unknown – creativity techniques and methods in order to promote their adoption in requirements engineering. It is a first contribution towards a description of creativity techniques suitable to support a requirements engineer in choosing between the large number of available techniques.

The parameters in the matrices have been advocated by project management good practices and reflect a practical approach. Nevertheless, the two matrices have to be validated and refined. The first one should cover as many techniques as possible. Some of them are variants of the same technique, so that a hierarchical sub-classification could also be added [36]. Moreover, creativity techniques have to be described briefly to be of practical use. Subsequently, following an incremental process, the second

matrix allows a requirements engineer to compare candidate techniques chosen from the first matrix, adding more information only for a limited sub-set of the existing techniques. More importantly, such information has to be 'customized' according to the project, the company, the sector, the process model, and any other aspect that could affect a successful application of creativity practices. Finally, as creativity techniques can be adopted to support many different activities in requirements engineering, the matrices could also be adapted to include criteria and parameters for those activities.

The two matrices framework constitutes the conceptual core of a creativity techniques knowledge base, which in turn can be used to design and implement a knowledge-based decision support system (a KBDSS, [37]). The architecture and the interface of the KMDSS have to be designed (a) to effectively exploit the information in the two matrices, (b) to allow a requirements analyst to adapt them to satisfy a company's customization and selection process requirements.

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