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Dolog, Peter; Lin, Yujian; Grube, Per Pascal; Schmid, Klaus

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Creativity Support at the Workplace

Peter Dolog¹, Yujian Lin¹, Pascal Grube², Klaus Schmid²

¹Department of Computer Science, Aalborg University
Selma Lagerlöfs Vej 300
9220 Aalborg East, Denmark
{dolog, yjlin}@cs.aau.dk

²Institute of Computer Science, University of Hildesheim
Marienburger Platz 22
D-31141 Hildesheim, Germany
{grube, schmid}@sse.uni-hildesheim.de

Abstract: In this paper, we discuss creativity as a form of learning from the perspective of idea generation in the creative process. We analyze forms of creativity and present the *statement-based creativity techniques*. Based on these concepts a tool prototype IdeaTrigger is presented and verified. It shows the advantages for innovative activity, especially in collaborative environment.

1 Creative Work and Creativity Support

Creativity can be seen as the hallmark of intelligent work. As Europe's future is seen as a knowledge economy [KE09], intelligent and creative work will become increasingly important. While sometimes creativity is seen mostly in the context of the Arts, we see *creativity* as a general phenomenon, which is relevant to each and every kind of complex problem solving [Bod04]. From this perspective, creativity is treated as a process to find solutions, which is also referred to innovative activity and involves both idea generation and idea management.

As idea generation is an activity to retrieve existing knowledge from memory and to combine them into novel ones, it can be regarded as a form of learning in the sense of psychological activity. People acquire new knowledge, not by being taught or by acquiring in other ways existing knowledge, but rather they develop this knowledge anew, as it does not exist yet.

Creativity is by definition hardly predictable, thus supporting it effectively is very difficult. In this paper, we will describe an approach towards integrating domain-independent creativity support effectively in a workplace environment. As *creativity support* we will regard any kind of methodological or IT support that enables people to be more creative, both in terms of quality and quantity of their ideas. Our approach relies on established creativity techniques, integrates several techniques and aims to automatize as much as possible of the information handling. The work, we describe here, is part of the IdSpace project, an ongoing EU project which aims at developing an enterprise portal that supports ongoing learning and creative work, with a specific focus on product innovation [IDS09].

This paper is structured as follows: in Section 2, we discuss the notion of creativity techniques and will discuss some psychological background research on human creativity. In Section 3, we discuss a very important subclass of creativity techniques, i.e., statement-based creativity techniques and an example is presented to illustrate the mechanism. In Section 4, we discuss a tool concept for creativity support. In Section 5, we discuss some experiences we gathered so far, while applying the underlying approach. Finally in Section 6, we summarize and conclude.

2 Creativity Techniques

The phenomenon of creativity has triggered a lot of research, especially in psychology [Bod04, Ste99]. Several models have been developed as part of this research. Some models focus on the creative product (i.e., what makes a product a creative product) or on the creative person (e.g., questionnaires that help to identify creative traits in people). However, the work which interests us most focuses on the creative process. This tells us how creative products are generated and understanding this is key for supporting learners to be more creative. Various models of the creative process have been described over time. Perhaps the most well-known (and simplistic) model is the Wallas-Model [Wal26]. It consists of the stages preparation, incubation, illumination and verification. Here, illumination characterizes the event of “having the idea”, and verification describes the necessity of making sure that the idea is correct.

A different, well-known categorization is given by the various types of creativity as described by Boden [Bod04]: she differentiates exploration, transformation, combination and evaluation. A rather detailed model of creativity is the IPC-model of the creative process [Sch95]. This model also

provided a basis for a categorization of various AI techniques to better understand how AI can contribute to creativity [Sch96].

As a result of psychological work in creativity techniques, a large number of techniques have been described [Myc09], which aim at supporting people in developing creative ideas. Probably, the most well-known technique is brainstorming [Os53]. As part of our research, we collected, analyzed, and categorized a very large number of techniques [GS+08]. One interesting fact we have found is, although there are already a large number of creativity techniques, current creativity tools as software, either commercial tools or free tools, are mostly implementing the mind mapping creativity technique as a way to organize ideas[GS+08]. However, there is a special kind of creativity techniques, which describe a set of principles for innovative activity. These principles are guidance for people to generate idea. In this paper, we focus our discussion on such creativity techniques, which we call statement-based creativity techniques.

Statement-based creativity techniques are creativity techniques which direct creativity sessions by a set of principles that can be represented as a number of questions. Example is 5WH providing who, what, when, where, why, and how questions to answer in a creativity session. Those questions are called *statements*.

In order to select specific techniques and combine them in specific situations, we introduced the following categories:¹

- Context factors – they describe the elicitation context in which the techniques can be applied.
- Operation types – within the creative process different forms of creativity operations can be distinguished.
- Main activity groups – we identify six groups that emphasize the underlying approach of the techniques.

The *context factors* describe under which circumstances one of the approaches can be successfully applied. This includes questions like whether the approach can only be used by a single person or in a group, does it require physical interaction among the people (i.e., can it only be used by groups of people who can physically interact), and so on. The *operation types* are given by the four types that Boden distinguishes as

¹ A more detailed description can be found in [GS08]. This list is only an excerpt of the full set of categorization dimensions. These categories are also given in [GS+08].

given above (Exploration, Validation, Transformation, and Combination). The third dimension, the *main activity groups*, consists of the following categories:

- Free Association
- Question List
- Different perspectives
- Structuring
- Expert Knowledge
- Random Input

When aiming at supporting creative work by the use of creativity techniques, it is important, to provide an integrated set of techniques. Towards this goal a set of techniques should be selected which adheres to the following criteria:

- *Coverage* – together the various techniques should cover the various operation types in the creative process. (It is in particular advisable to cover the various categories defined by the IPC-model [Sch96].)
- *Continuity* – use techniques that make similar assumptions about the environment and can thus easily be used together. Similarly, input and output types of the techniques should fit.
- *Diversity* – idea generation is a key part (including transformation and combination), thus it is good to have here various alternatives.
- *Adequacy* – adapt the number of techniques to the available amount of time.

Based on these rules, we selected a number of techniques for further studies. We took the following two creativity techniques as a start point to illustrate the mechanism:

- SCAMPER – The acronym stands for Substitute, Combine, Adapt, Modify, Put, Eliminate, Reverse and denotes various operations that shall be performed using the base idea.

- 5W1H – this acronym denotes: When, Where, Who, What, Why and How. It describes various idea trigger questions that shall be asked relative to the base idea.

3 Integrating Creativity Techniques

In the context of our research work, we are particularly interested in the knowledge representation of the results of the creative process and the intermediate steps. As mentioned in section 2, the creativity techniques discussed in this paper are statement-based creativity techniques. The statements are extracted from the principles and are stored somewhere else. For example the “substitute” principle from SCAMPER is transformed to a set of statements such as “Can you replace it?” “Is there an alternative?” “What else?” “Can you try another way?” and so on.

The purpose of these statements is to aid in transforming existing knowledge into new knowledge. Thus, a trace of a creative activity can always be described in the following manner:

existing idea → *statement* → new idea

By describing different steps of the creative process in this way, we generate clouds of ideas (similar to mind-mapping). The individual connections describe creativity techniques and the various transformations can be developed either by the same person or collaboratively by a group of people.

This restriction in fact allows us to define a conceptual model which is a graph connecting ideas as nodes by edges labeled by the statements. As we will see later, this provides us with several advantages:

- It has a simple **meta-model** very closely related to topic maps or other similar semantic based knowledge representation mechanisms
- It has good **extensibility** to support other creativity techniques which can be also transformed to statements.
- It allows for **integration of various other tools** such as editors and chats on top of such a conceptual representation

- It allows for the **preservation of ideas** as generated historically together with a connection to the other ideas as well as views over ideas provided by the integrated toolset

We have a name *IdeaTrigger* for the approach we developed. As mind mapping is a good approach to visualize ideas, IdeaTrigger organizes ideas in an *idea graph*, which is a mind-mapping-like approach, but with small, yet significant, changes, i.e., keeping the relations between ideas. IdeaTrigger not only supports the generation of ideas but also keeps the relations between the ideas. Figure 1 is an application example “design a small house for holiday” of IdeaTrigger.

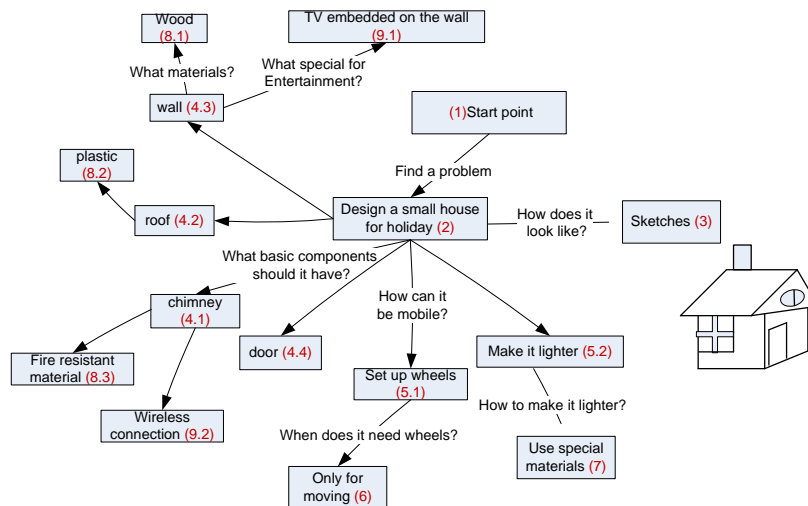


Figure 1: “design a small house for holiday” by IdeaTrigger

This is only a part of the innovative activity “design a small house for holiday”, which illustrates both mechanisms of statement-based creativity technique for idea generation and idea graph for idea organization. Please note this is only part of the result; actually, there are more ideas and it cannot be displayed here as a whole; and the statements used here is not only “5W1H”.

Innovative activity usually begins from a problem. Here the statement “find a problem” triggers an idea “Design a small house for holiday”, which is a task. With “5W1H”, this task is divided into several sub-tasks. Statement “how ...” push people come out a sketch, which is *idea 3*; “what...” stimulate the *ideas 4.1, 4.2, 4.3, 4.4* which are all connected with *idea 2* by

the “*what ...*” (omitted for simplicity in the figure). The process continues, and there will be more and more ideas. As we can see, the statements provided by the statement-based creativity techniques are general and incomplete and can be modified to fit specific problems; these statements assist people to think out in particular direction; and one statement can trigger multiple ideas; and the idea graph is a directed graph with labeled edges.

4 The IdeaTrigger Tool Concept

Based on the concepts described above, we are currently developing a first tool prototype to implement these concepts and test them in real-life product innovation scenarios.

Imagine a standard creativity session which is organized locally with several team members by utilizing white or black boards and other tools such as post-its. In any session, there is a problem to start from and a team more or less structurally generates, explores, elaborates, and validates ideas. Team members often discuss and draw some sketches, make their personal notes, collaboratively contribute to the drawings, etc. After the creativity session is finished or after several sessions the team is asked to produce a final result to be presented to other organization members and stakeholders. Thus, a consolidation is necessary. Further, the other team members, who did not participate in idea generation, need something to guide them through the generated ideas to learn and understand them effectively. Therefore, it is important to provide a user-friendly view on the idea graph.

So far, tool support for such a consolidation is limited and mostly comprises paper and pencil tools. It simply takes to redraw the sketches to its final electronic versions, extend them with additional material and descriptions. Furthermore, if the team members are distributed, it gets even more difficult as the personal notes, black board sketches and extensions are not really connected to each other. Thus, one needs at least a combination and integration of a collaborative real time editor for specific domain of concern in the creativity sessions (for example programming, biology, architecture, and so on), underlying representation of ideas and connections between them and some kind of personal notes exchange tool such as chatting room.

Figure 2 presents a sketch of a prototype close to the one discussed above. It provides an editor for idea representation and connections among them, an editing tab for domains of concern, evaluation and other functions.

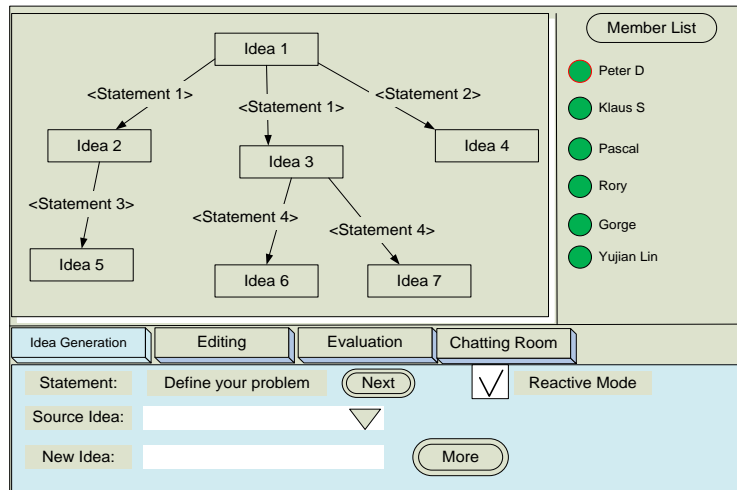


Figure 2: IdeaTrigger Toolbox with Tabs of Idea Generation, Editing, Evaluation, Transformation and Chat Room

5 Validation of the IdeaTrigger Tool

The above mentioned ideas for IdeaTrigger Tool were extended and verified during a one week meeting in October 2008 at Aalborg University. The aim of the meeting was to verify the support for a distributed creativity session by the IdeaTrigger Tool. Four researchers participated on site in the meeting. They met every day for a stand up brainstorming in the morning for an hour, and then continued with generating ideas alone in a distributed fashion and meeting again together with five other researchers connected with Skype in the afternoon.

The original plan was to utilize different creativity techniques on the problem of creating a story board for idSpace. We started with the 5W1H technique and iteratively asked the questions "How it is used" and "How it can be realized". It turned out difficult to fulfil because the problem was not firstly properly stated, which required us to turn to other creativity techniques. We ended with an idea graph simply by the 5W1H creativity technique and some principles from SCAMPER especially when brainstorming alternatives. Besides the idea graph, we had many sketches to illustrate the ideas, and eventually made a storyboard which covered the main points of IdSpace platform. Among the small amount of ideas and the relations built by the statements, one could understand how one idea was

derived and how it was related to others, which helped those who did not directly participate in the sessions learn the process.

A whiteboard, together with pen and paper was sufficient for the communication among the team members participating at Aalborg, but the information gathered from each individual had to be transformed into an electronic version. This was also required to share the information with the offsite team members during the daily online meetings. Therefore support for real-time collaborative editing and sketching was another important functionality of IdeaTrigger. The online meeting itself demonstrated support for online note exchange was still another preferred functionality.

6 Conclusions

The idSpace project aims at developing a novel product innovation support platform. This platform shall be a rather generic collaboration platform which integrates creativity techniques and provides them in a context-specific manner to the product innovation team [IDS09]. The integration of traditional collaboration techniques and novel creativity support aims to provide people with a seamless experience that enhances their creativity in a natural manner.

The work we described in this paper is part of the ongoing work on identifying an “optimal” product innovation support. We are currently analyzing various product innovation support approaches. The IdeaTrigger tool concept described as part of this paper is the currently most promising creativity support approach.

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