

# Knowledge Sharing Strategies for Collaborative Creativity

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**Abstract.** This paper proposes the use of Knowledge Sharing Strategies for Collaborative Creativity (KSS4CC). These KSS4CC are a combination of learning and collaboration flow patterns and creative techniques. This approach allows for collaborative learning, whereas using creative techniques merely focuses on the generation of ideas. By formalising them in XML documents, they may be used to support moderators and users during the collaborative idea generation process. Future work may include the formalisation of KSS4CC using RDF, OWL or IMS Learning Design.

**Keywords:** idSpace, creativity, learning, collaboration, knowledge sharing strategies, NPD, workflow.

## 1 Introduction

In new product development (NPD), people work together to arrive at new and innovative products and solutions. This requires teams to be creative. Creativity may be seen as a way of collaborative learning and thus needs support appropriate to that. To support dispersed teams working in the context of NPD, the idSpace project develops an integrated, web-based environment in which context-sensitive tools and techniques together with pedagogy-based recommendations enhance a team's learning and collaborative creativity during the creative phases of NPD. Creative techniques merely aim at fostering creativity, whereas pedagogical strategies promote collaborative learning. We propose a merger of pedagogical strategies and creative techniques into something we call Knowledge Sharing Strategies for Collaborative Creativity (KSS4CC).

For many European firms, being innovative is crucial to sustain their market share. To keep up with today's dynamically changing global economy, they need innovative solutions and effective product-to-market cycles. They do however face a number of challenges, ranging from idea generation failures, transformation from concept to product shortcomings, managerial issues and marketing problems. Structural limitations in creative team performance include (1) ineffective learning in the project team and (2) a lack of effective tooling to support collaborative creativity [1].

The missing link, in our view, is the use of pedagogical strategies that foster knowledge sharing and development in collaborative learning settings. These strategies include Progressive Inquiry, Think Pair Share and Jigsaw. They provide predefined workflows that foster the co-creation and sharing of knowledge through, for instance, a series of inquiry or structured knowledge sharing activities. This is complementary to the use of creative techniques in the sense that pedagogical strategies focus on fostering collaborative learning, whereas creative techniques focus merely on the generation of ideas.

The KSS4CC will be used to generate recommendations on the workflow to be used during a collaborative creativity session. Such recommendations may be divided into three categories [2]:

- 1. Higher order recommendations, which will help a practitioner to choose among the most suitable creativity strategy for a specific scenario/case. This choice will be based on elements such as the type of learning objectives that need to be accomplished, the complexity of implementing a whole strategy and its constituent activities.*
- 2. Organisational recommendations, that will involve decisions about the formation of groups, leadership schema, etc.*
- 3. Technological recommendations, that will concern the use of specific tools, features for the implementation of the strategy into a real specific scenario/case.*

In this paper, we will only focus on the first recommendation type, the higher order recommendations.

The structure of this document is as follows. In section 2 we will elaborate on the concept of Knowledge Sharing Strategies for Collaborative Creativity. KSS4CCs consist of higher order recommendations, which focus on the workflow during ideation sessions. Section 3 we provide a way of formalisation of the KSS4CCs described in section 2. In section 4 we envisage the output to the users of the system. We draw our conclusions in section 5 and propose future directions of research.

## **2 Knowledge Sharing Strategies for Collaborative Creativity (KSS4CC)**

As discussed, we propose to combine pedagogical strategies and creative techniques in order to support dispersed teams in being creative collaboratively. When combined, they form workflows we call Knowledge Sharing Strategies for Collaborative Creativity (KSS4CC). The KSS4CC aid the moderator, who in our view should always be available to guide collaborative creative processes, in choosing the right actions to present to the user. In other words, they provide workflows for collaborative creation of knowledge (collaborative learning), whereas the creative techniques and creative flow patterns (CreaFP) such as Six Hats Thinking [3] provide strategies for collaborative creativity, that is, a specific type of collaborative learning

[1]. The KSS4CC may thus be regarded a superset of the creativity techniques. This is shown in Figure 1.

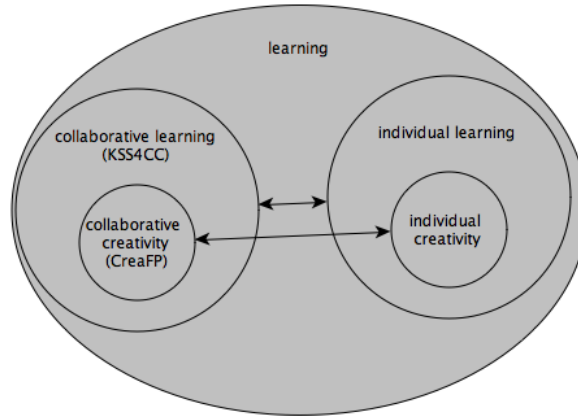


Figure 1: an overview of the relation between Knowledge Sharing Strategies for Collaborative Creativity (KSS4CC) and Creative Flow Patterns (CreaFP)

## 2.1 Higher order recommendations

As already discussed, in our view, the KSS4CC is a specific type of support that is on a high order (macro level) rather than support aimed at fostering the generation of ideas, which is on the micro level [4]. KSS4CCs occur in the form of recommendations to the ideation session's participants and moderator. After thorough examination of the characteristics of both pedagogical strategies and creative flow patterns, we suggest to combine the following strategies and techniques into KSS4CCs.

**Table 1.** Matrix overview of pedagogical strategies and creative flow patterns compatibility.

| CreaFP<br>ped.<br>strategies | Progressive Inquiry | Jigsaw | Pyramid | Think Pair Share |
|------------------------------|---------------------|--------|---------|------------------|
| 5W1H                         |                     | X      |         |                  |
| SCAMPER                      |                     |        | X       |                  |
| Disney                       | X                   | X      | X       | X                |
| Six Hats<br>Thinking         | X                   |        |         | X                |

Table 1 is based on characteristics of patterns and techniques defined by Grube et al. [5]. They include operation types, such as the Boden creativity types exploration, combination, transformation and evaluation [6]. Besides, the characteristics include

whether or not they focus on the problem and use question lists to facilitate the co-creative process. Lack of space prevents us from detailing our arguments for each and every combination. Details may be found in deliverable 1.3 of the idSpace project [2]. However, our choice for the combination of Progressive Inquiry and the Six Thinking Hats strategy may for instance be justified by pointing out that both take into account the problem definition and use different views for critical evaluation of ideas.

### 3 Implementation

We laid down our suggested combinations of strategies and techniques into KSS4CCs informal XML documents. Other ways of formalising this knowledge include the use of RDF, OWL(2) and IMS Learning Design . The reasons for not choosing such languages are:

- There is a time constraint in building the current system prototype, which is the first version of the system. We therefore choose to test the use of KSS4CC by the participants of an ideation session first, before investing time in more complex representations of our knowledge.
- The amount of relational data is not large enough such that it pays off to use RDF or OWL(2)

These XML specifications mention several characteristics, such as the problem complexity, how well the problem is defined or whether or not a problem is divisible into sub problems. Below we provide an XML snippet containing such characteristics for Progressive Inquiry.

```
<strategy id="pi">
  <identifier>pi</identifier>
  <problemType>open</problemType>
  <problemDefinition>ill-defined</problemDefinition>
  <complexity>medium</complexity>
  <problemDivisible>yes</problemDivisible>
  ...
</strategy>
```

The workflow of Progressive Inquiry is modelled in an XML document that consists of states and transitions between these states. These states are mapped to processes or functions of the idSpace platform [7]. For instance, the state (action) "Create Working Theories" may contain a link to the idSpace prototype process number 10 ("Individually Generate Ideas"), which is denoted by the bold XML text shown below.

```
<state>
  <state_id>create_working_theories</state_id>
  <moderator>no</moderator>
  <co-operative>no</co-operative>
```

```
<chatbox>no</chatbox>
<mxGraph>yes</mxGraph>
<notes>yes</notes>
<recommendations>yes</recommendations>
<process_id>10</process_id>
</state>
```

By comparing the XML specifications with characteristics of the actual context given, we will be able to distinguish which KSS4CC to use. This will be explained in the next section.

## 4 Exemplification of use

There still exists a gap in the formalisation of the knowledge and the actual use of this knowledge by the users of the idSpace system. Therefore, we distinguish two ways of presenting the user with information on the knowledge we formalised. Firstly, we define user-directed support to be support provided to the user in the form of textual explanations of the KSS4CC we would like them to work with. Secondly, we distinguish workflow-oriented support, which is directed at the moderator of a session. This type of support is aimed at recommending the moderator with an appropriate workflow, given a certain problem.

### 4.1 User-directed support

When the system user would like to know about Progressive Inquiry, the idSpace system switches to the appropriate XML specification and extracts the description of the strategy Progressive Inquiry, which is:

*Progressive inquiry relies on an idea of facilitating the same kind of good and productive practices of working with knowledge -- progressive inquiry -- that characterize scientific research communities in education. By imitating the practices of scientific research communities, students are encouraged to engage in extended processes of question- and explanation-driven inquiry. Accordingly, an important aspect of progressive inquiry is to guide users in setting up their own research questions and working theories. In practice, this means that users are making their conceptions public and working together for improving shared ideas and explanations. It is also essential to constrain emerging ideas by searching for new information. Participation in progressive inquiry, in the present case, is usually embedded in computer-supported collaborative learning environments that provide sophisticated tools for supporting the inquiry process as well as sharing of knowledge and expertise.*

Similarly, the ideation session's participant may be presented an explanation of the actions that need to be performed within a KSS4CC. Below, we include such an explanation for the Progressive Inquiry action "Create working theories". Whenever

this action has to be taken, the idea generation participant will be shown the following text:

*“Think about /Write down your own working theories how to solve the problem. Explore and combine steps from other problem solving meetings.”*

#### **4.2 Workflow-oriented support**

We envisage the following use of the KSS4CC workflows. For example, when a project starts, the moderator has several choices: (1) the moderator assigns participants to the session or not, (2) the moderator defines the problem or not, (3) the moderator chooses an appropriate technique. The first two choices are kept in memory and the system subsequently analyses which of the KSS4CCs is most suitable to assist the session's participants. For instance, an ideation participant may be facing a problem that is open, but ill-defined. If one looks at the specification of the KSS4CC shown earlier, one sees that Progressive Inquiry is especially useful to support ill-defined and open problems. The moderator may thus choose Progressive Inquiry to be the main workflow for the ideation session. The system recommends a combination of Progressive Inquiry and the Six Hats Thinking method to be the most suited type of KSS4CC. The moderator is presented with the workflow of Progressive Inquiry and he or she subsequently instructs the ideation process participants accordingly.

### **5 Conclusions and Future work**

We proposed the application of collaborative learning strategies to the domain of creativity. Combined with the creative techniques they form workflows that we have called Knowledge Sharing Strategies for Collaborative Creativity (KSS4CC). The added value of KSS4CC lies in their combining of pedagogical strategies and creative techniques. We exemplified the formalisation and implementation of our knowledge in the idSpace platform. Besides, we indicated how the formalised knowledge can be used within the idSpace platform that is currently being developed.

We envisage a number of directions for future research. First, we think that support for the reuse of knowledge and expertise should be combined with the creative process. For example, when teams are in an ideation session, and run into a problem that is out of their scope, they need additional knowledge. This additional knowledge may be provided by a person who participated in a previous project. During the previous project, that person entered his or her knowledge and expertise in a profile that was saved to the system's database. The use of public profiles on networking websites such as LinkedIn, Facebook and Myspace to foster social interaction in Learning Networks has already been argued by Berlanga et al. [8].

Second, we think that formalising the knowledge we have at this moment by means of an ontology language such as OWL(2) may provide us with a more elaborate picture of our knowledge. Another option may be the use of IMS Learning Design [9] that allows for reuse. Both result in more reasoning power for the system about the workflow and thus better support for the higher order recommendations.

Similar work has been done by Villasclaras-Fernández et al. [4], who modelled CSCL scripts in an ontology to assist moderators in creating pedagogically sound collaboration scripts. They do not, however, use problem characteristics to determine which script to use. By formalising our knowledge, we will take this a step further by recommending the moderator which script to use, depending on the problem characteristics.

Third, we think a focus on the interactions between people in an ideation session would help improve the KSS4CC recommendations. When people support each other's ideas by either consciously supporting them, or unconsciously through building on someone's idea, they form sub groups, or coalitions [9]. Various factors influence the way people form such coalitions during the idea generation process. Hierarchy, for example, could severely hinder the process of generating ideas, as people necessarily tend to follow their boss' idea that is of low quality, while other people may have generated ideas that are of higher quality. Hence, people need to be made aware of the value of their interactions in order to develop intrinsic motivation for group behaviour [9].

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