

## **STUDYING THE ROLE OF CONTEXT IN SOCIAL CREATIVITY FOR THE DESIGN OF DIGITAL RESOURCES**

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*This paper presents a study of social creativity in the collaborative design of digital educational resources with a new technology enabling the meshing of text with dynamic digital widgets. Our focus was on understanding processes of social creativity taking the context of four socio-technical environments seriously into account. Our collective was a Community of Interest made up of members from diverse communities of practice. Our hitherto achieved results from the design of one digital resource in France show a deep interconnectedness between emergent creativity and contextual issues such as connectivity to curriculum and to local situations as a forum for student mathematization.*

### **INTRODUCTION**

The advent of digital technologies has made possible the generation of ‘socio-technical environments’ (Fischer, 2001), providing appropriate settings for teachers and other educational professionals to co-design digital resources for students. Addressing resource design as a creative social activity within such environments becomes therefore a new and challenging field of research. For us, a first far-from-easy task was to articulate an operational definition of social creativity in resource design. In the study presented here we deal with a special kind of resource, the ‘c-book’ unit (‘c’ for ‘creative’). C-books can be collaboratively produced via an innovative authoring digital environment which was developed in the framework of a European project titled ‘Mathematical Creativity Squared’ (MC2). This technology is innovative because it affords meshing narrative with dynamic digital artifacts thus leading to a generation of new kinds of digital resources for teaching and learning. It is therefore interesting to study social creativity as it emerges amongst designers around the c-book affordances and explore how such processes are influenced by contextual factors.

### **SOCIAL CREATIVITY IN THE COLLABORATIVE DESIGN OF NEW DIGITAL EDUCATIONAL RESOURCES: THEORETICAL FRAME AND METHODOLOGY**

The ‘social creativity’ approach views creativity as it springs and grows among designers within appropriately designed socio-technical environment. More particularly its ‘social dimension’ can be identified in the exchange and negotiation processes taking place amongst the designers, leading to the co-construction of novel/new, shared and thus more enriched perspectives of their task at hand (John-Steiner, 2000). Different types of creativity can be traced in the related literature. The one informing the theoretical frame of our research is the so-called ‘everyday’ or ‘little-c’ creativity (Simonton, 2010). This approach is close to what Craft (2000) calls ‘possibility thinking’, which is when a person realizes a new and improved way to approach an issue or accomplish a task. Boden (1994) uses another term ‘psychological creativity’ (p-creativity), to refer to something which is identified as creative at least by the creator her/himself.

Since social creativity needs the “*synergy of many*” and is fostered by heterogeneity, a “*community of interest*” (CoI), which “*brings together stakeholders from different communities of practice*” and is characterized by a “*collective concern with the resolution of a problem*” (Fischer, 2001), enhances the creative potential of its members more than in the case with a typical designers’ community of practice (Wenger, 1998). In the MC2 project we therefore decided to form four distinct CoIs rather than CoP, from four different countries, bringing together teachers, researchers, teacher educators, artists, computer scientists to design together c-book resources for mathematics.

Apart from the “little-c” theoretical perspective of creativity our approach moves within the “componential” tradition of creativity assessment (Hennessey & Amabile, 1999) asserting that creativity is a multi-component and in-context activity. More particularly, our operational definition of social creativity, as identified in the collaborative design of c-book units fostering creative mathematical thinking taking place within the MC2 socio-technical environment, views creativity as the *generation of ideas* which: **(a)** stem from a combination of two or more individual ‘activity systems’, that is the CoI members’ knowledge systems or other socio-cultural domains, **(b)** result from various interactions among the CoI members and with the c-book infrastructure and tools, **(c)** are externalized in and through specific digital artifacts (the c-book units) which are not only the final ‘products’ but also act as ‘boundary objects’ enabling and boosting communication, shared understandings and the negotiation and construction of new knowledge among the CoI members during the various phases and activities of the design process, and **(d)** are considered to be: (1) **novel** (original, unusual or new), at least to the minds of the CoI members who produced them, (2) **appropriate**, that is they conform to the characteristics and functions of the c-book units, as defined by the CoI members with regards to their intended target group(s), and (3) **usable**, ready and available to be used in the design of the c-book units according to the designers’ estimation.

Our research on social creativity in a designers’ CoI takes therefore into consideration the context within which creative processes take place, that is the conditions, either personal, social, institutional, or cultural in which the designers work is located. We are more particularly interested in exploring how such conditions influence the selection of the topic, the elaboration of the scenario and the construction of the mathematical content of the c-book, so that ‘de-contextualization’ (Lagrange & Kynigos, 2014) of the design process may become possible making our findings useful more broadly. To study collaborative design, we employ the documentational approach (Gueudet & Trouche, 2009) focusing on distances between the various versions of a resource, which result from the interactions with others and/or with the technology. It considers both the individual and collective resource systems, i.e. organization of the resources, individual profiles and it brings to the fore institutional constraints which affect collaborative design.

Among other the c-book socio-technical environment includes a shared communication space, ‘CoIcode’, to enable researchers to collect data and users to communicate. This space was designed to promote social creativity by enabling exchanges between designers and, at the same time, by saving all interaction traces as a logbook for both designers and researchers to refer to them. Moreover, in order to obtain data about the contextual issues impacting social creativity in the four distinct situations proper to each CoI, we developed a set of ‘integrating tools’. Two of them were directly addressing the composition and work organization in each CoI: the ‘CoI profile’ and ‘CoI moderation’ templates. The first collects data on the CoI and its members: the number of CoI

members, their profile and institutions, the CoP they represent, their intended role in the c-book resources design. The second describes moderation strategy, orchestrations of activities and procedures to support and facilitate the CoI's creative performance. For instance, in the case of the Greek CoI the "profile" template reveals that several members are concerned with environmental issues, which is reflected in the choice of topics for their c-books (e.g. in the c-books 'Windmills' and 'Cycling in the city'). The French 'CoI moderation' template gives information about the CoI decisions with regards to the design of their c-books, such as the involvement in each c-book design of a small number of CoI members playing different roles (moderator, designers and reviewer).

### **NEGOTIATION OF A SCENARIO IN THE DESIGN OF THE C-BOOK "SKI TOURING"**

In this section we selected a snippet from the analysis of the negotiation processes taking place around the crafting of a c-book scenario among French CoI members to show the role of context in their joint work. The members who took part in the design of this c-book were Tom (c-book reviewer), Zoe and Paul (c-book designers), and Jack (moderator and c-book designer). Other members of the CoI intervened sporadically, either spontaneously or when asked by the designers as Leo (researcher), with an expertise in modeling who was often asked to design dynamic digital artefacts (widgets). The topic of this c-book was suggested by Zoe who lives in an area where many students practice ski (cultural context). She had already worked on it with a secondary teacher, and she had a lot of relevant resources: video, experiment, journal and documents. These resources, stemming from her personal resource system, were combined to constitute the initial version of the scenario, (version 1: from one designer personal resource system). The second version of the scenario was conceived through the various posts in CoIcode. First, Zoe suggested different themes she used to experiment with students. She also added a novel idea not fully elaborated about the snow texture which allows addressing other mathematical themes. Because of time constraints due to various obligations of the designers (dissertation corrections, oral presentation examinations, meetings - institutional context), Jack was the only designer who accepted to invest time to the implementation of the scenario in a c-book. To help him with the scenario, Zoe posted two contributions about the ski tour preparation, and another one related to risk and danger (personal concern): "*Start the scenario with a reflection on the concepts of risk and danger*" whereas Paul seemed more focused on the activity (appropriateness) because of his concerns as a teacher educator: "*The purpose of the activity might be c: how to prepare his sticks to be able to determine the angle of the slope?*" (version 2: emergence of narratives mixed with technology). Then, Jack made a proposition for the scenario under construction, meshing the different perspectives, exposed technical issues and, at the same time, some new widgets were designed. The implementation in the technical environment yielded a third version of the scenario, (version 3: technological and didactical enrichments). But the designers found that the mathematical content did not fit with the national curriculum: the content was too wide for one level and it would be difficult for a teacher to experiment with it in her class and a usability suggestion was made to split it in two separate c-books (institutional context and usability). Nick had an objection during a CoI meeting just after having presented the c-book: "*It is true that the c-book is rich, but that is what makes it interesting. It is a pity to split it in two c-books. Is it possible to consider a more obvious difference between the levels?*" Tom, the reviewer, explained within an alternative node that this version was not the way he had understood the second version: "*When you talked about the project of this c-book, I made myself an idea... I find the activities very **appropriate**, the guiding principle is that we see the theme*

"avalanche" but a story could give a little *more novelty*", i.e. to take the opportunity of meshing both text (storyline) and widgets afforded by the socio-technical environment (novelty). Likewise, Zoe, still not being satisfied with the scenario that she found quite far away from what she imagined added two more nodes with some files to better explain her expectations about the reduction of risk and she proposed to work with Jack to the development of the c-book. This new version of the scenario was crafted by Zoe and Jack, taking into account the comments by Nick and Tom and the curriculum constrains (institutional context), keeping all the activities intact but explaining to the teacher the way to ensure usability by orchestrating the c-book, in relation to the students' level and pointing out the reduction of risk, the whole embedded in a story (version 4).

## CONCLUSION

Our analysis provides some preliminary results showing how time constrains, personal concerns and curriculum standard can influence the design of a c-book resource, and it gave us a clear hint that collaborative design in collectives of individual educational designers, carrying a different background and set of personal and professional concerns, supported by an appropriate technology, can bring forth new and alternative ideas, solutions and implementations from the part of the designers, thus leading to a richer and improved design both as a process and a product. Documentational approach provided a useful and appropriate theoretical frame in the effort to better understand the role of resources and context. This analysis was also conceived in a way to be reasonably communicated to the researchers of the other CoIs, by focusing on the contextual factors which led to the design of this particular c-book unit (i.e., to allow 'decontextualisation').

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