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1. INTRODUCTION

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CoCreat – *Enabling Creative Collaboration through Supportive Technologies* was a three year project funded by the EU's Lifelong Learning Programme, and finalized in the end of year 2013. The aim of the project was to design, implement and evaluate new pedagogical concepts and learning practices that lead to better collaboration and problem-solving skills. Since the needs of current working life and society have changed, there's a need to focus on developing so called 21-st century skills that call for new kind of flexibility and innovative collaborative practices. The aim of education is not to develop only professionals with certain knowledge and skills, but to support collaboration and creative problem solving between students (Hämäläinen & Vähäsantanen, 2011).

The CoCreat project consortium consisted of eight partner universities in seven different European countries. The coordinating partner was University of Oulu (UO) in Finland, and the other partners were Norwegian University of Science and Technology (NTNU) in Norway, Linnæus University (LNU) in Sweden, Universitatea Valahia din Targoviste (UVT) in Romania, University of Bristol (UB) in United Kingdom, Tallinn University (TU) in Estonia, Fundació per a la Universitat Oberta de Catalunya (FUOC) in Spain, and Kymenlaakso University of Applied Sciences (KUAS) in Finland.

In CoCreat-project the partners designed and implemented five different Collaborative Spaces, where creative collaboration and collaborative learning was supported with different pedagogical and technological decisions. One of the main ideas in the project was to support collaboration and problem-solving skills across the life course, so the five Collaborative Spaces range from elementary school to university to spaces for elderly people.

In addition to creating these practical learning situations for different target groups, there were data gathered and scientific research conducted in each of these situations, in order to better understand the process of creative collaboration and enhance the practices to design and support it. As one of the main objectives we explored how social media and mobile technology can effectively enhance creative collaboration

This electronic publication is one of the main products of this project, as it aims to give practical guidelines to every educator that is interested in supporting creative collaboration with technology. As an officially mentioned project result we promised to produce practical and methodological guidelines for promoting, implementing and assessing creative collaboration. With this publication we aim to give simple and easy ideas to start with, many options for technical implementation, and multiple practical and detailed examples of pedagogical designs to support collaboration and creative.

In this publication we present the most valuable results of this project, based on the research that we have conducted during this project, and most of all based on our own experiences in the project. During

the project we have produced a great amount of documentation from different stages of the project and different theoretical and practical viewpoints. Many of these documents are published during the project and linked to this publication for those who are interested. This publication is written as more popular style, but we have published also multiple scientific articles and conference presentations regarding this project.

In Chapter 2 the concept of creative collaboration is explored and discussed. We also aim to frame the phenomenon to the contexts of collaborative learning and the field of technology-enhanced learning, since the idea of the project was to explore the possibilities to enable creative collaboration through supportive technologies. Chapters from 3 to 7 present the main results of the project: What we have learned during the project. All of these project results and ideas are complemented by both practical examples and scientifically studied facts. In Chapter 3 we discuss the importance of learning design and scripting for successful creative collaboration. Chapter 4 describes the creative collaboration in different ages and it's relation to lifelong learning and in Chapter 5 the creative collaboration is discussed from the technological solutions' point of view. Finally, in Chapters 6 and 7 we present what we have learned about time in relation to creative collaboration and the possibilities of assessing creative collaboration. Chapter 8 is structured to give a selection of technological tools and pedagogical ideas for the reader to try and use in their own educational practices. We have gathered different technological applications to a table and evaluated their possibilities in enhancing learning and creative collaboration. In this chapter we also list some of the pedagogical practices we have used in this project and can be utilized by the reader as well. In the last Chapter (chapter 9) we summarize the project results and things we have learned during these years, and look for the future of formal, informal and nonformal learning from the perspective of creative collaboration.

We hope that this publication serves every reader that is interested in creative collaboration as a phenomenon, and enabling these sort of practices in their work or personal life. Also we hope to give new insights to any reader with interest of technology-enhanced learning and new and innovative learning design. With this publication, like with the whole project, we aim to actually make a difference by affecting the ways of respecting and supporting the process of creative collaboration.

2. ENABLING CREATIVE COLLABORATION THROUGH SUPPORTIVE TECHNOLOGIES

Tommi Inkilä, University of Oulu

2.1 What is Creative Collaboration?

The overall aim of the CoCreat project was to further our understanding of how to enhance *creative collaboration*, through research which is based on theories of collaborative learning. The main interest is in understanding how creative collaboration can be realized by combining mobile applications, social media and pedagogical tasks. This project was our answer to the new needs for developing education for the need for creativity in modern society. Craft (2005) refers to a "revolution of creativity in education".

Before we can discuss about creative collaboration one might ask what we see as *creativity*. Typically it is defined as an activity where "someone produces something new that has value for others" (e.g. Kampylis, Berki, & Saariluoma, 2009; Sawyer, 2006b). Concepts like distributed creativity are used to define this kind of creative collaboration, where the collaboration leads to a creative product, but the creativity within the collaborative process itself are not in the focus (Sawyer & DeZutter, 2009).. Initially we understood creative collaboration as a process where problems are explored from novel perspectives and the result of collaboration is not defined beforehand. In addition we thought that there is link between successful collaborative knowledge construction and creative collaboration (Eteläpelto & Lahti, 2008). While there is literature about creative collaboration, it has not yet been adequately studied from perspective of collaborative learning. Practical implications are rare.

During the project we were able to identify more specific types of creative collaboration. It can be individual centered. For example writers usually write their books alone, but the writing process is supported by the writer community. Artists create their pictures and sculptures alone, but the artist community may help them to paint the picture or make the sculpture based on the instructions of the artists. The output of this creative collaboration is individual although the process was collaborative. This side of creative collaboration was seen in our creative writing course implementation. Other option is that the group is working collaboratively to produce something creative, e.g. jazz band. There is an option of group working collaboratively and their working process is creative. The outcome of the work can be creative or not. This was the most typical case in CoCreat-project. Finally there's the option that collaboration process does not appear to be creative, but the outcome of the collaboration is. We did not encounter this type of process in CoCreat-project, but one might expect that this might be possible for a team in working life. Hopefully it will be possible to work with this kind of teams consisting experts and professionals of different fields.

In beginning of the project the CoCreat-team did extensive literature review and identified criteria for

creative collaboration to succeed.

This criteria was based on previous literature and it contained e.g. features of the atmosphere of the group (such as playfulness, safety, trust and tolerance of ambiguity) features of an environment and of group skills that foster collaboration (e.g. existence of common ground and jointly constructing new knowledge or artefacts) etc.

The criteria and the themes around them were incorporated into the pedagogical designs of our collaborative spaces. The collaborative space can be technology-enhanced physical or virtual space that's designed for effective creative collaboration.

2.2 Creative Collaboration in technology-enhanced CoCreat implementations

The CoCreat-project's main target groups are elementary school pupils, university students, adult learners and aged people. Different collaborative spaces are designed for different target groups based on the needs of the age group and tasks at hand. The vision of the project is that through enabling the pupils and students to collaboratively solve tasks in the collaborative spaces, they will be able to learn how to think divergently – or creatively; specifically, they will develop the ability to express divergent ideas within a group context and to collaborate effectively.

In our implementations with elementary school pupils we found out that for the children it was important to have trust and equality between the group members. The individual roles in the groups motivated the students to work and engage in the task. For older students this was not that important. With them existence of common ground, especially on goals, came into more important role in the creative collaboration process. One mobile device per group (as opposed to one per student) promoted animated discussions and decision-making throughout the group. The technology also allowed the creation of whole story on site instead of bringing files home where the group could have break down if everybody would have then individually completed their part of the task – resulting in co-operative work instead of creative collaborative learning.

During our second collaborative space different criteria seemed to be more important for enabling the creative collaboration. Based on our research and evaluation students have to be provided enough freedom to explore contents for unique and new perspectives (Glassner & Schwarz, 2007). On the other hand students need support and guidance during their collaboration, and teachers should at some level structure their learning process. The experience of this collaborative space indicates that creative collaboration is challenging process both for the teachers and the students. It was also interesting to find out that the university students did not see playfulness, challenging boundaries, creative tension or safe atmosphere important for group success. For group to be successful they identified more practical factors; groups resources, knowledge, organization, effective collaboration and engagement. However, the university students thought that for effective collaboration to successful the safe atmosphere and themes related to it are more important. The technology – Second Life and Moodle – had natural role of providing the means to collaborate and discuss for international students. The 3D environment seemed

to increase the feeling of working together in same space. For example, groups were asking other members to turn around so that they can see their (avatar's) face. Also from teacher's point of view, it's interesting how giving lecture in 3D environment has same qualities as in real life. If someone's avatar leaves during your presentation the feeling is pretty much same as in real life. This does not happen as much in video-based web courses where the participants are only names in a list.

We worked with university students in our third implementation as well. In this case they were solving pedagogical problems in scenarios that we created for them, and wrote collaboratively a book chapter about it. Each scenario were designed so that it would require the expertise of each university's students as their background was different. Solving some challenging scenario with collaboration and writing together would imply that the output is creative. The interesting thing is that the student's did not think that they were that creative. They thought that they were working on a problem that had been already solved in numerous ways. The group sizes were quite big in this implementation which caused the students to coordinate their work more. This was seen also in their feedback. In this implementation the time frame in which students had to work, was also relatively short. All these factors seemed to work against the criteria for creative collaboration. Also the wiki environment seemed to facilitate the collaboration but not really the creativity within that collaboration as it has given set of functions that can be used on the end product – the handbook chapter.

In our implementation with aged people, the technology enabled the creative collaboration from different perspective. For the elderly who had not used technology much, the iPad and network connections opened many new ways to collaborate with friends and relatives. This also bridged the gap between the generations. The elderly used the iPads for communicating, sending pictures of cake recipes, traveling by looking at Google maps etc. They found this valuable, enjoyable and something new – in many ways it's a great example of creative collaboration that is supported by technology. As suggested by Romero, Hyvonen, & Barbera (2012) there are few major aspects to consider when designing computer-supported collaborative creativity spaces for elderly. First, choose easily approachable technology (tablet), secondly reduce trial-and-error in understanding process and lastly make the utility of ICT explicit in the creative process.

In our last implementation the technology allowed the writers to stay in connection with their course mates thus creating the connection with their writer's community. We used blog environment to connect all course participants together. The technological choice removed the need of sending documents back and forth and contributed to equality and safe atmosphere. The blog also allowed interaction between the writers. This implementation is a good example of where the community works collaboratively to help the individuals reach better creative results.

As phenomena both creativity and creative collaboration is interesting and multifaceted and there's still a lot of room for research. Creativity and creative collaboration are considered as key competencies that could be learned and developed in a path of life-long learning (see, Kampylis, Berki & Saariluoma, 2009). What we can do as teachers for creativity and creative collaboration? It can be concluded that creativity denotes the quality of collaborative situations and processes, where emotionally safe atmosphere,

equality, rich interaction, flexible divergent thinking and playfulness are afforded. (e.g., Eteläpelto & Lahti, 2008; Romero, Hyvönen, & Barbera, 2012; Wheeler, Waite, & Bromfield, 2002)

3. SCRIPTING CREATIVE COLLABORATION

Essi Vuopala & Venla Vuorjoki, University of Oulu

In CoCreat project we designed and implemented five different *collaborative spaces*, in other words five learning situations, where creative collaboration was supported by different pedagogical and technological solutions. In this chapter we discuss the role of design in collaborative learning and creative collaboration. By design we mean the plan and structure of different learning activities, tasks, roles of learners in the learning situation etc.

There are a number of studies which have evidenced that applying different collaboration scripts can improve interaction in computer supported collaborative learning situations (Stahl 2007; Weinberger 2003). However, there are also contradicting evidence (see Dillenbourg 2002), and more research is needed especially on scripting implemented in extended period, like semester or university course (Haake & Pfister 2010). In this chapter we open some perspectives on scripting collaborative learning and creative collaboration based on some previous research, research done in the CoCreat project and our experiences as teachers.

3.1 Scripting collaborative learning

Collaborative learning can be defined as a shared knowledge construction where knowledge is built jointly on others' thoughts and ideas (Arvaja, Salovaara, Häkkinen, and Järvelä, 2007; see also Roschelle & Teasley 1995; Sawyer 2007). Research on *computer supported collaborative learning* (CSCL) focuses on possibilities for technology to enhance collaboration and interaction between learners, group work and sharing expertise (Dillenbourg 2005). A CSCL environment is defined as a tool that can shape interaction between participants in both co-present and geographically distributed settings (Dillenbourg 1999). Technology, like virtual learning spaces, can provide tools for negotiation and argumentation (Kolodner & Guzdial 1996; Stahl 2007).

The core of collaborative learning is building joint understanding, shared meanings and new knowledge through interaction with other learners (Roschelle & Teasley 1995). This requires learners' commitment in joint activities and tasks (Dillenbourg 1999; O'Donnel 2006). Besides shared understanding about content matters learners have to share an understanding about social organization in the group and relationships between group members. (Stahl 2007). Successful collaborative learning requires also learners' active and equal participation (Baker 2002) and argumentative interaction (Barron 2000). When exploring collaborative learning from the viewpoint of group's strategic behavior Järvelä and Järvenoja (2011) argue that the group has to be able to regulate its' activities by planning, monitoring, coordinating and evaluating.

Collaborative learning is not a spontaneous process and it needs to be supported. One way to enhance collaborative processes is structure learners' activities through *collaborative scripts*. Collaborative scripts include supporting activities through which collaboration is specified and structured, and responsibilities between students are divided (Hämäläinen 2008; Kollar, Fischer, & Hesse 2003;

Weinberger 2003). Scripts comprise numerous rules how learners should interact in order to achieve a joint task (O'Donnell 2006).

Collaboration scripts can be described as scaffolds that aim to improve collaboration between learners through structuring their activities. According to Kollar et al (2006) they consist of at least five components: *learning objectives*, *type of activities*, *sequencing*, *role distribution* and *type of representation*. Collaboration scripts have been proven to be able to improve the balance between individual and collaborative activities, engagement in discussions, quality of discussions and individual learning outcomes (Fisher et al. 2013), but scripting should always be done very carefully, trying to avoid either under- or overscripting the collaboration, that might in wost case even totally prevent *creative collaboration.*

3.2 Can scripts enhance creative collaboration?

As presented before, the collaboration scripts and their effect on collaborative learning processes has been studied (e.g. Dillenbourg 2002, Kollar et al 2003, Fischer et al 2013), but when it comes to creativity and creative collaboration, more questions arise. Can you script creativity and creative collaboration? If the learners' behaviour and the forms of collaboration have been strictly structured, can the collaboration be genuinely creative?

One perspective to study creative collaboration is to analyze different forms of interaction during collaborative learning. Certain forms of interaction might indicate that learners are collaborating creatively. For example asking thought provoking questions, presenting explanatory comments or answers and creating playful group atmosphere are such forms of interaction (see chapter 2).

During the CoCreat project, in a collaborative space for university students, a study of collaboration scripts was conducted with a research question of *What kinds of forms of interaction occurred in virtual discussion among groups whose studying was scripted differently?* This research question included also aspect of creative collaboration: What kinds of interaction forms related to creative collaboration occurred among group discussions? The study (Vuopala 2013) was conducted as a case study where 49 students participated in an international virtual course for three months. The group-task for the students was to design, implement and evaluate an advanced virtual course in a small group. The small groups were working both in asynchronous and synchronous virtual environments like Moodle and Second Life.

Scripts applied in the course were both epistemic and social in nature. Some of the groups studied with prompts and functional roles while other groups worked without any specific script, just by following the basic instructions for the course tasks. Prompts were sentence openers and questions aiming at clarifying the joint task and supporting the task-related discussion. Functional roles aimed at enhancing multiperspective content discussion related to the task. Every group also had a tutor to guide the students' work. Hypothesis was that both pedagogical and technological design could promote interaction forms related to creative collaboration.

The results indicate that between groups, whose studying was scripted differently, there was no significant variance in the forms of interaction. In other words certain script, such as applying functional roles, didn't enhance creative collaboration compared to non-scripted studying. However, scripts has an effect to the participation and also to course grades. The script groups were more active than non-scripted groups. The activity was measured by the average amount of sent messages, amount of active group members and the activity in arranging on-line meetings in virtual course environments. There were also a slight differences in course-grades between scripted groups and non-scripted groups. In the study, it seemed that learning task had more effect on the occurrence of different forms of interaction than scripts. Especially such tasks which required joint decision making, promoted argumentative and commenting discussions. Instead, collaborative writing task enhanced more co-operation like discussions about division of learning tasks and time management.

The analysis of interaction forms showed that most of the messages in Moodle and speech turns in Second Life were group-related instead of task-related. Most of group-related units were related to coordination of groupwork, especially in organizing groups' activities. In addition, there were also such forms of interaction which aimed at creating cozy and trustful group atmosphere. Especially in real-time interaction one third of the speech turns aimed at decreasing tension or expressing cohesion. These might have created an atmosphere for creativity.

Half of the task-related discussions were answers or comments to previous messages. One third of the messages presented new knowledge, which was most often experience-based. However, in SL the percentage of new knowledge units were lower. Only 7% of all task-related speech turns presented new knowledge. Instead, the amount of questions was higher in SL than in Moodle. Also, in real-discussion more questions were presented and answers provided. It can be concluded that real-time discussions were more reciprocal and argumentative, which might have promoted creative collaboration.

In another collaborative space we designed in CoCreat project for university students the students worked in international groups in order to write a book chapter to an electronic publication (cocreat.purot.net/handbook) . The idea behind the course design was based on the distributed expertise approach (Brown et al 1993), and supported collaboration between students from different backgrounds and disciplines. The idea of distributed expertise highlights the importance of heterogeneous groups for capitalize on their complementary knowledge and skills to achieve higher level of collaborative objectives (Hakkarainen et al. 2013).

The structuring, timetable and guidance of the course was quite loose, so the student teams could decide their own working methods, working times, outlook of their product etc. So in this case, the script for collaboration and learning activities was not strict, but the students did have a given scenario (i.e. pedagogical problem) to work with. The scenarios were built in a way that the students would need the expertise of all the team members to come up with solutions and a working and fruitful collaborative process in order to learn from each other. Even though the the scenarios were reflecting real life situations in educators' life, some of the students seemed to suffer from lack of motivation when the scenario was given to them as a "too ready" situation to solve. The scenarios could not be solved by

giving one straight and simple "right" answer, and the students were encouraged to come up with multiple and innovative solutions, but still it seems that the university students had some problems not trying to give the teachers the answers they were assuming for them to want.

When designing collaborative learning situations, we cannot be focused on narrow textbook problems and transmission of existing knowledge and procedures. According to Hakkarainen et al (2013) successful collaborative learning engages the learning community to challenging inquiry objectives and problem solving. Finding solutions to complex problems is the only way to prepare our students to the challenges they will face in their future in working life (Marton & Trigwell, 2000). This was the main idea when designing this collaborative space for students.

In his article about overscripting CSCL Dillenbourg (2002) presents some critical points in collaborative scripting. He claims that in some cases a script can disturb the natural problem solving process by sequencing the task into too small peaces. In our design of collaborative space 3 we tried to avoid this problem by giving the students more freedom in terms of their working arrangements and collaboration. Still it seems to be apparent that the students also need some level of structuring of online activities to have supportive external landmarks and goals for their work and time management.

Fisher et al (2013) discuss the effects of collaboration scripts from different perspectives. They argue that even though external collaboration scripts are not always in line with the learners internal scripts and spontaneous ways of acting, scripting does not kill "true" collaboration. It empowers learners by giving them positive freedom to participate successfully as part of a learning community. Still depending on the level of scripting and it's relation to the level of internal collaboration script of the learner, some might feel subjective over- or underscripting. Also, scripting sometimes needs to be structured to make learning harder, since smooth collaboration does not always lead to a successful learning of the individual learners. Technological scaffolding can be designed in a way that it problematizes important aspects of the learning content (Reiser, 2004).

Many studies (e.g. Hämäläinen 2008; Stahl 2007) have shown the challenge of collaborative learning. Passive group members, unequal participation and superficial discussions are common phenomena in courses where ideas of CSCL have been applied. One of the challenges in scripted collaboration is requirement of shared goals that is mentioned in many definitions of collaborative learning (see Dillenbourg, 1999). The more the script cuts the collaboration into smaller sub-processes, the more difficult it can be to students to create their own shared goals and organize the teamwork around them (Dillenbourg, 2002). It's also critical not to take social interaction in CSCL environments for granted or understate the significance of non-cognitive and non-content related processes, such as creating a trustful atmosphere and forming a sense of community (Kreijns et al. 2003). Despite of all the challenges, many studies show that structuring seems to have a positive effect on students' activity and collaborative learning (see also Hämäläinen 2008; Weinberger 2003).

3.3 Discussion

Although creative collaboration is really challenging to capture by analyzing learners behaviour and interaction, some conclusions can be made based on studies and observations presented in this chapter. For example, it seems that real-time discussions are more effective in enhancing lively and multiperspective discussions (and creativity) while asynchronous discussion boards may suit better for considering theoretical issues. On the other hand, when talking about formal education with predetermined aims, it may be difficult to achieve and even allow creativity. Therefore a question about the connection between academic achievement and creativity may arise.

Besides of scripting and structuring, tutoring and guidance also play a significant role in promoting collaboration. It seems that active tutoring can enhance activity and participation, but does not guarantee it. Our experiences as educators have shown that there's a thin line between a tutor supporting collaboration and suffocating it with too active role. If the tutor acts too actively and becomes either an equal team member or a leader of the team, it may hinder the collaboration between the actual team members (students) and have effects on group dynamics. Even though the outcome or product of strictly tutored team might be more high quality than one created by more loosely tutored team, it doesn't guarantee that the product actually presents the learning and collaboration in the team, let alone creativity. Still with the right kind of tutoring, the students can be supported and scaffolded into a successful collaboration, problem solving and deep learning. One of the benefits of collaboration scripts is that usually they include an important and justifiable role for the tutor (Dillenbourg, 2002).

According to Fischer et al (2013) there is a need for more adaptable and adaptive collaboration scripts, that refer to scripts modifiable by the learners, tutors or teachers or scripts automatically adjusted by computers (see also Gweon et al. 2006). Adaptive scripts might prevent under- or overscripting, and they can also be one solution in promoting creative collaboration.

4. CREATIVE COLLABORATION IN DIFFERENT AGES

Tommi Inkilä, University of Oulu

CoCreat-project worked with different aged people. It was important to see how creative collaboration emerges in different age groups. First we started with elementary school pupils. Then we worked with university students and aged people and finally we collaborated with upper secondary school students and adult learners. It was possible to observe interesting differences between the age groups.

Elementary school pupils were enthusiastic to work with iPods to create stories about their history. Using the technology was inspiring to them but at the same time this kind of group task broke their daily school routines. The interesting thing was to find that for young children (age 10-11) the creativity was not the challenge. The understanding of collaboration process and the inexperience with storytelling seemed to cause most challenges. To overcome these challenges the pupils found the roles helpful. One might say that the roles in the group helped them to direct and concentrate their creativity. It was also motivating for the pupils to have responsibility in the team. Once the project implemented the same digital storytelling concept to a little bit older pupils (age 16-17) we found out that the pupils did not find the roles that important or the importance was more evident for them. The challenges were more on the creative collaboration process or in the dynamics within the group. Some groups did not function well when the individuals in the group had different goals or they had different expectations of the quality of the outcomes. Simply put, for pupils who want high grades or wants to complete the task with quality, it will be harder to collaborate with pupils who are not that motivated or interested in the task.

In the implementations with university students the periods of creative collaboration were longer than with the younger pupils. Different kind of challenge arose in this setting. University students are even more task oriented. Despite of the fact that creativity and unexpected outcomes were encouraged to the students, majority of groups aimed for completing the task instead of really trying to break boundaries of the given task. If you simplify, from university student's point of view, a course have tasks to complete in restricted time. While time limitations may trigger creativity it was more evident that students were more goal oriented. One might say that depending on student's interest on their course topic they will choose what grade they aim on, and then work to reach that goal. The university students are used to certain kind of course structure and for them breaking out of it is really hard. On the other hand this is also true for the teachers. In one of CoCreat's implementations the students said that it's hard to be creative in topic that is already well-grounded and done so many times. To really introduce creative collaboration in university studies you need change both in students and teachers

thinking.

Working with aged people gave yet another perspective. Whereas with university students are completing tasks the lecturers and teachers set to learn or to graduate, the elderly people set their own goals and work for themselves. For this generation the technology was not that familiar and typically the elderly have fear against it. We wanted them to learn in their own pace in safe atmosphere. During our course implementation they learned to use the technology with the support of groups based on their own needs and interests. The elderly used newly gained skills creatively with their own relatives and communities. For example they were taking pictures of receipts with iPads and sharing them with friends through email. They traveled by using Google Maps. Was this creativity as no one taught them to do that? For someone who's familiar with technology the answer is probably no, but for somebody who's using it for the first time without guidance it is. If you think about the children, from teacher's perspective their stories – the plot or the information it contains – is most likely nothing new, but the collaborative process for the children were definitely creative. The children said that they learned a lot from doing the task – the creative collaboration process.

During the CoCreat-project the team often had to think about the creative collaboration and what it really is and how age – or perhaps phase of life – affects to it. In the project's final implementation with upper secondary school students and adult learners collaborated in creative writing course. In this context the students and adult learners were able to do break free of the limitations that the school sets. The fact that this was extra course for the students and adult learners and they were interested the topic eliminated mostly the limitations that are on typical school and university courses. The setting also supported a different form of creative collaboration. The creativity was mostly individual but the creative process was supported by the group via the blog they were writing in. This is quite typical for writer's who work alone but the writer's community supports the individuals. Same kind of structure is used by artists. The members of the community might help the creator by giving feedback and even helping with painting the picture.

So one might ask how creativity and creative collaboration emerges at different ages. Children – and therefore people – are creative by nature so how we as teachers could foster that? It seems that the longer the children are in the school system the more they are interested in grades. With good grades you get good jobs. In good jobs, you can be creative. But can one be creative at that point of their lives if they have avoided being creative since childhood? This is interesting question that can't be answered within the scope of this project. What we are sure about is that in the future people need to be able learners both individually and in groups to tackle the challenges in everyday life. In the field of interdisciplinary Learning Sciences, learning is seen as a lifelong process and educated professionals should also have abilities to take

responsibility of their own continuing learning (Sawyer 2006). Learning skills, creativity and skills to collaborate are important for each one of us and we should start working on them at early age.

5. CREATIVE COLLABORATION AND DIFFERENT TECHNOLOGIES

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This chapter provides a description of how different technological solutions can be used to support Creative Collaboration. The target audience for this chapter is practitioners: teachers, administrators, and technical support workers. The examples and recommendations given here are based on the experiences and research within EU-funded CoCreat project.

5.1 Creative collaboration and technologies

Creativity can be applied to every domain of knowledge and must be seen as an important competence. There is evidence that creativity is an effective method, key component, and valuable outcome of learning (Eteläpelto & Lahtia, 2008; Kangas, 2010; Lewis, 2006; Livingston, 2010). However, creativity is not a spontaneous process and it needs to be promoted and supported with modern technologies. Collaboration among learners is a key element of modern university education. A significant part of course assignments and projects is done in groups in order to prepare the students for team-based activities in a workplace. Technology plays a core role in supporting these forms of activities, and therefore, it is important to learn available technologies, their advantages and limitations. Still, cooperation problems are rather common, due to different schedules, attitudes, level of activity, and interest in a specific project. These problems often lead to frustrations and disruptions in the learning process. Therefore, there is a need for better support of creative collaborative activities.

CoCreat project aimed at finding out how to enhance creative collaboration in educational settings with the help of new learning practices in complex and dynamic technological learning environments. Within the framework of the CoCreat project, several collaborative spaces were developed and used in various learning settings. In each collaborative space, we designed learning activities considering theoretical approaches together with supportive technologies. All this experience of instructional designers, teachers, and tutors has been accumulated within the project. In addition, in each collaborative space, researchers collected and analyzed qualitative and quantitative data from the participants to draw conclusions and reveal patterns. A significant part of the project's accumulated knowledge is related to different technologies, how they were used in different learning situations, and how successful were they used.

5.1.1 Technology in Collaborative Space 1

In collaborative space 1, three different study iterations were accomplished during 2011, 2012 and 2013, in which children and adolescents of various ages took part in the activities.
For the first study iteration in Växjö, Sweden, 24 elementary school pupils ages 9-12 participated in an outdoor activity at the ruined castle of Kronoberg, as part of the curriculum studies of Swedish, History and Geography. Based on the experiences of the activity, the pupils created a number of mobile digital

stories themed “Tell your story about history”, collaboratively using an iPod Touch and either one of the two AppStore storytelling applications chosen: StoryKit and StoryRobe. In groups of three, and with dedicated roles of responsibility to play during the activity, they photographed, recorded sound and took notes that they later used for creating their stories in the storytelling application. The group members were all equally responsible for processing and storyboarding and for recording the voice over. Their stories were later presented and discussed in class, and shared to the website of the local museum. For iteration two at the Kierikki Stone Age Center in Oulu, Finland, the same technologies and applications were applied, though with a greater number of participating pupils. Due to integrity reason, none of the stories created were shared. For the third iteration in Tallinn, Estonia, the iPods were replaced by iPads, and only StoryRobe remained in use together with the Apple iMovie software. This iteration was conducted at an indoors museum with 23 adolescents age 16-17.

5.1.2 Technology in Collaborative Space 2

In collaborative space 2, university students from four countries were designing a virtual course. Students were working in groups consisting of both local and distant members, and the technology needed to support this. The project offered a Course-Management System Moodle as the main technological environment where the students could get information about the tasks and the schedule and could communicate asynchronously between each other and with tutors. 3D Virtual World Second Life was offered as a platform for synchronous communication, which was replaced with Skype by some of the groups. The students were free to choose technologies for the technical implementation of the courses they designed, and these choices included Second Life, websites, wiki pages, Moodle , and combinations of these technologies. A pre-study for this collaborative space was conducted entirely in Second Life, and university students were creating educational visualizations of the major course concepts.

5.1.3 Technology in Collaborative Space 3

In collaborative space 3, university students from three countries were designing a media handbook for educators. Students were working in groups consisting of both local and distant members, and the technology needed to support this. Each group was working on one chapter for the handbook. The project offered a Purot wiki as the main technological environment for this activity. The tasks, announcements, and the handbook chapters themselves were created in this environment. Some of the student groups preferred to use Google Drive tools for collaborative writing, and pasted the results in the wiki page. Adobe connect was offered as a main tool for synchronous discussions, but it was replaced by Skype in some of the groups. In addition, the course required the students to create final presentations of their chapters in Prezi – a tool that was creative and new to most of the students. In this learning activity, the students were not only allowed, but encouraged to use any additional technologies to support their collaborative process and creation of handbook chapters.

5.1.4 Technology in Collaborative Space 4

In collaborative space 4, aged people learned to use iPad to ease up their daily lives. The main idea was to learn the basic functionalities of a tablet and how services can be nowadays found from the web e.g.

bank services. Also communication tools like Skype and email were introduced to them. The focus of the collaborative space 4 was to help the elderly to find use of the tablet in their own daily lives. Therefore only the most common applications were shown to them and they were then able to find applications that fit their needs. Applications that raised their interests were e.g. Google maps, Facebook, Mixel, games, electronic books etc.

5.1.5 Technology in Collaborative Space 5

In collaborative space 5, "Creative Writing on the Web" -course participants used iPads to write their stories to common blog which was hosted in Wordpress. The Wordpress was mainly chosen for the available app for iPad. Also list of inspirational tools (apps) were provided for the students but those were rarely used (list found at LINK TO CS5 material). Most of the course participants used iPad's notes -application to write the stories and then copied it to the blog via Wordpress app. The collaborative space 5 made use of mobility as participants reported writing the stories during e.g. bus rides. Also one of the tasks required the participants to make use of the camera function of the iPad.

5.2 Recommendations for technological support of creative collaboration

5.2.1 Technology supporting product creation and process

During the project, we learnt that technological tools that support creative collaboration could very often be categorized into two categories. The first category includes technologies that support the collaborative creation of a shared artifact. Technologies that fall into this category include those that support working with materials and content, e.g. sharing documents and media files, storing them is a shared repository, collaborative synchronous or asynchronous editing, annotating, commenting, discussing, and reviewing.

The second category includes other, but not less important technologies that support the collaborative process. Technologies that fall into this category include those that support planning and scheduling of collaborative activities, such as synchronous sessions, events, as well as division of labor and milestones. In other words, these technologies support taking decisions and reminding participants what and when they are supposed to do.

– *[…] belonging to different study programs, we have relied heavily on using online cooperation tools.*

– *That decision [to use Google Drive, Doodle] enhanced the overall effectiveness of the collaborative effort […] and every active member respected the deadlines.*

5.2.2 Supporting local and international interaction

We learnt that different way of forming groups causes different opportunities and challenges in collaboration and requires different technological support. We observed interaction within groups that consist of only local students, between established local groups, and in settings when larger

international groups were created by joining three or four local groups from different countries. Our experience and data demonstrate that creative collaboration even between local groups requires support on the community level. If collaboration between international and distant participants needs to be facilitated, even more such support is required. Each individual has preferences and experience with certain technologies, in the same manner as with work style. When several individual are to perform a collaborative task together and need to use technologies, these preferences and experiences can be both advantages and limitations. When the participants have different cultural and professional backgrounds, the differences in using technologies are larger. In the same way, if several established groups need to collaborate, they may face a challenge that the internal rules they have chosen and technologies they have been using are different from those used by other groups. One student group reflected on their experience:

– *To create a good [e.g., technological] environment for collaboration between different cultures and locations, we had to be open minded and tolerant regarding alternative ways of doing things, communicating and ways to interpret observations.*

At the same time, when participants in one group have different expertise, they can learn from each other, but also they become more flexible and able to adapt better, e.g. to the technology that is required to be used or to the technology used by other groups. One of the student groups noted:

– *We […] were able to complete a far more complicated task than we would have been able to by ourselves. Through working with students with very different expertise than us, we were able to gain insight in to another way of looking at our field of study.*

5.2.3 New versus familiar technologies and tools

We found out that new technologies are often associated with creativity and new way of dealing with challenges, while familiar technologies are considered providing more efficiency in the collaborative work. In the feedback we received, most of the student groups stated that they incorporated familiar tools in their group technological ecologies to start using them right away and work more efficiently.

– *[…] instead of striving and possibly spending lots of time to find what might have been the most efficient or most exciting tools for the job at hand, we found it easier to use tools that we were already familiar with.*

However, students often mentioned that using familiar tools, although contributing to the work done, did not necessarily lead to creative solutions, learning, or change.

– *Our tools were familiar, with […] little overhead and high productivity level. However, for the sake of learning more about cooperation technology, it is possible that we would have benefited from using more unorthodox tools.*

Some students explicitly noted that the assigned and other new tools used in the learning activities (being unfamiliar, challenging, and different) contributed to the increased understanding of the course topics and facilitated learning.

– *[The new tools…] required us to think differently than when we use more familiar tools, and although we did not always enjoy using them […], we believe that it taught us even more about how distributed collaboration works […].*

5.2.4 Types of technologies for learning activities

This section provides our experience on using technologies for specific creative collaborative activities.

- *Collaborative writing and annotating* activities were mostly supported by the wiki tool Purot and Google Documents. The participants appreciated the advantages of both tools. Using Google Documents was convenient, as it allowed to see who is writing what in real time, see the revision history, and chat. At the same time, the wiki platform was appreciated for the formatting features, possibilities to insert media, and creating hyperlinks and pages.
- *Sharing and storing materials* were supported by Google Drive and Dropbox. Both tools were used to a large extent, especially in the international collaboration for storing preliminary versions of documents and additional/supplementary materials. It should be noted that these tools were picked up by the participants themselves, and not provided by the teachers.
- *Planning and scheduling* were supported mostly by Doodle, online calendars (in few cases), and very often by exchanging emails when no single LMS was employed. However, when Moodle LMS was employed, asynchronous messages were used for announcements and, in some cases, planning. Asynchronous messages in Purot wiki were used as reminders and announcements. Few groups of participants employed social media, such as Facebook, for these purposes.
- *Synchronous communication* was supported by several tools, including Second Life, Skype, and Adobe Connect. Second Life and Adobe Connect were provided by the teachers in different courses, while Skype was picked up by the participants. In both cases, part of the groups were switching to Skype, while the others continued using provided tools, fining them more convenient and/or effective. Embodiment and more real immersion in Second Life were found useful. Ability to have a common writing space in Adobe Connect was found useful. And Skype was employed, because most of the participants were already familiar with it and knew how to setup voice settings.
- *Asynchronous communication* was supported mostly by Moodle LMS when it was employed and by the Purot wiki in the other case. The participants were using email very often to supplement these tools, especially when not every participant checked the main environment (Moodle or Purot) regularly. Asynchronous communication and discussion were slow to start with any tool without a synchronous session.
- *Informal communication* was partly supported by the synchronous tools and by social media (mostly, Facebook). Most of the groups discovered that building trust and friendly atmosphere is very important for effective collaborations, and started to take some time during the synchronous discussions for informal communication. In addition, some of the groups started to

use Facebook for informal communication, quick updates on the status, and idea generation. SInce, this was not monitored by the course stuff, the participants felt more relaxed and afterwards reflected very positively on using Facebook.

- *Presenting materials and results* was supported by Second Life and a combination of Prezi and Adobe Connect. Second Life was used as a presentation tool, allowing not only present graphical slides and voice, but design environments, simulations, and games to express ideas and concepts (in the pre-study for CS2). Prezi was used by all the participants in another course, and was found new and creative by most of them.
- *Mobile technologies* were used mainly in CS1, CS4 and CS5. The possibility was also available in CS3, but it was not actively used. In CS1, the pupils created their digital stories on-site with the help of the mobile device and application. In CS4 and CS5, iPads were used. In CS4, the main reason for using iPad was it's user friendly interface. It was easier for the elderly to approach than desktop computer. In CS5, the participants used iPads for writing and taking pictures. The tablet enabled nearly realtime connection with other writers via common blog. As an example, one of the students reported writing her short stories during long bus drives to school.

6. CREATIVE COLLABORATION AND TIME PRESSURE IN COMPUTER-BASED LEARNING CONTEXTS

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6.1 Introduction

Creativity is recognized as one of the key competences for the 21st century. According to Kickmeier-Rust and Albert (2012, p. 680), 21st century skills involve "meta-skills such as problem solving, non-linear thinking, creativity, or communication skills". Pressures of time can greatly influence individual and collaborative creative processes and outcomes. Therefore, teachers in varying educational contexts are arguably facing the challenge of supporting all learners' development of meta–skills from the very young to the aged, both within and beyond the classroom.

As a response to this challenge, a European Project called CoCreat http://www.cocreat.eu/, funded by the EU's Lifelong Learning Program 2010-2013, aimed to develop and evaluate ways in which collaborative spaces for learners of different ages could promote creative collaboration supported by the use of technologies such as mobile technologies and social media.

This chapter focuses on how pressures of time or the 'time factor' can affect creative collaboration in computer-based learning scenarios. Pressures of time are important to creative processes and outcomes because they "may undermine precisely the kind of thinking needed to do creative work" (Amabile and colleagues 2002, p.1). For teachers, therefore, it is useful to know how creativity can be optimized in individual and collaborative learning tasks, and understand how time pressures might hinder

or foster creativity.

This chapter primarily focuses on previous research related to creativity, creative collaboration and time factor and lastly, concludes how the time factor can affect the creative collaboration of groups.

6.2 Creativity and Creative collaboration

Creativity can refer to the generation of ideas that are original, valuable or useful (Sternberg & Lubart, 1999). The importance of the usefulness of the ideas or acts that are considered creative is highlighted by Franken (1994: p. 396) who considers "creativity as the tendency to generate or recognize ideas, alternatives, or possibilities that may be useful in solving problems, communicating with others, and entertaining ourselves and others".

For years, creativity has been conceived as an individual trait, but also as a process and the product of that process (Amabile, 1996; Eysenck, 1995; Plucker, Beghetto & Dow, 2004; Romero & Barberà, 2012; Romero, Hyvönen & Barberà, 2012; Runco, 2007). However, creativity can be considered as a collaborative and situated process (Eteläpelto & Lahti 2008) that cannot be understood merely as an individual process. Furthermore, creativity is not merely an original act or idea but also an accepted new solution that is collaboratively (co)constructed and shared by a group. Indeed, the outcome of the creative process may be an act that transcends the creator of the creativity (Sak & Oz, 2010) and produces "changes in an existing domain, or transforms an existing domain into a new one" (Csikszentmihalyi, 1997: p. 315).

6.3 Computer-based creative collaboration

Computers can and do act as cognitive and metacognitive tools. The potential uses of technology are extensive and they can be oriented towards supporting cognitive processes, such as creativity in general and more specifically creative collaboration. According to Yamamoto and Nakakoji (2005, p.514), computer-based "tools for fostering, not obstructing, creativity need to be designed around the understanding of what representations a user needs to interact with". Fozard, Bouma, Franco and Bronswijk (2009) argue for the value of collaboration technologies as a way to enhance fun and creativity in the second half of life. According to Lambropoulos, Romero and Kommers (2011), technologies enable the creation of shared contexts for engaging participants. Fun technologies are an opportunity for adults of all ages to engage in creative collaboration and interaction.

6.4 Pressures of Time: perceptions and reality

Pressures of time or 'time pressure' can be understood as an objective reality such as a time in a calendar as well as a subjective perception (Gross, 1994). Different factors can affect people's subjective perceptions of time pressure including longer working hours and time spent caring for

children (Zuzanek, 1998) as well as the affect of their individual differences such as the preferred level of time pressure for carrying out academic tasks (Feather & Volkmer, 1988). Therefore, two learners involved in the same learning activity could have different perceptions of pressure depending on their time availability, their preferred use of time and other individual differences. These differences are not a problem when the learning activity allows the learners some flexibility with time in which they can regulate the level of time pressure by deciding the quantity, structure and quality and time spent on task. However, when the activity rhythm is not flexible and the time-on-task cannot be regulated by the learners, they may suffer from too much or not enough pressure.

6.5 Time Pressure and Performance: better or faster, more creative?

Individual preferences towards a certain level of time pressure also apply to creative activities. While some people consider themselves more creative with a certain amount of time pressure, others prefer to have sufficient time to develop more creative work.

A number of studies have shown that time pressure can increase performance (Andrews and Farris, 1972), lead to faster performance but lower performance quality (Beersma and colleagues, 2003). The organization of a group can also be influenced by the degree of time pressure they experience. On the one hand, Isenberg (1981) observed a more prominent leadership in groups with a higher time pressure. On the other hand, Kelly and McGrath (1985) observed that in a context with lower pressure, the teams developed more original and creative tasks.

Despite the mainly positive effects of time pressure on individual and group performance, some studies show that time pressure can have a negative impact on creativity (Amabile et al, 1997; Andrews & Smith, 1996). Baer and Oldham (2006) observed diverse types of time pressure, some of which could hinder creativity while others seem to foster it. They found that a moderate level of time pressure increases the level of creativity.

In collaborative contexts, a high level of time pressure could reduce performance quality. For example, Bowman and Wittenbaum (2012, p.309) observed that groups experiencing “high time pressure engaged in shorter discussions about the decision alternatives and exchanged less information than groups with low time pressure”. The reduction of quality in the collaboration process in terms of information and discussions could explain the reduction of collaborative creativity in contexts of high time pressure.

6.6 Time factors in education

The time factor and time quality are important aspects in understanding learning activities (Gros, Barberà & Kirschner, 2012; Romero, 2010; Romero & Barberà, 2011), and especially in the creative process of collaboration. Effective learning requires a certain amount of time for the learner therefore time pressure regulation at different levels, including the institutional level, the instructional and teacher level

and the learner level are crucial to successful learner outcomes. Table.1. below demonstrates how time can be regulated to support learners activities following the Academic Learning Time model (ALT). Caldwell, Huitt & Graeber, (1982) and Berliner (1984) have contributed to characterizing each of these three times.

ALT	**Time pressure regulation**
Scheduled Time: e.g. start and finish date of learning programs, flexibility of the academic year, terms and holidays.)	Intensive programs have higher time pressure than flexible enrolment programs that allow learners to complete the program with a certain amount of flexibility.
Allocated Time: the time defined by the teachers to be allocated to the learning tasks	The teacher can regulate the level of time pressure by increasing the time for completing a task or by increasing the task requirements but maintaining the initial deadline.
Engaged Time or Time-on-Task (ToT): the time learners spend actually learning.	Learners are able to regulate their time pressure to a certain extent when the allocated time offers a degree of flexibility. The learner could decide to start the task earlier and lighten the task load. Also, the learner could, intentionally or not, increase the time pressure by starting to work on the task at the last minute (procrastination). According to Chu and Cho (2005) learners who show a preference for time pressure, and have the ability to meet the deadlines, could intentionally procrastinate, leading to active procrastination behavior, as opposed to the passive procrastination behavior of learners who delay task completion for other reasons, such as a fear of failure.

Table 1: Time pressure regulation in the ALT model.

6.7 Time pressure in computer-based creative collaboration

Despite the creative collaboration opportunities described in the previous section, computer-based collaboration has been also observed as a factor that introduces a higher level of time pressure “in terms of expectations regarding the frequency and timeliness of communication” (Thomas & Bailey, 2009, p.627). Computer Mediated Communication (CMC) which is often a feature computer-based creative collaboration increases the time pressure felt by the group in four aspects. Firstly, computer-based interaction increases the time pressure on the group because they take more time to exchange the

same information than face-to-face groups (Walther, 1992). Secondly, the CMC groups must learn how to use computer-based environments, which increases the time pressure depending on their e-competence. Thirdly, CMC groups often work from different locations, which require asynchronous exchanges or planning to meet synchronously, depending on the availability of their teammates (Romero, 2010). Fourthly, in some cases, the groups working on a computer-based creative collaboration task as short-term groups, with no previous history together, also experience increased time pressure (Walther, Anderson & Park, 1994). For these reasons, computer-based creative collaboration could increase the time pressure felt by the members of the group.

6.8 Conclusions: Collaborative spaces and creativity in the CoCreat Project

Based on the experiences and results of the CoCreat project, a number of conclusions relating to the affects of time on creative collaboration were drawn.

- Creative collaboration in computer-based learning activities can be developed most effectively when the level of time pressure is achieved for both the individual and the group.

- The most effective level of time pressure should take into account individual and group time pressure differences and preferences in the intragroup creative process.

- In order to plan and regulate the time required during the task, the team should take into account the different levels of time pressure for each of the teammates and consider adjusting the task to allow members with preferences for lower levels of time to maintain their most effective level.

- Reducing procrastination during the collaborative task and increasing asynchronous modalities of collaboration would allow the group to work at lower levels of time pressure and lead to higher quality performance, increased originality and creativity both in the collaborative process and final products.

7. ASSESSING CREATIVE COLLABORATION

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Assessing whether participants agreed with statements sourced from previous research on creative collaboration was found by the CoCreat partners to be a useful way of gauging whether there were sufficient opportunities in a set task for a group with available digital tools to collaborate online. In addition the level of creative collaboration in a task can be judged by asking the participants to rate how strongly they agree with the different statements.

The first group of these statements refer to the necessary mechanisms that should be in place to ensure within group communication and for sharing representations of the product being created. They need to be repurposed by the educators or researchers deploying them so as to ensure they refer to the relevant tools.

- We could see or find out what other people knew or were thinking about. For example, we could draw, write or build models on the computer that the other group members could see and/or read.
- We were able to chat informally with the other group members via text or social networking and/or
- We were able to share information with the other group members formally e.g. in a wiki or shared document and/or
- We were able to video conference/talk face to face with the other group members.

Example means of successful communication drawn from the CoCreat findings are the online blog in CS5 used to host the students' creative writing exercises and feedback comments from the other participants in the collaborative space. Less successful examples include the difficulties the Romanian students had joining in CS2 as they lacked the language skills and technology to run Second Life effortlessly.

The next group of statements refer to the necessary resource and shared understanding of the task within the group that needs to be in place to enable opportunities for creative collaboration.

- I had a good idea of what the others in my group knew that is relevant to this activity.
- We understood each other's viewpoints at the start of the project.
- Our group had the necessary knowledge to be able to complete our task.

The importance of clarity over the task and having to knowledge to complete it was shown up well in CS2 where students without scripts to scaffold their understanding of the set task to build an online course to teach others resorted to unofficially accessing other group members' scripts. Also CS3 demonstrated how having too large a group meant that it was difficult for members to get to know each other well enough. Whilst CoCreat did not research which was the optimum group size it is noticeable that most of the groups in the different iterations of CS1 had three members. It seems likely that having between three and seven members is the most effective group size for engendering creative collaboration.

The third group of statements refer to the motivation of the group for the task and how well they engaged with it.

- Everyone in my group wanted to make a successful product.
- Everyone in our group was interested in the task.
- Everyone in our group was engaged in the task.

Again the findings from the interviews conducted in CS3 where some students report their disappointment with the lack of engagement of others from a different university in the task show how important this is. In contrast CS4 demonstrated full engagement of the elderly in the 'Creative Hut' however it should be noted that there was a very high tutor-student ratio in that collaborative space.

The next group of statements refer to the group atmosphere and the need for a safe environment where students can express themselves freely as they explore new, untested ideas with their peers.

- My classmates/colleagues in my group trust each other
- We were all able to express our ideas, even controversial ones freely.
- We sometimes disagreed but we discussed our different points of view.

Another group of statements refer to the importance of ideation, with the safe atmosphere, as described above, enabling divergent thinking and a sense of playfulness.

- We were able to share and discuss our early ideas with each other.
- We played with ideas while we were working on the project
- Between us we used a lot of imagination.
- My group generated different and novel ideas in response to the task.

The results of using these statements in the assessment scale for the different tasks carried out in the CoCreat project show clearly that students in the different collaborative spaces all associated ideation with creativity. However, it seems that they need to be supported to help them assess when and where they are being creative, for example, in CS3 students didn't really recognise their work on the production of an e-handbook, as creative. This was in direct contrast to CS5 where students and tutors readily acknowledged the role of creative writing in the set tasks for the online blog. That said, the CoCreat partners working in CS3 did note that, whilst the efforts the students put into team working were not directed at producing creativity in the product, they creatively resolved the problems that arose with team working itself.

Team working is also central to the next group of statements that ask about effective collaboration.

- We had a feeling of belonging together.
- Our group worked together well.

Effective collaboration is seen most clearly in the first two iterations of CS1 where younger students given a finite amount of time and roles to play within their groups engage in mobile storytelling triggered by a school visit to a location of particular interest. Having set roles was less important to effective collaboration amongst the slightly older teenagers taking part in the third iteration.

The next group of statements share the finding that students in all collaborative spaces were less likely to agree with them compared with the results for the other statements.

- We weren't always certain about how to carry out the task which led us to explore different possibilities.
- We went beyond the set task.
- The set task/activity enabled us to express our emotions.

Whilst uncertainty and going beyond the set task are associated with creativity in the literature it seems that, given the academic nature of the set tasks that the students in the collaborative spaces engage in, the students were more concerned to ensure their product met the given criteria within the allowed time than to push the task boundaries in the pursuit of creativity.

The final group of statements refer to learning time regulation and whether individuals and groups organised time on task effectively.

- I organised my time for learning well.
- Our group organised our time for learning well.
- My group were pressured to complete in time.

Like the mechanisms to ensure within group communication this is a necessary but not sufficient condition for supporting creative collaboration. In general the groups in the different collaborative spaces felt they had organised their time on task well though it was noted in CS2 that lack of participation from some students was linked to unforeseen limitations on their available time.

8. DISCUSSION

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Success of wikipedia, open source communities etc. are just a few examples of the increasing role of modern technologies and networks in collaborative knowledge construction. Technology supports interaction that enables creation of digital artefacts, that people can then interact with (Hakkarainen et al. 2013).

In this publication we have presented what we think are the main results of the CoCreat-project. We have aimed to make our experiences as concrete as possible by giving examples from the implementation of the project. In previous chapter we also gathered tools and methods for those readers who want to support creative collaboration and collaborative learning in their own work.

Creative collaboration is not an easy phenomenon to understand, and really not easy to design and implement. Still from the perspective of modern life and expectations of lifelong learning, collaboration skills and creativity can be considered somewhat vital to modern professionals. In the field of learning sciences, the way we understand learning today, educated professionals need profound understanding of the complex concepts of their field, and ability to work with them creatively to come up with new ideas, theories, products and knowledge (Sawyer 2006).

During this project we did see indicators of studying cultures supporting individual performing and competition instead of true collaboration. Teacher can be often seen as an authority with the one right answer instead of seeking multiple creative and innovative solutions for genuinely complex and open problems based on real life practices.

The CoCreat project created multiple answers and practices to support and enable creative collaboration. Our aim to support new kinds of acting and thinking succeeded occasionally very well and occasionally we learned to do better next time. In long run, in order to develop creative and collaborative educational practices, institutions and actors need time and support from the educational environment. These kind of activities should be left as a individual experiments. All the partners of CoCreat project have now more theoretical and practical knowledge about supporting creative collaboration, and we are aiming to develop the European practices in a way that collaboration and creativity would be familiar ways of working to the student way before they enter the working life in the future.

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