Computer-Supported Collaborative Learning: Scripting, Metacognition and Motivation
Computer-Supported Collaborative Learning: Scripting, Metacognition and Motivation

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Picture: Ellaveera Hyvönen
Mobile devices enable a rapid access to Internet and many applications using cloud services keep our ideas and work accessible anywhere. Sharing of ideas or contributing to a joint writing is just a click away. We can apply multiple sources of data in communication and knowledge construction. The possibilities of digital media enable to apply the pedagogical principles of computer-supported collaborative learning (CSCL) in practice. CSCL research has unique contribution to the pedagogical and theoretical understanding of the cognitive and social processes taking place in different technology based learning environments (Jeong, Hmelo-Silver, & Yu, 2014; Roschelle, 2013). Since the technological devices allow learners to engage learning in at any time, scripting and regulation of emotional, motivational and cognitive processes are central for obtaining and maintaining a shared goal in collaborative learning (Kirschner & Erkens, 2014). Researchers in the field are discussing on the different forms of regulation (self-, other-, co-, and shared regulation) aiming to define what shared regulation is and how these processes can be examined (Hadwin & Oshige, 2011; Järvelä & Hadwin, 2013; Kempler Rogat & Linnenbrink-Garcia, 2011; Volet, Vauras, & Salonen, 2009). For example, a specific area of metacognition research attempts to define what makes metacognition as socially shared (Hadwin, Miller, Webster, & Winne, 2011; Hurme, Merenluoto, & Järvelä, 2009; Iiskala, Vauras, Lehtinen, & Salonen, 2011; Winne, Perry, Hadwin, 2012). However, many of these studies have been conducted in instructional settings although more and more learning will take place in informal learning situations supported by new technological devices and tools. The role of youth's multitasking within a learning task would probably give new insights for metacognition as well as motivation and emotion regulation in terms of learning outcomes.

The usage of latest technological tools and digital media in itself it does not guarantee effective learning in CSCL. For better learning outcomes, scripting has been taken as a pedagogical tool to facilitate organizing and reaching the learning goals (Kirschner & Erkens, 2014). Scripting is a form of other-regulation to help learners engage in interaction patterns that support knowledge construction (Fischer, Kollar, Mandl, & Haake, 2007). For instance, learners can be assigned specific complementary roles and activities in a discussion, like analyst and critic. Typically, these roles are rotated during interaction (Kobbe, Weinberger, Dillenbourgh, Harrer, Hämäläinen, Fischer, 2007). Teachers can instruct students on what roles and activities a script entails or the script is embedded in a CSCL environment through additional scaffolds that define roles. One such scaffold could be sentence openers that structure the communication interface and guide learners to approach a collaborative task in a certain way, e.g., "What I do not understand about your analysis is ...", "I would modify your analysis in the following way ..." or "A synthesis of these views would be ...". In this way, scripts are directed towards specific processes of collaborative learning, e.g., increasing the transactivity of learners' interactions, i.e. to help learners to better operate on the reasoning of their peers (Fischer, Kollar, Stegmann, & Wecker, 2013; Weinberger, 2011). In scripting the most topical issue is how scripts can foster shifts from other- to self-regulation. One area of debate is how some scripts may impede learning by being too fine grained or leaving too little degrees of freedom (Mäkitalo, Weinberger, Häkkinen, Järvelä, & Fischer, 2005). While scripts may enable some novice learners to engage in socio-cognitive processes beyond their current level of ability, others, more advanced learners may not benefit from additional, external regulation of
their interaction processes. In this respect, scripts may need to be adaptive, i.e. faded in only when needed and faded out once learners have developed internal scripts for regulating their interaction themselves. One approach to facilitate the shift from other-regulation by scripts to self-regulation by the learners is to instruct learners to continuously monitor each other's regulation (Wecker & Fischer, 2011).

This book focuses on the central components of CSCL – scripting, metacognition, and emotions and motivation. The authors of this book are university students studying educational subjects and having a joint international CSCL course. At the beginning of the course, the students wrote literacy reviews individually. Based on these literacy reviews, the international groups of students were formed. A collaborative task was to produce a book article by using only online learning tools. The groups were not only learning about the theoretical aspects of CSCL but also experiencing it. This was a true possibility for the students to get an insight the demands of participation into a collaborative task, and how regulation of emotions, motivations and cognitions requires more attention when gestures and mimics are not always available.

The chapters of this book are organized into three parts according to the topics given to the authors. **Part I** focuses on the motivational and emotional aspects of CSCL. Neofotistou, Alnatsheh, Levshenko and Santiago discuss the role of the motivations and emotions in CSCL (article 1). They also stress the role of emotion and motivation regulation play in the usage of learning strategies. In the article, the concepts are defined carefully giving a short insight to the network of the concepts widely used in the literature. In the second article, Conte, Lanto, Lazareva, and Hang Limbu explore the role of emotions and motivation in collaborative learning situations, as well as practical strategies for motivational regulation. They also describe personal experiences in order to demonstrate specific challenges faced during collaborative work and strategies used by the team to overcome them. **Part II** focuses on scripting in CSCL and it begins with Fatiu, Mahmood and Mayuri’s (article 3) introduction to the general guidelines for CSCL scripting. They also discuss the criteria for designing CSCL script and they use a real life example of a football club script to describe the factors that influence to the success and weaknesses of scripts. Agamez, Dukuzumuremyi and Grigoreva (article 4) discuss the requirements of a successful CSCL scripts. They also discuss the the negative effects from scripting alongside with possible solution efforts. **Part III** describes the role of metacognition in collaborative learning. Krüger-Vargas, Parzhetskaya and Tast (article 5) focus on to demonstrate the importance of task in computer supported collaborative learning and socially shared metacognition. They also discuss how task difficulty effects on collaborative processes and outcomes. Finally, Darvasi, Palosaari-Aubry, Sun and Uhde (article 6) provide a fresh approach for designing pedagogical scripts to support socially shared metacognition, also a practical example is included.

The authors are university students from Finland and Germany: Learning, Education and Technology Master’s degree programme, University of Oulu and Edutech Master’s degree Programme, University of Saarland. Having a heterogeneous background, some of them have been participating in CSCL courses online before and some of them were novices in this respect. Some of the students have been studied educational sciences longer than the others. The CSCL course assignment included an individual and a collaborative learning task. At the individual phase, the students got familiar with the motivational and emotional
aspects of CSCL, and scripting as a pedagogical tool for organizing collaboration and support learning, and the role of metacognition in collaborative problem solving. During the individual phase, the students wrote a short essay on each topic and provided constructive feedback and comments on a peer’s writings. For a collaboration phase, each participating student selected a topic found the most interesting to write an article with peers. For group interaction and planning, a synchronous (Skype, Adobe Connect) and asynchronous tools (Google Docs) were used. The groups created their own scripts how to collaborate and advance their collective writing. Instructional support was given by tutors commenting on the group’s work on Google Docs. As a result of this extremely demanding but hopefully also rewarding writing process, Computer-Supported Collaborative Learning: Scripting, metacognition and motivation book was born. The authors have done their very best to make the book enjoyable to read without forgetting critical viewpoints towards current research in the field. It should be also noticed that during the course English language which is not their mother language was used.

We are grateful to each of the authors for the efforts and hard work invested in writing the chapters. The efforts invested in completing the articles and the high quality of work can be seen in articles. The students also had a strong intention to implement the theoretical ideas to the practical learning situations which requires deep understanding of the phenomenon under study. Writing scientific article is in itself a demanding task and collaborative online working makes it even more complicate. During the collaboration process, the lessons learnt were not only about CSCL but also learning through CSCL showing the importance of sharing ideas, thoughts and feelings openly, and supporting each other to hold on a shared goal. The authors have been successful in their writings - you should all be proud of the work done!

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WHAT IS THE ROLE OF MOTIVATION AND EMOTIONS IN CSCL? TOWARDS EFFECTIVE LEARNING STRATEGIES BASED ON EMOTIONS AND MOTIVATION REGULATION

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Abstract Emotions and motivation regulation emerged as substantial elements in computer supported collaborative learning (CSCL) environments. It is important to understand how learners regulate their emotions and motivation and how to support learners by effective learning strategies to regulate emotions and motivation in CSCL. The purpose of this article is to provide effective learning strategies that can be applied in order to achieve high learners’ emotions and motivation regulation levels. To achieve this goal, a specified conceptual understanding of emotions and motivation regulation and learning strategies in CSCL context are proposed in details. The results of this study show that learners can influence and control their emotions and motivation positively by applying particular learning strategies which assist them to fulfill high learning outcomes. Finally, learners’ emotions and motivation in CSCL contexts can be controlled individually if learners are able to utilize appropriate learning strategy.

Key Words: motivation, emotions, regulation, CSCL, regulation strategies

INTRODUCTION

Due to the fast changes in the present human’s life and the unlimited growing of computer technologies, the need to understand how human learn and connect within the modern technological environment is increased. Computer technology changed the way human learn and construct knowledge. Learning becomes different than before and it takes place in socio-technological environments. Learners tend to utilize computers to learn and to collaboratively learn together (Järvelä, Hurme, & Järvenoja, 2011).

Virtual Worlds emerge into our lives and the way we are learning, since by their nature they provide an excellent opportunity for collaborative learning. At first learning in virtual worlds was restricted to classroom meetings and lectures, similar to their counterparts in real life. Now collaborative learning is evolving as companies starting to take advantage of unique features offered by virtual world spaces - such as ability to record and map the flow of ideas (Naone, E. 2007). CSCL involves the connection remote between students using technologies and social interactions in learning environments, having successful engagement in collaborative learning and allowing the students to share their ideas (Järvelä, Hurme, & Järvenoja, 2011).

Collaborative learning includes a variety of shared processes, emphasising the meaning of motivation and emotions for successful collaboration (Crook, 2000). So, in order to engage the learners into computer based learning environments, motivation and emotion control is an area of study that is very important in the field of collaborative learning research. Here we don’t aim to analyze all the factors, which influence the learning process, but we get
focused on the role of motivation and emotion regulation in learning processes.

Before trying to describe how these terms are related in a CSCL environment, a short definition of the terms motivation and emotions would be essential. Motivation is defined as the process that initiates, guides and maintains goal-oriented behaviors. Motivation is what causes us to act: put additional efforts for better grade, reading a boring book to gain an important knowledge, write essay through all night. Psychologists have proposed a number of different theories of motivation, including drive theory, instinct theory and humanistic theory. In this article we are focused on the educational part of motivational science.

Not only motivation, but also emotions have a very important role in the learning process, because the aim is that students get more involved. When students are motivated and have good emotions, they carry out effective activities to improve their learning. Alexander, Kulikowich and Jetton (1994) demonstrated how emotion has effect on learning and achievement. Their research, about role of interest in text comprehension, showed how emotions could influence on cognitive processing and activation of prior knowledge.

Relationship between emotions, motivation is defined as reciprocal and recursive in the area of computer supported collaborative learning (Zimmermann, 1989). When we regulate our motivation, emotions can influence motivation in a positive or negative way, especially in a CSCL environment. That’s why it is useful that students learn how to regulate their motivation and emotions and here we try present some ideas how one can regulate his/her emotion and motivation and what strategies exist towards this goal.

**Motivation and Emotion**

**Motivation**

Motivation is basis and a psychological feature that arouses an organism to act towards a desired goal and elicits, controls, and sustains certain goal-directed behaviors. It can be considered a driving force; a psychological one that compels or reinforces an action toward a desired goal. Motivation has been shown to have roots in physiological, behavioral, cognitive, and social areas. Motivation may be rooted in a basic impulse to optimize well-being, minimize physical pain and maximize pleasure. It can also originate from specific physical needs such as eating, sleeping or resting, and sex (Schater & Daniel 2011, p.325). It is essential to understand and to focus on what teachers and students say and do during learning activities in classrooms. The way to understand students' and teachers' emotions is through related, theoretical perspectives on motivation (Meyer & Turner, 2006). The theories of motivation are (a) risk taking, (b) flow theory, and (c) goal theory.

**Motivational theories**

The definition of an academic risk taker is a student who makes a choice for tricky tasks, acceptable for failure, and the ability to utilize strategies flexibly when facing obstacles (Clifford, 1991). A student as a risk taker is expected to select tricky tasks due to that tasks increase learning and feedback on goal progress. Risk taker is also expected to be more open to deal with suspicion, faults, and embarrassment due to his capability to visualize them as critical to his larger goal of understanding. In addition, a risk taker explains higher self-regulation through...
controlling his learning and modifies his strategies in an efficient way. The student who accepts academic risk taking is assumed to (a) reach academic challenges, (b) to provide essential causes for seeking tricky classroom-work, (c) to notify taking action when he did not grasp, also (d) to overcome with negative emotions after failure in following of his learning purposes (Boekaerts, 1993).

Flow theory integrates cognition, motivation and emotion. The flow theory demonstrates the students’ experiences quality in classroom learning activities in a multifaceted way (Csikszentmihalyi, 1975). The flow theory assumes that ideal learning experiences are essentially motivated and related to positive emotions and foster cognitive processing (Csikszentmihalyi, Rathunde, & Whalen, 1993). Csikszentmihalyi (1975) pointed that students when examine flow report: (a) obvious objectives and progress toward fulfilling them, (b) powerfully focused, effortless, attention or concentration during the task, (c) a feel of time passing quickly and loss of self-consciousness, and (d) a balance among the challenges of the activity and students capability to meet them (i.e., they felt that their skills were “stretched” to meet the challenge).

Goal theory demonstrate the reasons of why students would involve or avoid academic risks and what instructional features may participate to high engagement classrooms, why students choose to approach or avoid different types of achievement goals (Meyer & Turner, 2006). Ford (1992) mentioned that emotions provide "guides about the content of a student's goals through affecting selective attention, recall, event interpretation, learning, decision making, and problem solving in predictable ways”. Emotions are a mediating effect among students' achievement goals and their resulting beliefs and self-regulatory behaviors (Turner, Thorpe & Meyer, 1998).

Goal theory concentrates on the connection between students’ perceptions of their emotion and motivation. The negative influence about unsuccessfulness or making failures might help demonstrating why students with more approval of performance goals report thoughts and behaviors which are more directed to ego safety than to learning and advancement. Self-reported which reflects negative influence after failure is a mediator among performance goals and self-regulated learning thoughts and behaviors (Meyer & Turner, 2006). Students who are more able to efficiently regulate their emotion might be more intend to report an ingenuity goal perspective. For example, we feel that those students could have improved strategies such as the utilize of reassuring self-speech, for example “don’t worry” and “try harder” in an attempt to control possible debilitating states like anxiety (Corno, 1989).

**EMOTION**

Emotion is a subjective, conscious experience characterized primarily by psychophysiological expressions, biological reactions, and mental states. Emotion is often associated and considered reciprocally influential with mood, temperament, personality, disposition, and motivation. Emotion is often the driving force behind motivation, positive or negative (Gaulin & McBurney, 2003). An alternative definition of emotion is a "positive or negative experience that is associated with a particular pattern of physiological activity. (Schacter & Daniel, 2011). This process needs to involve cognitive, motivational and social interactions.

A general efficient situation assists in identifying various classroom environments which are linked to students' emotions and conceptions of contexts. Positive emotions can be
considered as "markers" of powerful supportive instructional interactions and positive classroom climates (Meyer & Turner, 2006). An instruction which is linked to positive student motivation is mostly connected with emotion's explicit displays, such as laughing on teacher's joke about his faults in the classroom or a student's expression of pride at grasping a hard problem (Meyer & Turner, 2006).

It is central in students’ and teachers’ efficient engagement within instructional interactions to understand and identify emotions. Understanding and identifying emotions assist in making positive classroom environments. In learning and motivation, emotions can be seen as shared and generative factors which constrained to the context (Meyer & Turner, 2006). Emotions contain appraisals, action tendencies, desires, feelings, and physiological responses of students and teachers (Ortony & Turner, 1990).

Emotions emerge through interactions (Ford, 1992). Emotions can be defined as "an empowering source of information about how to influence motivational patterns" (Ford, 1992). Pintrich and Schunk (2002) focused on Ford's responsive environment principle. That principle included: (a) integrate student's goals and classroom goals, (b) teacher's interacting with student's competencies, (c) provide actual and suitable tasks, and (d) assist and motivate an emotional environment which support confidence between students and teachers. Emotions emerge from personal interactions in an environment and consistently changed with time and situations. Emotions do not emerge through an environment or through a student, but through the students' interaction (Lazarus, 1991). Emotions in classrooms are important for the comprehension of instructional interactions. As an example, teacher's positive support which contains positive emotions contributes to students' motivation (Meyer & Turner, 2006). The definition of emotions is that individual expertise which is connected with situational meaning that generates action states (Frijda, 1988). In relational–motivational–cognitive perspective, emotions can be identified as individually related evaluations of a status (e.g., harm, threat, challenge, or benefit) which contribute to a possible for action and physiological modifications (Lazarus, 1991).

A general efficient situation assists in identifying various classroom environments which are linked to students' emotions and conceptions of contexts. Positive emotions can be considered as "markers" of powerful supportive instructional interactions and positive classroom climates (Meyer & Turner, 2006). An instruction which is linked to positive student motivation is mostly connected with emotion's explicit displays, such as laughing on teacher's joke about his faults in the classroom or a student's expression of pride at grasping a hard problem (Meyer & Turner, 2006).

**Regulation**

In the process of collaboration learning, the members interact and work to obtain a common goal; first, they must define their objectives and sharing responsibility to achieve a shared goal during learning process. The regulation of motivation and emotions both individually and in groups is critical for successful in CSCL. Therefore, the regulation of emotions and motivation for learners is needed for to complete a task (Dillenbourg, Järvelä & Fisher, 2009). In addition, in different phases of collaboration learning may arise some obstacles such as conflicting goals and different challenges between group members, different levels of interest and lack of common ground in shared problem solving. Therefore, the group members need to negotiate,
explain, compromise and pay attention in the development of a shared goal and emotional aspects in the group. It is possible through regulation processes, due to learners can use three different regulation processes, each of which provides to how students achieve their goals and these participants could regulate their emotions, motivation and cognition each other, through shared responsibility (Järvenoja & Järvelä, 2009). These regulation processes are: 1) Self-regulation, in which each member of the group regulates himself/her, 2) Shared-regulation, in which the aim of the group members is to regulate themselves together to achieve a shared goal, 3) Co-regulation, in which the group members assist other’s regulation (Järvenoja & Järvelä, 2009).

The aim of this is that students can regulate correctly emotions collaboratively as well as individually in challenging situations during collaborative learning process. The regulation process in collaborative learning should consist of an individual regulation process and socially shared interactive processes of learning. Therefore, students should monitor and regulate the processes for their motivation and with this form of self-regulation; they will have an impact on their learning and achievement.

According to the view of motivation, regulation of motivation is described through which individuals start, provide and complete a particular task or group’s goal. This regulation is acquired and improved by managing and controlling processes of motivation that determine this willingness. Regarding behavior, motivational regulation covers thoughts and actions, through which students act to determine their choice and persistence for tasks. Motivational regulation under these conditions should enable students overcome problems and enhance their productive level of engagement in the tasks. Therefore, individuals who regulate their motivation correctly should have fewer situations in which students choose not to perform a task or provide a wrong effort (Wolters, 2003).

A critical part of self-regulating learning is that students should know and identify different strategies to regulate their motivation. The use of motivational regulation strategies should engage a positive association with their motivation, their effort and their engagement. However, sometimes students begin and complete tasks with a high level of motivation, and they don’t experience obstacles that interfere with their effort and engagement at the tasks. During these cases, learners are unlikely to need some kind of regulation. This suggests that learners who develop more effectively their motivational attitudes should use motivational regulation strategies less frequently than learners with less effective motivational attitudes (Wolters, 2003).

In next section of this article, research relevant is provided to guide and describe different strategies for regulating motivation that learners might use to regulate their motivation within academic contexts.

**Strategies**

Attempting to regulate their cognitive, motivational and emotional learning processes (Boekaerts, 2001), students have to cope with their own emotional and cognitive demands and conflicts, as well as social settings and environmental cues in every learning situation (Volet & Järvelä, 2001). That is to say, that regulated learning and its effectiveness is influenced by several factors, such as metacognitive processes, motivational regulation, emotional regulation, learning strategies. Thus, the point is to find ways to support regulatory processes, in order to
have more successful individual, such as collaborative learning. By acquiring specific strategies, students can learn to take control over their thinking, behavior, and environment. Based on what was mentioned above and according to Wolters (1999), motivational regulatory strategies refer to “a variety of tactics and actions individuals use to sustain their effort in specific academic tasks”.

As they become increasingly self-regulated, learners are able to work independently or in a group on increasingly complex problems and projects. It is therefore very important that the learners become more aware of the emotions and motivation regulation. It can be achieved, if learners set their motivational goals and develop strategies how they can achieve these goals (Järvenoja & Järvelä, 2009). Towards this direction, we aim here to describe various key activities that can be considered strategies for self-regulating motivation (Wolters, 2003) and making it easier to achieve a goal as individual or as a part of a group in a CSCL environment.

**SELF-CONSEQUATING**

A prototypical way in which students regulate their motivation is through the use of self-consequences for their own behavior. Self-consequating means choosing your own rewards and punishments based on your performance associated with completing a task. Another way to think of self-consequating is that you are making a promise to yourself. Promising yourself a reward once your goal/task is satisfactorily completed, or promising a punishment if you do not complete it, can help you get motivated to achieve your own goals. An example of this strategy
would be a student who, when reading a textbook chapter at the library, states to herself as “self-reinforcement”: “If I finish reading this chapter, I can watch TV tonight when I get home.”

GOAL-ORIENTED SELF-TALK
Goal-oriented self-talk is another strategy to help you regulate your motivation and it involves students’ use of thoughts or subvocal statements while they are engaged in a task. It is very important to be aware of your level of motivation throughout the task and consciously remind yourself about your goals. For example, when you notice your motivation is getting low, you could purposefully think about various reasons you have for persisting or completing a task:

- Getting high grades.
- Completing the goal in order to satisfy your curiosity, becoming more knowledgeable about a topic, or increasing your feelings of autonomy.

Through this strategy, you can increase your motivation, which will allow you to increase your focus on mastery-oriented goals and thus, your effort, and ultimately, achievement within a task.

INTEREST ENHANCEMENT
Students may use strategies designed to increase their immediate enjoyment or the situational interest they experience while completing an activity in order to cope with boring or repetitive tasks. According to research, some students who are required to complete a task would modify what they were doing to make the process less repetitive or boring. This modification may make the task somewhat more difficult, but it serves to increase the students’ motivation by making the task more situational enjoyable, interesting, or challenging to complete.

ENVIRONMENTAL STRUCTURING
Another type of strategy that students may use to regulate their effort and persistence for academic tasks is environmental structuring (Zimmerman & Martinez-Pons, 1990). Typically, students using an environmental structuring strategy actively work to remove distractions or other obstacles that hamper motivation or impede their progress in completing a task. A variety of environmental structuring strategies (Wolters, 1998) is described below:

- changing location to a more suitable study environment to avoid distractions and to maintain focus on the task
- eating or drinking food that may increase the level of attention
- taking naps or short breaks to increase the readiness for study
- keeping a calendar with important deadlines noted, and/or
- setting aside specific times for studying

Environmental structuring is incorporated into a general measure of volition or self-regulation that itself is associated with greater effort, persistence, or performance.
SELF-HANDICAPPING

A related to environmental structuring but quite different type of strategy for regulating motivation involves the manufacture of obstructions before or during a task that make performing that task more difficult. This somewhat counter-intuitive regulation of motivation activity is called “self-handicapping” (Riggs, 1992; Urdan & Midgley, 2001). Putting off doing work until the last minute, avoiding studying, and staying up late the night before an important exam have all been used as examples of how students self-handicap within academic settings. (Eronen, Nurmi, & Salmela-Aro, 1998; Martin, Marsh, & Debus, 2001; Rhodewalt, 1994)

ATTRIBUTION CONTROL

When using this strategy, individuals purposefully select causal attributions to maintain or increase their motivation for a task or for future tasks that are similar. Students may, for example, intentionally avoid blaming their academic setbacks on internal, stable, and uncontrollable causes because this type of attribution tends to lead to a helpless orientation (Weiner, 1986). Students may instead purposefully use attributions that reflect internal and controllable factors because they lead to more adaptive motivational outcomes. Modeling, feedback, or reinforcement provided by a teacher or trainer is used to get students to make more adaptive attributions. Overall, there is much research showing that attributions can be manipulated through external means and that the attributions students make can impact their motivation and performance.

EFFICACY MANAGEMENT

Students’ self-efficacy or beliefs about whether they will be successful on a given task are a powerful predictor of their choice, effort, and persistence for academic as well as non-academic activities (Bandura, 1997). Students’ ability to monitor, evaluate, and control their own expectations, perceptions of competence, or self-efficacy for tasks represents a significant form of motivational regulation. Three strategies students may use to manage their perceived competence for academic tasks are considered here: proximal goal setting, defensive pessimism, and efficacy self-talk.

PROXIMAL GOAL SETTING. Proximal goal setting consists of breaking complex or larger tasks into simpler more easily and quickly completed segments. For example, a student who has 30 pages of textbook reading to complete may identify reading 10 pages as a short-term goal. The goal properties of proximity and specificity have especially been tied to increase in self-efficacy and subsequent motivation. Hence, students should be able to positively influence their motivation by purposefully setting and monitoring their own proximal goals.

DEFENSIVE PESSIMISM. In this strategy, students highlight their level of unpreparedness, lack of ability, or other factors to convince themselves that they are unlikely to complete a task successfully (Garcia & Pintrich, 1994). The anxiety associated with these lowered performance expectations is used strategically to increase students’ willingness to prepare and thus, avoid the outcomes associated with the anticipated failure. For example, college students identified as defensive pessimists described their behavior the night before an exam with statements such as “I think about how unprepared I am in order to get myself to work harder.” (Norem & Cantor, 1986) Defensive pessimism may best be considered a preventative strategy that
facilitates students’ motivation and performance in the short run but may serve to hinder these outcomes in the long term. (Martin et al., 2001).

**Efficacy self-talk.** Students using this strategy engage in thoughts or subvocal statements aimed at influencing their efficacy for an ongoing academic task. Students might say to themselves: “You can do it, just keep working.” or “You are doing a good job; you are going to be successful if you just keep at it.”

**Emotion Regulation**
Emotions and emotional reactions permeate the processes of self-regulation and of learning more broadly (Aspinwall, 1998; Carver & Scheier, 1990). The ability to regulate this aspect of one’s functioning is considered an important skill. As a regulation of motivation strategy within educational settings, emotion control describes students’ ability to regulate their emotional experience to ensure that they provide effort and complete academic tasks (Corno, 1993; Schutz & Davis, 2000). There are many specific strategies that students may use to influence or cope with their emotional reactions such as slowly counting to 10, breathing slowly and deeply, and wishful thinking (Knapp, Kukjian, Spirito, & Stark, 1991; Schutz & Davis, 2000). Individuals might also use inner speech to control their affective reaction, making statements such as “It’s not going to help to get frustrated; just keep trying.” Self-affirmation, a process by which students conduct a cognitive search for positive evaluations of themselves, also has been described as a strategy used to avoid negative emotional experiences (Garcia & Pintrich, 1994). By controlling positive emotions and reducing the negative ones, students can enhance their motivation and thus, have better performance. Especially in the context of a CSCL environment, where the socio-emotional challenges are typically higher than in conventional learning situations, it is very important that the students are able not only to regulate their emotions individually, but also according to the demands of the collaborative environment.

**Conclusion**
Research of student motivation and emotion is open a huge multidisciplinary perspectives for educational science. Importance of opening new CSCL directions for current issues in learning and teaching was proved many times.

Various perspectives of usage of students’ motivation and emotion in learning and teaching contexts are opened nowadays. Scientists have been developing more and more new effective motivational and emotional regulated models. This article is highlights three general key points: motivation, emotion and regulation. Three general themes include information about motivational and emotional regulation strategies with general scientific approach for research in CSCL. Nevertheless, these findings will always need to be adapted to the affordances and constraints operating in the local classroom or another learning environment. Students should have clear idea and understanding of benefits of the learning environment that was chosen. They might be inexperienced with online collaborative learning spaces and miss some instructions or feedback from a teacher. This learning situation could cause the feelings of loneliness with problems and decrease personal contribution in collaboration. If student feels left alone with the task, good idea to know how the others are handles these challenges

Collaborative learning is a situation in which two or more people learn or attempt
to learn something together. Unlike individual learning, people engaged in collaborative learning capitalize on one another’s resources and skills (asking one another for information, evaluating one another’s ideas, monitoring one another’s work; see Bruffee, 1993). Thus teacher could organize regular exchange meetings with group members and install group reward structure (e.g. share roles: manager, notes maker, editor). Such installation helps to seeking, instructional techniques and methods of interaction for help regarding the usage of online working environments to obtain better results for the students. According this, students could improve behavior and environment regulation, relate study subject to their professional experience and realize central aspects of the effort of learners. Regular communal online (Skype, Adobe connect) meeting should be established by the students or the teacher, allowing for the converging of multiple goals and achievements.

“Classrooms and schools also can differ in dramatic ways; they do not all have to look the same in terms of how they attempt to motivate students”. (Zimmerman, 1989 p. 338)

For future development and application of motivation and emotion in CSCL environment seems necessary to have new vision focused on design new instructional strategies, materials, for usage of new technologies and computer programs based on pedagogical approach.

References


emotions evoked from social challenges? *British Journal of Educational Psychology*, 79(3), 463-481.


REGULATION OF EMOTIONS AND MOTIVATION IN THE CONTEXT OF COLLABORATIVE LEARNING

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Abstract Emotions and motivation, and the ways they intermediate, have a crucial effect on a student’s engagement and learning outcomes. In order to be successful, every learner has to be able to understand and control own emotions and motivation. This topic is particularly important in collaborative learning situations, where individual regulation is not enough - regulation needs to be socially shared. The aim of the present article is to explore the role of emotions and motivation in collaborative learning situations, as well as practical strategies for motivational regulation. The article gives an overview of recent theoretical works and research studies. The article includes description of regulatory processes in collaborative situations, definitions of motivation and emotions as well as other related concepts. Next, strategies for motivational regulation are discussed from two perspectives: individual regulation and regulation in socially shared learning situations. In the following section challenges students might face in collaborative learning situations are presented. In the end of the article two examples from the authors’ experiences are described in order to demonstrate specific challenges faced during collaborative work and strategies used by the team to overcome them. The article demonstrates that being aware of own emotions and motivation, as well as those of one’s peer students, and being able to apply relevant regulation strategies is a powerful tool on the way to successful learning.

Key words: emotions, motivation, motivational regulation strategies, collaborative learning

INTRODUCTION

When a student faces a challenging learning situation or a learning setting he or she is not familiar with, it might cause emotionally-based reactions, which might have a strong effect to his or her motivation. A student must overcome these challenges to continue with effective learning. In other words, a student’s successful learning process is significantly dependent on his or her regulatory skills, which also implies monitoring and control of emotions and motivation. In this sense, the theory of self-regulated learning (SRL) plays an important role, also when it comes to motivation and emotions. Furthermore, when learning happens in less traditional settings, for example in a collaborative context, the process shifts to the social sphere and becomes more complex. This is the reason why considering motivation, emotions and their regulation dynamics during collaborative work is very important for effective learning (Järvenoja & Järvelä, 2009).

The aim of the present article is to explore the concepts of emotions and motivation in social learning situations by not only having the theoretical approach, but also by providing an enriching practical vision of the topic. The central questions discussed in the article are as follows: what are the reasons hindering successful collaborative learning, and what are the beneficial methods for students to control their emotions and maintain motivation during collaboration? First, the theoretical concepts are explored in the article, starting with three different regulatory processes occurring during collaboration, and a broad vision of emotional and motivational aspects during learning. The discussion is continued by considering practical
strategies learners apply to manipulate their engagement and challenges social situations bring to motivation. In the end of the article examples from personal experiences of the authors are described in the light of what was discussed in the theoretical part.

The methodological approach used to answer the questions mentioned above is reviewing existing literature and providing a scientific overview of the topic by exploring the main concepts and the ways learners control (or attempt to control) their motivation. Real examples of situations describing challenges in the authors’ previous collaborative work and strategies they applied are described and analyzed.

TYPES OF REGULATION IN COLLABORATIVE LEARNING

The theory of SRL considers individual skills which enhance successful learning processes and the ways a student can learn them. The research in collaborative learning has proven that effective collaborative learning is shaped by many elements, including SRL processes, which encompass goal setting, observation and negotiation during collaboration. In social settings the regulatory activities can take place in three different ways, in fact the conventional view on self-regulated learning can be complemented with a social perspective. It can be hypothesized that students apply three qualitatively different types of regulation processes when working together. Each of the types contributes to the way students reach their goals in learning situations. These types are: self-regulation (an individual regulating him- or herself), co-regulation (the individuals assisting each other’s regulation), and shared regulation (some or all of the group members regulating each other together with an aim to achieve a shared goal). It may not be sufficient to control oneself in collaborative learning situations, because a need to control emotional state at the group level may also become necessary (Järvenoja & Järvelä, 2009).

The focus of the present article is particularly on shared regulation of emotions and motivation. Socially shared regulation refers both to the actions by which several students regulate their common activity, and to individual regulatory actions as part of socially constructed knowledge (Järvelä, Järvenoja, & Veermans, 2008). While picturing how self-regulation works in collaboration, it becomes visible that when individual members perform some regulation actions, they contribute to a group’s common emotional stability. For example, in order to define common aims and objectives, members of a group have to be able to discuss, negotiate, provide arguments, listen to each other and find a compromise. Controlling personal emotions and supporting other members of the group in this process happens through all of these actions. Members of one group reciprocally regulate each other during the process of defining common aims and setting a shared goal (Järvelä, Hurme, & Järvenoja, 2011).

When discussing collaboration, it is important to take in consideration both individual and social perspectives, the cognitive agents and the situative agents. Each individual has own cognitive and emotional processes that create challenges when involved in social situations. For example, they can be related to perceived incompatibility of personalities, to cognitive processes required in collaborative learning and to external circumstances. These challenges give pressure to individuals when it comes to engagement, to maintain motivation and to achieve personal and group goals. The students’ motivation is continuously challenged, and this is the reason why regulation of emotion and motivation is fundamental (Järvelä, Volet
Motivation and Emotions

Motivation is a mental state which promotes goal-oriented behavior that fosters self-regulation. Motivation influences intensity of needs and desires that directs and sustains the behavior towards satisfying physiological and psychological needs. Thus, motivation explains activation, direction and persistence of and individualized effort in order to achieve the goal. Motivation can be applied extrinsically, when the desire to perform an act is to meet external demands or requirements, or intrinsically, when the desire to perform an act because it is satisfying or pleasurable in itself. There is a multitude of factors that trigger motivation, one of the central ones being the learning task. The task students are involved in should be challenging enough so that their goals are attainable with their current skill level, but it should not be too easy in order to avoid boredom (Järvelä, Hurme, & Järvenoja, 2011).

Järvelä, Volet and Järvenoja (2010) conceptualize motivation in social contexts in two different ways. The first conceptualization sees motivation as a psychological phenomenon that is influenced by the social context. When involved in social learning activities, students’ individual goals, behaviors and perceptions are influenced by others. Through a process of canalization they internalize what exists on a social and contextual level and develop individual interest. The second conceptualization sees motivation as a social phenomenon that is jointly constructed. In this sense individuals do not merely influence each other, but they construct interest and engagement within the team, building through interaction an unique group motivation that varies according to the contextual factors, and it is not possible to differentiate individuals and social context because they are inseparable and mutually constitutive (Järvelä, Volet & Järvenoja, 2010).

The focus of this article is on the concept of motivation as co-constructed by the team members through socially shared regulation. Reaching such a high level of social regulation of motivation implies also many challenges and obstacles. The multi-dimension that characterizes collaborative learning includes personal factors, such as individual preferences, aims and goals, expectations of achievement, and cognitive conflicts. Contextual factors, such as learning tasks and interpersonal factors, such as interactions and social conflicts, trigger different kinds of emotions. Emotions are conceptualized as reactions to complex learning situations, and they have a strong effect on motivation (Järvenoja & Järvelä, 2009). Emotional reactions can be caused by several factors, and in particular during collaborative learning they have an even more crucial effect on motivation in comparison to individual learning settings as the context is richer, and a set of unpredictable mechanisms takes place. Group’s members should be sensitive toward each other’s emotions and take in consideration their own emotions to be able to regulate (individually, influence each other’s regulation processes and / or jointly regulate) and successfully collaborate to achieve their goals. This means that in order to have effective collaboration it is important for participants to have sufficient social skills to externalize their emotions and take into account what others feel, so to adopt emotional regulation in the group (Järvenoja & Järvelä, 2009).

In challenging collaborative learning situations learners must start thinking aloud so that their thinking processes, which might have been subliminal, become explicit. These
processes have been observed to have a positive effect on learners’ motivation and engagement. In addition, it has been observed that computer-supported collaborative learning (CSCL) can enhance these processes by offering concrete tools to help students to organize their goal-orientated interaction (Järvelä, Hurme, & Järvenoja, 2011). Furthermore, Crook (2000) states that collaboration is highly dependent on the immediate environments in which activities take place; so the artifacts, the technology and the spaces for acting have all a strong impact on collaboration. Scientific studies have proven that the parameters of environment constrain or facilitate patterns of social interactions, and in this sense technology could provide great support if their affordances are carefully evaluated. It is anyway important to mention that, if on a side technology holds a significant potential for team work, it also may obstruct interactions and motivation (Crook, 2000; Dillenbourg, Järvelä & Fischer, 2009). Collaborative learning tasks in CSCL environments are usually less structured in comparison to individual tasks, especially when it comes to traditionally structured face-to-face settings. This means that there is more responsibility required from learners, as well as more effort to sustain motivation, keep engaged with learning and focused on a task.

**Regulation of Motivation**

Regulation of motivation and emotion control is an emerging area of study within the research on collaborative learning. Even though the processes of motivation and regulating motivation do interplay, it is necessary to make a difference between these two conceptualizations. Theories of motivation discuss several factors that affect one’s effort to aim the learning goals. Motivation regulation focuses on how students are able to take control of their motivation and overcome the challenges that reduce engagement. Thus, motivation can be seen as an intrinsic or an extrinsic construct that affects students’ willingness to learn, and regulation of motivation refers to techniques that they use to overcome the poor level of motivation and to keep going with learning. Traditionally, self-regulated learners are defined as agents who actively coordinate their learning processes by observing and regulating their thoughts and activities, including their emotions and motivation (Wolters, 2003; Zimmermann, 2001). It can be concluded that self-regulated students would always be aware of the factors that have an effect on their motivation, and consequently, this awareness would be a crucial component to enable them to regulate their motivation.

The capability for self-motivation and purposive actions are rooted in cognitive activity. People motivate themselves cognitively through causal attributions, outcome expectancies, and cognized goals. People as aware, cognitive agents are guiding their actions anticipatorily through the exercise of forethought, expecting to reach the likely results of their actions. By cognitive representation in the present estimates the future events, and these representations are translated into emotions and perceived into incentives and actions via self-regulatory mechanisms (Bandura, 1998).

Though, from the aspect of the cognitive theories students are not always aware of the factors affecting their motivation, and in consequence students are not always able to regulate these factors. A student’s attitude (negative or positive) to a learning task might be caused by earlier experiences in a similar context. According to the causal-attribution theory students’ reasoning of their success or failure in a particular task is based on their prevailing
emotions, and has a strong effect on their future attitudes. Wolters (2003) claims that becoming aware of the causes of these reasoning, or belief-structures are not inevitable to enable motivation regulation to begin. What is needed to start the motivation regulation is that a student realizes his or her position, and the fact that one has a power to control and coordinate the learning processes.

In addition to importance of the differences between motivation and motivation regulation, it is also useful to highlight the concept of volition as a separate, but not totally disconnected phenomenon. They both direct behaviors toward goals through a variety of strategies consciously controlled by the learners. But if on one side regulation of motivation can be seen as a parallel process to regulation of cognition (the first one focuses on explaining how individuals control their motivation, while the second one focuses on the cognitive processes); the volition is a broader concept that involves both of these two types of regulation. In this view, regulation of motivation is conceptualized as a narrower process (Wolters, 2003).

In order to understand how individuals make decisions about their behaviours towards managing their motivation, it can be useful to take a look at the expectancy theory (Porter & Lawler, 1968; Vroom, 1964). This theory deals with the direction aspect of motivation, that is, once behavior is energized, what behavioral alternatives are individuals likely to pursue in order to keep themselves motivated. The following description explains the relation between the motivational force, expectancy, instrumentality and valence:

\[
\text{Motivational Force} = \text{Expectancy (Is it worth doing?) } \times \text{Instrumentality (Can it be done?) } \times \text{Valance (How much does it v}
\]

Expectancy and instrumentality are specifically cognitions. As such, they represent an individual’s perception of the likelihood that effort will lead to performance and performance will lead to the desired outcomes or valence which is the value of the expected outcomes. All these factors determine how students regulate their motivation once it has been initiated.

**Strategies for Motivation Regulation**

In order to regulate their emotions and motivation to maintain engagement during learning processes, students may adopt a number of regulation strategies, and in the article “Regulation of Motivation: Evaluating an Underemphasized Aspect of Self-Regulated Learning”, Wolters (2003) has identified eight categories for different strategies:

*Self-consequating* as a strategy to regulate one’s motivation refers to one’s use of an extrinsic reinforcement while achieving a specific learning goal. By using this kind of strategies, the learners are able to influence their motivation, and furthermore shape their own behaviour. The examples of the self-consequating motivation regulation are a concrete reward or punishment that students allow themselves after achieving a specific goal. An example can be having an ice cream after completing a task. Self-consequating strategy can also be realized through behavioral activities like rewarding oneself with spending an evening with friends. A learner may also use verbal statements in order to self-consequate. These verbal statements are usually more immediate, like a thought that students repeat to themselves “You finished another task, good job, you are making good progress”.

*Goal-oriented self-talk* refers to students’ reasoning about why they should persist and complete
the task. The goal-oriented self-talk can be based on mastery goals (e.g., becoming more competent) or performance goals (e.g., getting high grades). An example of mastery goal-oriented self-talk can be “Reading this chapter will give me more knowledge about the topic”, while performance goal-oriented self-talk could be “I will read this chapter really carefully because I want to get the higher grade in the class”.

*Interest enhancement* is a strategy to regulate motivation by increasing one’s immediate enjoyment or interest during the ongoing learning activity. Learners who adopt this strategy would try to make the task more interesting, if they feel it is boring. For example, in a study children who were asked to copy a text found the task not interesting. Some of the children enhanced their engagement by using a nicer calligrapher, and focused more on this aspect. This way they manipulated the task to increase their interest.

When students use the *environmental structuring* as the strategy to regulate their motivation, they are attempting to decrease the possibility of distractions by altering the environment and their physical, and mental readiness to focus more effectively on the task on hand. For example, the students adopt this strategy when they turn off television or radio and look for a quiet place without distractions to study. They are manipulating their physical environment as well as their mental readiness to increase and maintain their motivation.

*Self-handicapping* as a motivation regulating strategy has different effects than other strategies because, instead of trying to shape the level of motivation, it serves to obstruct optimal ability to complete the task. In other words, by adopting this strategy students can justify poor performance with factors other than low ability. Students have been observed to adopt this strategy for example when they procrastinate and postpone a task for so long that in the end they have only a little time to complete it. In this way students can justify their low performance with lack of time, instead of lack of ability.

*Attribution control* is a motivation regulation strategy that comes in to use when a student purposefully selects an attribution to maintain or increase their motivation for a task. For example, when a task is particularly difficult the student avoids blaming uncontrollable causes, and is using attributions that reflect controllable factors that lead to adaptive motivational outcomes instead. For example, a maladaptive attribution for low performance would be blaming one’s lack of innate ability, while adaptive attributions could be evaluating and probably changing one’s amount of effort and considering different strategy use. Adaptive attributions make students feel that their learning is under their control, therefore, such attributions have positive effect on motivation.

Students can also use the strategy of *efficacy management* to regulate their motivation. A students’ perception their own competence may have an influence on the ability to monitor, evaluate and control their motivation. There are three ways defined how students are able to manage their perceived competence. First, *proximal goal setting* as motivation regulation occurs when a student is aiming at executing a complex task by dividing the task into smaller sections in purpose to avoid getting confused while reaching the main goal. For example, a student who has to read a thick book that includes much of detailed information, might feel
incapable of internalizing all the information. A student may take in use the strategy of the proximal goal setting by dividing the book in smaller pieces, and studying the book through a section by section. Second, defensive pessimism refers to an action when one is focusing on his or her lack of ability, or other factors to convince themselves that they are not able to complete the task successfully. In this way one is increasing his or her motivation to work harder, to avoid the anticipated failure. For example, the day before an exam, students can focus on how unprepared they are, in order to motivate themselves to work harder. And third, efficacy self-talk refers to mental statements that one is telling to him- or herself, aiming at increasing the feeling of the self-efficacy. The examples of such self-efficacy supportive statements could be the following “You can do it, just keep working” or “You are doing a good job; you are going to be successful if you just keep at it”.

Emotion regulation is about monitoring, evaluating and changing the occurrence, intensity or duration of a particular emotion. It also includes voluntary manifestation or dissimulation of emotions that are felt and not felt by students. This kind of strategy may include inner talk, such as “Don’t worry about others, you are doing great”.

After discussing motivation regulation strategies for individual learners by Wolters (2003), it makes sense to turn to motivational regulation strategies that could be used in socially shared learning situations. In the study by Järvelä, Järvenoja and Veermans (2008), Wolters’ framework of motivational regulation strategies was adapted from the perspective of individual regulation to the perspective of socially shared collaborative learning. The modification was done using the video data collected during observations of collaborative learning activities of two groups of students (consisting of four students each). The modification included three phases: first, two researchers read the transcriptions and combined theory-based ideas with the video data. Second, two independent codings were carried out. Third, the codings were compared, and contradictory codings were negotiated until a common solution was found. The modification resulted in six categories, which were summarized in a table (see Table 1).

During collaboration the way that emotions are expressed, identified and understood by students are fundamental to create a positive atmosphere in the classroom. They are inevitably dependent to the context, evolved through interactions and are an important predictors of student motivation (the more positive emotions students have about a specific learning situation, the more engaged they will be).

Meyer & Turner (2006) found that students who persist when faced with negative self-thoughts or who respond to error with strategic actions were more likely to achieve in terms of the higher level of learning. How the students emotionally react after unsuccessful collaboration depends on peers and interaction climate. Meyer & Turner (2006) suggest in their findings that the students who are able to regulate their emotions more effectively than others may be the ones more likely to report mastery goal orientation. They used goal theory to explore how features of interactions affected the understanding of relationships among peers to regulate emotion, cognition and motivation for self-learning. They found that the interactions among peers were primarily involved in emotion generation that motivated students towards self-learning.
### TABLE 1. Motivation regulation strategies in a socially shared learning situation (Järvelä, Järvenoja, & Veermans, 2008).

<table>
<thead>
<tr>
<th>Regulation strategy</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social reinforcing</td>
<td>Students’ identification and administration of reinforcements influencing their motivation and shaping their joint behavior</td>
</tr>
<tr>
<td>Socially shared goal oriented talk</td>
<td>Students using goal-oriented dialogue; thinking about various reasons for persisting in or completing a task</td>
</tr>
<tr>
<td>Interest enhancement</td>
<td>Increases aspects of students' intrinsic motivation or situational interest while completing an activity</td>
</tr>
<tr>
<td>Task structuring (environmental structuring)</td>
<td>Decreasing the possibility of off-task behavior by structuring a task or environmental conditions</td>
</tr>
<tr>
<td>Self-handicapping</td>
<td>Manufacture of obstructions before or during a task that make performing difficult</td>
</tr>
<tr>
<td>Efficacy management</td>
<td>Students’ ability to monitor, evaluate and control their expectations, perceptions of competence, or self-efficacy</td>
</tr>
</tbody>
</table>

### TYPES OF SOCIO-EMOTIONAL CHALLENGES STUDENTS EXPERIENCE IN COLLABORATIVE LEARNING

Crook (2000) illustrates how a joint activity can arouse both positive and negative emotions by describing an example about young children collaborating in pairs. He mentions that in some pairs students were ready to discover and negotiate a resource of shared experiences. At the same time, in some collaborative pairs conversation reminded more of competing between individual ambitions (e.g., one student wanted to solve the problem and the other one was willing to do some other activity). What are the reasons why collaborative situations do not always work? Crook (2000) address the quality of collaboration may depend on the participants’ enthusiasm for engagement just as much as it depends on their knowledge and experience in conflict resolution.

Järvenoja & Järvelä (2009) examined the types of socio-emotional challenges experienced by students during collaborative learning situations. In their study, fourteen socially challenging situations were presented to students in the form of scenarios. The scenarios had been created based on previous empirical research identifying various reasons why learners fail to collaborate successfully. The fourteen different challenges were classified in five groups (see Table 2). Students were asked to rate the extent to which they experienced each of the fourteen challenging situations in their collaborative learning. The results showed that the greatest challenges reported by students covered thirteen out of the fourteen scenarios (the only scenario that was not reported was scenario 5 in the Table 2). The most frequent type of challenge reported was teamwork, followed by challenges in collaboration,
work and communication, personal priorities, and finally challenges related to external constraints.

TABLE 2 Socio-emotional challenge scenarios and their distribution to the different challenge types (Järvenoja & Järvelä, 2009).

<table>
<thead>
<tr>
<th>Challenge type</th>
<th>Specific challenge scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal priorities</td>
<td>1. Our goals for the project were different</td>
</tr>
<tr>
<td></td>
<td>2. We had different priorities</td>
</tr>
<tr>
<td>Work and communication</td>
<td>3. We seemed to have incompatible styles of working</td>
</tr>
<tr>
<td></td>
<td>4. We seemed to have different styles of interacting</td>
</tr>
<tr>
<td></td>
<td>5. One / some people had problems with other students’ accents and / or level of language proficiency and thought it was difficult to work with them</td>
</tr>
<tr>
<td>Teamwork</td>
<td>6. People in our group did not connect very well with one another</td>
</tr>
<tr>
<td></td>
<td>7. One/ some people were not fully committed to the group project</td>
</tr>
<tr>
<td></td>
<td>8. People had very different standards of work</td>
</tr>
<tr>
<td></td>
<td>9. Group members were not equal</td>
</tr>
<tr>
<td></td>
<td>10. Some people were easily distracted</td>
</tr>
<tr>
<td>Collaboration</td>
<td>11. Our ideas about what we should do were not the same</td>
</tr>
<tr>
<td></td>
<td>12. We differed in our understanding of the content / task</td>
</tr>
<tr>
<td></td>
<td>13. Our conceptions of how to organize the work varied</td>
</tr>
<tr>
<td>External constraints</td>
<td>14. We had different personal life circumstances or family / study and work commitments</td>
</tr>
</tbody>
</table>

EXAMPLES FROM THE AUTHORS’ PERSONAL EXPERIENCES

In this section examples from the authors’ personal experience are described in order to demonstrate what kind of socio-emotional challenges took place during collaborative learning situations, and what kind of motivational regulation strategies were used to overcome them.
Example 1. Collaborative book chapter

Last year two of the authors of the present article were taking part in a course. One of the main course assignments was to work in collaborative groups consisting of students from three different countries and write a book chapter on a certain topic. The task, being originally exciting, turned out to be rather challenging not only in terms of content, but in terms of collaborative work as well. The beginning of collaboration was the most difficult part. The team formally consisted of eleven members, but only four seemed to be taking initiative in suggesting and proceeding with writing the chapter. These team members started working, but they did not feel confident about proceeding without meeting the rest of the group. For that reason, the first phase was not very active and the progress was not very efficient. As it can be concluded, that situation felt not-motivating. The challenge was in teamwork: obviously some of the team members were not committed to the group project, by that making the team participants not equal.

However, in the little active group of four students communication was good and supportive. Within this group it was discussed that in spite of the fact that not everyone is participating equally, the right thing to do was to go on with the task anyway. It was also discussed that the most frustrating fact was that the time was being wasted on waiting for other participants to react, join the virtual meetings, suggest an idea or show up at all. It was decided that no more time should be wasted, and that the little group is capable of completing the task by sharing the responsibility and workload reasonably and effectively among themselves.

In the group it was suggested and negotiated how to proceed with the task, and ideas about how to build the book chapter were discussed (social reinforcing). When the group was facing some difficulties in proceeding with the task, it was suggested to list the most important things that needed to be done at that moment (task structuring). At the virtual meetings the group always tried to evaluate the current progress - whether the work had been done effectively or there was something to be improved (efficacy management). Regulating motivation within the little group and supporting each other helped to overcome the difficulties in the collaborative work. It helped the participants to feel connected and stay engaged in the task. As the result, the four students managed to complete the task successfully in time.

Example 2. Game design

One of the authors of the current article took part in a project which aim was to design an educational game. The team consisted of five people having different cultural background and native languages. English was a common language among four team members, and it was difficult to understand the fifth participant. Therefore, one of the major challenges since the beginning was in communication. Educational and professional background of the team members was different as well: two persons were specialized in psychology, two other persons in computer science, and one person in computer games technology.

Initially all the team members were motivated by the idea of coming up with a single game, but in the middle of the process, when different ideas and methodologies began to collide, the motivation started to decrease. Team’s focus started to divide, as well as approaches became diverse, as the team strived to create an educational game that would have a strong theoretical background, sophisticated features, appealing outlook, and would be
fun to play. Sadly, the project limitations did not allow applying all the ideas, while everybody wanted to have their ideas implemented. Therefore, collaboration in itself became challenging for the team. The fact that ideas were criticized and it was denied in implementation created a negative emotion in the team. Members, who felt left out began to show lack of enthusiasm.

The team members attempted to solve the problem by selecting a leader, making sure that everybody felt included, stopping criticism of ideas, reducing the amount of face-to-face meetings. The team participants focused more on virtual meetings where everybody could freely express themselves. Thus, the team members identified major challenges and tried to apply task and environmental structuring strategies to overcome the challenges. These arrangements worked well except for the fact that the student with communication barrier was left behind. However, the majority kept moving on and completed the assignments before the deadline.

CONCLUSIONS

Emotions and motivation are complex and fundamental elements that can trigger or constrain learning, including both traditional learning settings and collaboration. In order to enhance learning processes and gain better learning results, taking these factors into account is essential. There are differences in students’ self-regulatory skills, and teachers play a key role enabling students to learn and improve these skills. According to Järvenoja & Järvelä (2009, 15), when “groups are also provided with scaffolding for the regulation of both cognitive and socio-emotional processes, there is a chance to improve the quality of collaboration and academic achievement”. By scaffolding students to regulate their emotions and motivation and asking relevant questions, encouraging students’ reflections and comparing previous and current experiences teachers can guide learners to regulate their emotions and motivation both at individual and social level. The most important thing is that any student can and should learn how to regulate emotions and motivation.
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CSCL SCRIPTS DESIGN; A STEP TOWARD BETTER CONCEPTUAL UNDERSTANDING

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Abstract CSCL has emerged as a new paradigm for research in instructional technology. The design of Computer-Supported Collaborative Learning (CSCL) situations should include positive well-known forms of interaction among participants. A way to deliberately promote productive interactions that enhance the effectiveness of collaborative learning (CL) is the use of collaboration scripts. Scripts could be considered as contextual resources in CSCL. Therefore, this paper is a step toward understanding the scripts categories and principles, bearing in mind that the idea behind the script is related to the pedagogical goal of the learning unit, so the focus is on how scripts can be designed to facilitate discourse and cognitive activities related to individual knowledge acquisition. We also focused on defining the CSCL design, script design and effects of script in CSCL. Furthermore, this paper listed the components of script which are the criteria for designing CSCL script using some real life example of a football club script.

Keywords: CSCL, CSCL design, Script categories, Designing scripts

CSCL

The model of instruction underlying work in CSCL is termed "collaborative learning." Although it is easy to recognize examples of collaborative learning, it is difficult to provide a precise definition. Bruffee (1993) describe it as "a reculturative process that helps students become members of knowledge communities whose common property is different from the common property of the knowledge communities they already belong to; This definition, focusing on what collaborative learning is meant to accomplish, resonates with the view of learning as entry into a community of practice.

On the other hand, Roschelle and Behrend (1995) described it as "the mutual engagement of participants in a coordinated effort to solve a problem together". This latter definition highlights several facets of the method: a commitment to learning through doing, the engagement of learners in the cooperative (as opposed to competitive) pursuit of knowledge, the transitioning of the instructor's role from authority and chief source of information to facilitator and resource guide. Examples of collaborative learning methods include Expeditionary Learning, Group Investigation (Sharan, 1980), Problem-Based Learning (Barrows, 1994; Barrows & Tamblyn, 1980; Koschmann, Kelson, Feltovich, & Barrows, chapter 4), Project-Based Learning (Blumenfeld et al., 1991; Soloway, Krajcik, Blumenfeld, & Marx, chapter 11), and other forms of small-group learning (Noddings, 1989; Webb, 1982).

Over time, interest has grown in the question of how technology might serve to support collaborative methods of instruction (Crook, 1994; Koschmann, 1994a). There have been a number of significant events germane to the emergence of this area of this area of work as a new paradigm in IT. A preliminary exploration of the issues engendered by the use of technology in collaborative education took place in 1983 at the Conference on Joint Problem Solving and Microcomputers held at the Laboratory of Comparative Human Cognition (LCHC)
(Cole, Miyake, & Newman, 1983). A later workshop, conducted under the auspices of the NATO Special Program on Advanced Educational Technology, was held in Acquafredda di Maratea, Italy in 1989 (O'Malley, 1995).

Because this was the first gathering to adopt the title "computer-supported collaborative learning", in 1992 (Koschmann, Newman, Woodruff, Pea, & Rowley, 1993). The first international conference on this topic took place at the University of Indiana in the fall of 1995 (Schnase & Cunnius, 1995) and a follow-up is planned at the University of Toronto for 1997.

CSCL Design
The design of Computer-Supported Collaborative Learning (CSCL) situations should include positive well-known forms of interaction among participants. A way to deliberately promote productive interactions that enhance the effectiveness of collaborative learning (CL) is the use of collaboration scripts, which describe the structure of CL processes. In recent CSCL research, the collaboration script approach has been widely discussed (Fischer, Mandl, Haake & Kollar, 2007). The main idea of computerized collaboration scripts is to promote productive interactions by designing the environment such that suggestions of different degrees of coercion are made to the collaborating students, engaging them in specific activities that otherwise might not occur (Kollar, Fischer, & Hesse, 2006).

What is Scripting?
Some authors use the term 'scenario', to refer to what is now more commonly called a script or scripting' to refer to the analysis, by the student, of the log file of their own interactions (Zumbach et al., 2002). Others might prefer the definition formulated by Dillenbourg, which differs from the above one: “A collaboration script (O'Donnell & Dansereau, 1992) is a set of instructions regarding to how the group members should interact, how they should collaborate and how they should solve the problem. When a teacher engages students in collaborative learning, he or she usually provides them with global instructions such as "do this task in groups of three". These instructions usually come with implicit expectations with respect to the way students should work together. The teacher's way of grading collaborative work strengthens this implicit contract. A script is a more detailed and more explicit didactic contract between the teacher and the group of students regarding to their mode of collaboration. (Hoppe and Zumbach (2002) call this sort of script ‘orchestration’, while others refer to it as ‘storyboarding’: comment of the author) Regulating collaborative learning is a subtle art. The tutor has to provide prompts or cues without interfering with the social dynamics of the group.

Scripts enhance the effectiveness of collaborative learning activities; scripts integrate these activities within more traditional instructional sessions:

- Scripts enable integration of activities that were often separated: individual, cooperative, collaborative and collective activities.
- Scripts enable integration of co-present activities and computer-mediated activities.
• Scripts often include an important role for the tutor
• Scripts introduce a time frame in distance education where students often lack landmarks for their time management.”(Dillenbourg 2002)

Dillenbourg (2002) describes the syntax of script the following way: “A script is a story or scenario that the students and tutors have to play as actors play a movie script. Most scripts are sequential: students go through a linear sequence of phases. Some scripts are defined in an iterative way, but from the student’s point of view, they are run as a linear sequence.”
Each phase of the script specifies how students should collaborate and solve the problem. This requires five attributes: the task that students have to perform, the composition of the group, the way that the task is distributed within and among groups, the mode of interaction and the timing of the phase. A large number of scripts can be built from the combination of a limited number of components, in the same way that a language is made of words and grammatical rules.

**SCRIPTING DESIGN**
What is the idea behind the script? What are the pedagogical values? Is the script 'playable' by the students? Is the script specific to the content to which it is applied?

The Idea behind the script is related to the pedagogical goal(s) of the learning unit as:
• Concept building
• Deep understanding
• Getting an overview
• Grounding
• Combination of mentioned goals

Different families of scripts have been designed and explored that can be coarsely categorized into macro and micro scripts (Dillenbourg & Hong, 2008; Fischer et al., 2007). **Macro** scripts arrange learning activities by grouping and regrouping learners, distributing (different) resources and access rights, as well as sequencing different learning arrangements, e.g., intertwining classroom, individual and collaborative learning phases. Macro scripts organize groups and sequences of learning arrangements to bridge between formal and informal education, to reduce process losses of coordination in groups of learners, and to raise specific expectations and awareness of the specific learning sequences and arrangements. **Micro** scripts support collaborative learning by specifying and distributing roles and activities within groups of learners. Micro scripts are typically realized through structuring the communication interface, e.g., through prompts such as ‘The following aspects are not clear to me yet’ (Weinberger, Ertl, Fischer, & Mandl, 2005; Weinberger, Stegmann, & Fischer, 2010). Micro scripts inform learners what to do and how to engage in specific learning activities. Thereby, micro scripts represent procedural knowledge and heuristics with which learners typically need to engage in specific learning activities, such as constructing sound arguments.
SCRIPT PRINCIPLES
Scripts may build on various underlying principles that could explain why scripts are an effective instructional approach for CSCL. Scripts can take over regulation of the learning process. Scripts can be regarded as an external representation of knowledge that complements a system of knowledge that is distributed among learning partners and the environment. A direct-instruction function of scripts is to make learners engage in activities that are related to knowledge construction, e.g., elaboration of arguments. Scripts can also reduce process losses in complex collaborative learning arrangements by taking over tasks that are not inherently related to learning, e.g., coordination of turn-taking. Moreover, scripts can make learners aware of the different responsibilities within the group and thereby facilitate beneficial motivational states and self-regulation. Overall, scripts can:

1. Regulate learning activities
2. Provide complementary procedural knowledge
3. Provide process-oriented instruction
4. Alleviate coordination
5. Foster awareness

The following are the list of the CSCL script design criteria or components as stated by (Kollar, Fischer, Friedrich W. Hesse, 2006):

1. Specific objectives
2. Specific activities
3. Sequencing of activities
4. Role distribution an
5. Types of representation
DESIGNING A SCRIPT IN CSCL

Designing a script in CSCL entails certain several processes. These processes and criteria must be met in order to fulfill the dream of designing a script in CSCL. And once criteria are fulfilled then there is the tendency of designing a well-structured script in CSCL. Hence, before we embark on listing the criteria, we would like to give an example to using football clubs script relating it to script design in CSCL.

Basically in a football club script the manager is given certain objective by the club owner to the manager, he/she to meet this certain objective which might be to win the league, qualify for the champions league or not relegate to the second division. This same objective is similarly passed on by the manager to the coaches in the club, while the coaches set-up an activity under the guidance of the manager to attain or achieve the main objective. This activities may include the following the amount of days that would be used on the training ground, amount of time for each training, tactics of play, formation of play, aerobics e.t.c. Each of this activities set-up by the coach under the supervision of the manager and then arranged in an order of preference and when it should be performed. Furthermore, the manager share this activities among is coaching crew where each coach obtain a position which he/she is allotted according to their expertise e.g. training on tactic, formation of play, aerobics, athletic e.t.c. Finally, the type of training that would be done by the players.

The following are the list of the CSCL script design criteria or components as stated by (Kollar, Fischer, Friedrich W. Hesse, 2006):

1. Specific objectives
2. Specific activities
3. Sequencing of activities
4. Role distribution
5. Types of representation

Firstly, collaborative script pursue specific objectives (Kollar et. al, 2006) due to the being objective specific oriented (Schank & Abelson 1977, as cited in Kollar et. al, 2006) scripts enhance both understanding and recall (on an individual level; e.g., Nuthall, 2000) and promote the coordination of activities in a particular situation (on a group level). Therefore, collaboration scripts are goal-oriented in the sense that specific approaches help learners engage in smooth collaboration processes and reach specific (learning) objectives (Kollar et. al, 2006). This could be related to the example given above about the football club script which indicates specific objective (goal) that the club owner stated to the manager he wants the club to achieve. This specific objectives is goal-oriented and would help club members to engage in smooth collaborative process.

Secondly, collaboration scripts engage individuals in specific activities (Kollar et. al, 2006). The football club script activities includes days of training, time of training, tactics of play, formation of play, aerobics e.t.c. While in collaboration script approaches, such activities might be summarizing, questioning or explaining (Kollar et. al, 2006). Hence, some scripts provide learners with a lot of freedom as to how to perform a specific activity, others do not (Kollar et. al, 2006). Therefore, activities should, however, be in accordance with the predefined
objective of the script, regardless of whether they are broken down into scripted substeps or whether there are constraints on how the activities can be performed (Kollar et. al, 2006).

Thirdly, looking at the football club script we would notice an order of preference and what time or moment an activity should be performed. Therefore, in collaboration script the sequence in the script specifies which activities learners should perform and also when they should perform them (Kollar et. al, 2006). Furthermore, collaboration scripts also specify or imply which activities collaborators should perform and in what order, for example, first reading a text and then summarizing it (see O'Donnell & Dansereau, 1992, as cited in Kollar et. al, 2006).

Fourthly, form the football club script there is a distribution of roles among coaching crews in accordance to their expertise for example tactician to the tactic role, exercise or fitness to the aerobics role and so on. While on the other hand, according to (Kollar et. al, 2006) collaboration scripts specify and distribute roles among the collaborating partners, for example, an explainer and a commentator role. Furthermore, role distribution in collaboration helps support the collaborating partners in approaching the task from multiple perspectives. This, in the long run, helps learners consider problems from various viewpoints (Spiro, Feltovich, Jacobson, & Coulson, 1991 as cited in Kollar et. al, 2006) and reduces the danger of acquiring inert knowledge (Renkl, Mandl, & Gruber, 1996, as cited in Kollar et. al, 2006). Moreover, collaboration scripts role distribution is not always made explicit because most times the activities that one participant is supposed to conduct define his or her role without explicitly naming this role (Kollar et. al, 2006).

Fifthly, scripts can vary in the type of representation through which specific instructions presented to the learners (Kollar et. al, 2006). Collaboration scripts at the beginning depicts external presentations that are presented textually (e.g., King, 1998, as cited in Kollar et. al, 2006), as graphical representation (Pfister, & Muhlpfordt, 2002, as cited in Kollar et. al, 2006), or orally (e.g., Palincsar & Brown, 1984, as cited in Kollar et. al, 2006). Therefore, different representations have differential effects on learning, which may, in the long run, interact with learner characteristics (e.g., Mayer, 2001; Plass, Chun, Mayer, & Leutner, 1998, as cited in Kollar et. al, 2006).

Succinctly, in designing a well-structured CSCL script the above mentioned criteria and components must be meant. In other words, there must be a specific objectives that is goal-oriented which is the learning objectives, there must be a clearly alighted activities that would be done which would be in line with the learning objectives, and the availability of activity’s sequencing which is the order of preference of activities at what time or moment an activity should be performed. Furthermore, there should be distribution of roles in an activity given to collaborator. Lastly, there should be a type of representation through which instructions are given to learners. Another important thing to remember when designing CSCL script in a learner's community (Kollar et. al., 2006), it should be designed to guarantee that individuals can fruitfully participate in these practices by supporting participation in group activities on the one hand and enhancing individual cognitive processes on the other.

In the nutshell, well-designed collaboration scripts may be able to support both individual and group processes simultaneously but there is a danger of providing learners with too much instruction and the wrong instruction (Kollar et. al., 2006) which (Dillenbourg, 2002 as
cited in Kollar et. al, 2006 ) called “Over-scripting” and might prove more detrimental for some learners than for others.

Effect of script in CSCL

CSCL scripts are considered an effective means of facilitating specific interaction patterns in computer-supported collaborative learning situations (Fischer, Kollar Mandl, & Haake, 2007). External scripts are, however, ill defined in terms of how their effects unfold in collaborative learning. Reducing process losses and inducing specific cognitive activities related to individual knowledge acquisition are two major functions of scripts. If scripts relieve learners of vital collaborative learning activities they might interfere with the social dynamics of the group and even impede learning – a situation known as over-scripting (Dillenbourg, 2002). Scripts might also provide too little help for some students or groups, which could be called under-scripting. Therefore, there is a need to strike an optimal balance between internal and external scripts. One of the major issues in scripting is thus how scripts can facilitate self-regulated learning and which collaborative and cognitive activities the actual human agents in learning and teaching processes in authentic classroom contexts are meant to take over when interpreting an external script and when following script suggestions.

However, it is important to keep in mind that scripts may also result in negative motivational effects. For example, advanced learners may already have functioning internal scripts, and they do not like it when external scripts “override” and do not leave any space for freedom. Different types of scripts may have different effects on different aspects, e.g., a peer-review script (which is transactively scripted discussions) aims to facilitate conflict-oriented consensus-building, and it was found that such script has a positive effect on increasing transactivity of learners’ discussions. However, the peer-review script made the task itself more challenging, and reduced the overall performance in the CSCL. On the other hand, epistemic scripts can increase task performance, but at the same time they can reduce transactivity of learners’ discussions (Weinberger, 2011).

For Kollar, Fischer, and Hesse (2006) external script refers to the pedagogical scenario that students are asked to play, while the term internal script describes the mental representation that students construct of the external script. (Dillenbourg and Jermann, in press).

- The external script is the storyboard to be used during a training session.
- The internal script refers to mental structures, that may have existed before the training session (e.g. "how to negotiate a conclusion with a peer learner"). They will continue to exist after the training session, maybe in adapted form.

An external script can become a pedagogical objective by itself when the goal is that they learn for reuse in future situations. The other way round, an external script can just be an instructional method (strategy) and in this case it relies on internal script to play well. Scripts are more effective once internalised, because they are more accessible and a smaller load to working memory capacity than external scripts.

Scripts may also induce specific activities by shaping learners’ expectations of what is going to happen in the collaborative phase. Learners expecting to engage in specific activities (e.g. giving explanations) have been found to acquire more knowledge individually
than learners who do not (Renkl, 1997). Making the collaborative scenario more transparent through scripts may also alter the motivational configuration of the learning group. For instance, scripts explaining that all group members are required to participate similarly may reduce social loafing and sucker effects (Kerr, 1983; Latane, Williams, & Harkins, 1979). Scripts may also clarify how specific activities may eventually lead to desired outcomes and thus increase learners’ motivation (Weinberger & Fischer, 2004).

CONCLUSION AND DISCUSSION
It is evident, that scripted collaboration does not happen without problems and challenges. Different groups will act differently regardless of the same instructional interventions and environments. Therefore, the question arises whether scripts allow enough freedom for the group members to choose the best way for them as a group to collaborate and learn together. We should consider that scripts may already be operating in the learners’ mind(s) or in the learning environment (internal scripts & external scripts; see Kollar, Fischer, & Slotta, 2005).

Learners have learned particular interaction patterns in everyday situations or in educational situations, which they try to transfer to, e.g. collaborative learning situations. However, learners might be unfamiliar with collaborative learning situations, and therefore, may fail to use skills and knowledge, which they already possess, in daily situations that enable them to collaborate. However, the focus is on how scripts can be designed not to substitute, but to facilitate discourse and cognitive activities related to individual knowledge acquisition. There is a need to investigate the interaction of different script components that may be adapted to the already existing internal scripts. Internal scripts can play a crucial role, i.e., when using scripts for example, in group learning, using the same guideline several times in learning scenarios may encourage learners to internalize it as a script. And, after a time, this internalized script may be able to support learners. Also, while one can design sequences of events or activities to be used as scripts, it is important to remember that their use will depend on how well they are learned as scripts. Therefore, one of the most crucial questions here is how external scripts can gradually be replaced by individual self-regulation.

A highly scripted activity implies a high level of external organisation and a lower level of self and co-organisation. When the CSCL activity has a low level of external regulation, the students’ requires a higher level of self and group organisation. CSCL approaches could then imply a high transactive cost in terms of organization that could reduce the time and efforts the students could devote to the knowledge construction and convergence process.
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CHALLENGES AND ALTERNATIVES FOR GOOD PERFORMANCE ON SCRIPTING IN COMPUTER SUPPORTED COLLABORATIVE LEARNING

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Abstract The article starts with theoretical basis of scripting in CSCL (Computer Supported Collaborative Learning), proceeds with a brief description of its components and structural classifications, which are followed by a presentation of a successful case study, where CSCL scripting has been implemented. Learning scripts are defined as activity programs that are aimed at fostering individual learning in collaborative environments with technological tools as supportive facilitators. Collaboration is positioned as a complex and manifold activity that needs some kind of external supervision or management. CSCL Scripts are believed to be promising tools to perform such management. Characteristics of a successful script include prompts that facilitate argumentative abilities, ways of dealing with misconceptions, reflexions on prior knowledge and skills, etc. Several examples of CSCL scripts are described with more details, and main challenges in CSCL are mentioned. Negative effects from scripting are also highlighted (namely, interfering with ‘natural’ interactions, ‘natural’ problem-solving processes, and increase of cognitive load, as well as didactisation of interactions, and goalless interactions), alongside with possible solution to those.

Keywords: scripting, educational scripts, collaboration, scripted collaboration, CSCL, computer supported learning, computer supported collaboration

1. INTRODUCTION

During many years, human beings have grouped together trying to achieve certain goals or ideals. Through interactions, which require pursuing common goals, relationships are established that in great extent hold a group together around specific purposes, for example for achieving certain objectives in a learning process. In this sense, through the different learning methodologies we can talk about collaborative learning, which has its beginnings in the 1970s, but the majority of theoretical studies on the subject date from the 1980s (Slavin, 1980). Through a collaborative learning, it is achieved to provide spaces, in which an individual can develop individual and group skills from the discussion between learners at the time of interacting, exchanging ideas, exploring new concepts and expanding the information that each one has about a specific topic, allowing the learner to achieve his/her learning goals. With the passing of the years and the incursion of technology tools in different environments of learning, Computer-Supported Collaborative Learning - CSCL has emerged. In CSCL the organizational dynamics changes because of the use of the computer as a tool that mediates collaborative learning. Collaborative learning in computer supported learning environments typically means that learners work on tasks together, discussing their individual perspectives via text based medium or videoconferencing, and consequently acquire knowledge (Weinberger et al., 2005). Roschelle, Pea, Gordin & Means (2001) argue that CSCL is leading a huge change in the
institutions, learners, educators and, not to a lesser degree of importance, the instructional design. However, learners do not spontaneously engage in productive epistemic activities and social modes and consequently, fail to achieve the desired learning outcome (Weinberger et al., 2005). During the phase of implementation of CSCL, some problems could occur as little participation of the learners, little argumentative competence, different cultural preferences, motivation, knowledge divergence and coordination of interactions. The challenge is the lack of transactivity, where the learners take enough time to consider the arguments of other classmates, before expressing their opinions (Weinberger, 2011). The most recent research talks about CSCL scripting, which provides specific instructions during the learning process. A script has a sequence of activities that the learners and the tutor follow, which can be designed to regulate the activities of learners (Weinberger et al., 2005). Then the success in the process of learning through a computer could depend on a good design in CSCL scripting.

In this article two types of scripts are explored: the macro and micro scripts (Dillenbourg & Hong, 2008; Fischer et al., 2007). A macro script organizes learning activities by groups and distributes resources and sequences of learning arrangements, in order to bridge between formal and informal education. In micro scripts the collaborative learning is supported by the distribution of roles and activities in learning groups. In the first part of this paper the analysis of a case study was made, in which CSCL was implemented. However, some CSCL scripting cases could not work properly and present some negative aspects. In this sense, this article identifies some of the problems that could occur during the development and implementation of a CSCL scripting. The reader will have also the opportunity to think through possible solutions expressed in it.

2. Theoretical basis of CSCL Scripting

2.1 CSCL Scripting

Script was defined as “activity program that aims to facilitate collaborative learning by specifying activities in collaborative settings, eventually sequencing these activities and assigning the activities to individual learners” (Weinberger et al., 2005). Dillenbourg (2002) identified that the activity program in script specifying how students should form groups, interact, collaborate and solve problem.

Referred to the above definition, script is essential in collaborative learning as it describes specific instructions that help learners in group to carry out a specific shared task and usually prompts or scaffolds the learners on how to perform the tasks from initial step of process to the outcomes. Introduction of technology in Education has added new features on how the face to face collaborative learning works and scripts design where the use of computers started to support collaboration whence comes the term Computer Supported Collaborative Learning (CSCL). Dillenbourg (2002) discovered that in CSCL, the script is exemplified often in the interface of learning environment.

(Edutech wiki, 2009, Learning environment, par. 1) identified that learning environment conceptually refers to the whole range of components and activities within which learning happens while technically learning environment relies on computer-supported systems such as a learning management system, a combination of various educational technologies,
virtual environments. (Edutech wiki, 2009, Learning environment, par. 2) outlined seven components of a learning environment which are (1) teacher component (guidance, instructions and design), (2) Monitor component (insures that something is learned), (3) fellow learners component (collaboration), (4) learning material (what has to be learned), (5) external information sources (additional knowledge), (6) tools (to produce things), (7) school (curriculum and student administration)

The design of CSCL script we have today is the results of many evolutions and generations in education and technologies. Current technology, learning theories, pedagogical models, knowledge construction, problem solving, participation, coordination activities and individual inputs are very important in CSCL and should be taken into consideration when designing CSCL scripts. Regular innovations and creativities in fields of technology give new functions and easier means of communications and documents sharing, editing, storing, managing and commenting as well Educators have to update their theories to fit today’s technology. CSCL Scripting is defined as a set of specific instructions facilitating group learning to perform shared task in online environments, specify, sequence and assign roles and activities to collaborators (Weinberger, Stegmann, & Fishier, 2010) or on computer screen environments with the help of specific software

2. CHARACTERISTICS OF CSCL SCRIPTING

Concluding from empirical research, successful CSCL scripts share a number of characteristics. They are as follows, however, not all characteristics can be present in one script equally.

How to argue, question, explain and comment in CSCL environments (Weinberger et al., 2010; Kollar, Fishier, & Hesse, 2006).
Type of computer software which mediates the communication of collaborators and coordination between collaborators (Weinberger et al., 2005; Kollar et al., 2006).
How to engage students in meaningful learning activities together such as argumentative of elaboration of the learning materials (Weinberger et al., 2010; Kollar et al., 2006).
How prior knowledge is used within a group (Weinberger et al., 2010).
How to distribute content based on roles and activities (Weinberger et al., 2010).
How to deal with particular misconceptions of individual group members (Weinberger et al., 2010).
How to support learners in solving complex problem and engage them in specific argumentative activities as well as to acquire individual domain specific and domain in general knowledge (Weinberger et al., 2010).
How to interact and facilitate learning outcomes beyond ones can be reached without scripts (Weinberger et al., 2010).
How to input based on specifics tasks of member’s role in group.
How to facilitate, guide, prompt and scaffold individual learners as well as groups (Weinberger et al., 2010; Kollar et al., 2006).
How technological tools motivate learners (Weinberger et al., 2010).
What are affordances of technological tools in use?
2. 3. Types / Classification of Scripting

Scripts can be roughly divided into two categories. A macro script is defined by (Dillenbourg & Tchounikine, 2007) as a pedagogical model that aims at producing desired interactions. It can include individual phases, collaborative phases and collective phases, and activity in each phase may last for several weeks.

A micro script is dialogue model that aims at raising argumentative. Example given shows that a micro-script scaffolds the interaction process where a student brings an argument, then script prompts his or her peer to state a counter-argument (Dillenbourg & Tchounikine, 2007).

2. 4. Examples of CSCL Scripting

Based on nature of tasks, learning theories, group members (e.g., number of participants, their locations, knowledge, learning strategies, task distribution, work phases, and interest, input, etc.), resources, communication tools (e.g., e-mail, chat, etc.), how learners work on given learning tasks and interactions among them, there are some CSCL scripts that were designed and used in academic tasks as the Grid script, the ArgueGraph script, the UniverSanté script, the MagicBook script, the courseware Design studio script, Problem-based script, Reciprocal teaching script, Jigsaw script (Dillenbourg, 2002), Argumentative script (Weinberger et al., 2010), Epistemic script and Social script (Weinberger et al., 2005), among others.

2. 5. Components of CSCL Scripting

Based on the works of Kobbe, Weinberger, Dillenbourg, Harrer, Hämäläinen, Häkkinen, Fisher (2007), the components of CSCL Scripting are participants, activities, roles, resources and groups, while task distribution, group formation and sequencing are mechanisms. (Edutech wiki, 2009, Learning environment, par.2) outlined seven components of a learning environment (teacher, monitor, fellow learners, learning material, external information sources, tools and School). In this theoretical framework, we know that CSCL offers learning environments where software allow learners and teachers to communicate, comment, share, monitor learning progress, access information and collaborate are used. We recognize that components of CSCL Scripting are not limited to those identified by Kobbe et al., (2007) but together with those of learning environments.

2. 6. Implementation CSCL Scripting and Successful Case Study

First and most important thing helping students to implement and succeed in scripted CSCL is how teachers and students understanding script and technology to use in performing the tasks. The second regards how the students are engaged in the tasks, knowledge about concepts, how they interact and how they want to create knowledge.

Based on expertise in learning and educational technology of teachers, Master and Doctoral students of University of Oulu (Finland), Learning and Educational Technology
Research Unit (LET), University of Saarland (Germany), and University of Turku (Finland) are good examples and successful case studies where implementation of CSCL script have been observed. Since autumn 2012, every autumn semester, Master and / or Doctoral Students from two or all above universities have joint course named CSCL with aim at deepening in CSCL method and producing article at the end of the course. Collaborators are located in different universities and countries. The course has five phases (e.g., orientation phase, individual phase, intermediate stopping points phase, collaborative phase and elaborative phase) but the activity program (script) of writing article has two phases among theme: individual phase, collaborative phase (wiki Oulu, 2103, Computer Supported Collaborative Learning 2013, Structure of the course, par.1). Aims, instructions and learning materials of each phase are available in wiki before starting course and students implement this script developed by those universities to write article in which we can call “writing article CSCL script” because of its purpose. Our interest here is in two phases of writing article.

Individual phase helps the students to understand current state of the CSCL method and prepares the students to enter in collaborative phase. Many activities are organised in this phase (e.g., Teachers organized the CSCL themes, facilitate, guide and give feedback students, students write a manuscript of each theme and publish it in wiki, commenting manuscripts of other students, etc. Collaborative phase, in small groups, the students deepen their knowledge in one of the themes of individual phase and write an article according to the academic standards.

In individual phase and collaborative phase, technology is a friend of the students. Different communication media (e.g., Facebook, Twitter, LinkedIn, whatsapp, viber, e-mail, messaging, Skype, Adobe Connect, etc.) are used for meetings, discussions and other communications as the students are located in different areas. Wiki is used by every student in individual phase to publish manuscripts of each theme, comments from colleagues and feedback from teachers. Google docs /Drive, Microsoft SkyDrive and Dropbox are used in different services according to group members. Google docs /Drive and Microsoft SkyDrive offer both presentation (document spreadsheet, survey tools, cloud storage) and synchronization, as well as e-mail services associated to them. They have been become solutions for collaborative learning as participants don’t need to use different accounts in collaboration activities. Dropbox offers only cloud storage and synchronization and can be used in associations of other software in collaborative learning. With only gmail account for Google docs /Drive and outlook or live account for Microsoft SkyDrive, the participants enjoy the use of different tools mentioned above. In addition Google docs /Drive allows the collaborators to comment on ones’ ideas, editing file, chat, video and audio calling simultaneously in asynchronous or synchronous ways and get notifications if collaborators made changes or left comments on shared file while Microsoft SkyDrive doesn’t have. Google docs /Drive, Microsoft SkyDrive and Dropbox allow collaborators to share uploaded file as web link to any participant or anyone else through different communication media (e.g., Facebook, Twitter, LinkedIn, whatsapp, viber, skype, email, messaging, wiki, etc.).

3. Description of the main problems of CSCL Scripting

Having in view the aforementioned characteristics, typological and theoretical structural descriptions, it is possible now to have a closer look on practical aspects of script
Our cognition prompts us to think, that two people could perform on a task better, if certain conditions are created. This supposition can be correct in many aspects. The whole idea of collaboration is to create such conditions and thus to enhance participants’ skills or understanding in some area. Areas can be numerous, for example, acquisition of factual knowledge, adaptation of particular skills, development of presentation, decision-making, or problem-solving skills, raising communication abilities etc. However, during any collaboration process participants face a number of barriers, various challenges and obstacle they have to deal with. Collaboration in itself depends on a multitude of personal behavioral and cognitive traits and habits, such as beliefs about the outer circumstances and self-beliefs, various assumptions, cognitive habits, reflexive abilities, and so on. Thus, it can be quite difficult to achieve productive collaboration even face-to-face. Technology is often believed to be a successful solution to some of collaboration challenges. For example, availability of materials, tasks, questions etc. online is usually mentioned as an opportunity for collaborators to work asynchronously, when it is more convenient and comfortable for them. Technological tools are indeed powerful, and they undoubtedly can be used in a much bigger amount of ways than analog tools. However, when technology is added to scripted or unscripted collaboration, it often brings some additional challenges and hindering factors. A few studies have already proven that CSCL requires a lot more dedication, motivation and commitment from participants (Weinberger, 2008, after Scardamalia & Bereiter, 2006).

Metaphorically, technological tools can work as a magnifying glass. Simultaneously, they support some learning activities, such as sharing of resources, pieces of information, various media content, discussions, etc., and also they are likely to allow negative group work effects to take place more often.

“Learners without additional guidance to critically review others’ arguments and construct sound arguments themselves rarely engage in such [extracurricular, any time any place, online, out-of-the-classroom] interactions, instead orienting themselves toward the minimal requirements of a learning task and quickly building false consensus as a result” (Weinberger, 2011, referring to Weinberger, 2008).

Here are the main problems of computerized collaborative scripts, extracted from empirical data:

- Little participation (Weinberger 2011, referring to Weinberger, et al, 2001)
- Little argumentative competence (Weinberger 2011, referring to Kuhn, 1991)
- Cultural differences regarding learning styles and preferences (Weinberger 2011, referring to Weinberger, Clark, Häkkinen, Tamura, & Fischer, 2007)
- Motivationally devastating group effects, e.g. free riding (Weinberger 2011, referring to Renkl, 1997)
- Satisficing (Weinberger 2011, referring to Chinn, O’Donnell, & Jinks, 2000)
- Superficial consensus building (Weinberger 2011, referring to Weinberger, 2008)

Doubts in mutual commitment are very common among students too (Weinberger, 2011). All these obstacles that lie on the way of successful group and individual learning are closely bound with each other, and can interplace one another in the circle of cause and reason if we try to
understand why collaboration failed to work in a particular case. The author of this passage believes, that deeper reasons of such obstacles are found in general behavioral habits, goals and assumptions of an individual, and cannot be overcome only by the means of scripted or unscripted collaboration. Argumentation skills, for example, include skills in critiquing and defending claims, advancing own thinking, and reasoning in discussions with peers (Kuhn & Udell, 2003). These are rather fundamental features of a human mind, and consequently, in debating in general. It is reasonable to think, that these skills need particular attention in any kind of interaction between human beings, and between learners during a learning process in particular. Kuhn and Udall (2003) argue, that aimed extended exercise in thinking and reasoning is beneficial and can be conducted in cognitively rich environments. Given a complicated and disputable question to discuss, learners are able to engage in a discourse, and through “enhanced understanding of discourse goals, and application of effective strategies to meet these goals” (Kuhn & Udell, 2003), they are able to develop their argumentative competence. The researchers noticed, that poor argumentative skills result in supporting own arguments and statements, rather than addressing opponent’s ones.

4. Negative effects of Scripting CSCL and possible solutions

The incursion of technology tools in learning environments has allowed new challenges in education, which is necessary from the point of view of evolution and human intellectual development. Empirical studies about collaborative learning indicate that the effectiveness depends on several conditions such as the composition of the group, size, heterogeneity, age and gender of the participants, the particular features of the assigned work and the media. However, these conditions are multiple and interacting with different types of people, sometimes turns out to be a very complex situation, which in some cases does not allow ensuring the effects of learning (Dillenbourg et al., 1995). On the other hand, there are tools that seek to increase the probability of occurrence of best and productive interactions in a particular group and learning environment, tools which are called the scripts (Dillenbourg et al., 2004). For years scripting collaboration has been implemented as strategy in different learning environments, however the scripting collaboration has some risks or negative effects which are described below (Dillenbourg, 2002):

4.1 Disturbing ‘natural’ interactions

During the collaborative phase, suitable interactions among the group members are important. If there are frequent problems in this interaction, all the collaborative process can negatively be affected. The aim to have a semi-structured interface during the entire learning process is just trying to influence in the ‘natural interactions’ of the group members. According to (Dillenbourg, 2002), he stated that the ArgueGraph works better with the interface, which forces students to select one and only one answer, compared to the interface that allows them to find a natural consensus. In this sense, this risk or negative aspect of scripting collaboration supports very specific interactions in comparison with other scripts, which globally detail the phases and have a high degree of coercion.

Three examples try to summarize how script designs involve disturbing a ‘natural’
collaborative system in such a way that the interactions necessary to maintain/restore collaboration produce the desired learning outcomes (Dillenbourg & Hong, 2008). The first one is based on the learning of the results obtained in each one of the interactions, in which the learners take part, allowing the construction of a shared solution in despite of the certain distributed resources. The second example shows the nature of the ‘split’, deciding in this way the nature of interactions. Interactions are mechanisms for overcoming task splits. The third case indicates that the increment of the collaborative effort can also damage the collaboration (Dillenbourg, 2002). The scripts should be sufficiently flexible to permit the learner to adapt the script to his/her manner of collaboration.

4.2 Disturbing 'natural' problem solving processes

Normally, the complex problems are subdivided in smaller problems for an easy solving. In that way, the script uses during the learning process the segmentation of general tasks into a sequence of activities for its effective development (Dillenbourg, 2002). The aim of this segmentation is, without any doubt, to convert a non-structured task into a clear sequence of activities. Nevertheless, for some apprentices it is difficult to adapt to a type of analytic approach (Fischer et al., 2007). The described above refers to the term ‘Over-scripting’, which is related with the design and negative effects of collaboration scripts (Beers et al., 2005; Karakostas & Demetriadis, 2009; Kollar et al., 2007).

Over-scripting appears to be implicitly defined as a negative learning result when collaboration is scripted, rather than as the specific cognitive or motivational effect of scripts on collaborative processes. Therefore, over-scripting could help researchers to express their concerns regarding that ‘too much script’ has a doubtful value as a theoretical concept to guide inquiry on the effects of collaboration scripts on collaborative knowledge construction (Stegmann et al., 2011). Over-scripting makes the development of tasks impossible and leads that the students’ motivation declines (Dillenbourg, 2002). One of the possible solutions to minimize this risk is the correct structure of the interaction and collaboration process, being achieved through the design and implementation of instructional methodologies, that promote and support collaborative and participatory processes of knowledge construction (Dillenbourg, 1999,2002).

4.3 Increasing cognitive load

Cognitive load is considered as the load generated by performing a particular task imposed on the cognitive system (Paas & van Merriënboer, 1994). According to the analysis of research works done with respect to increasing cognitive load (Schnottz et al., 1999), it was identified that collaborative learning is one of the pedagogical practices that will generate a quite heavy cognitive load. On the other hand, there are mechanisms that also increase cognitive load as the verbalization of thoughts, the construction of a shared understanding and the maintenance of a representation of the other team members (Dillenbourg, 2006). According to (Vygotsky, I., 1978), individual learners have different development capabilities in collaborative situations than when they are working on an individual basis. In CSCL, the need to manage interactions with the other group increased the 'social interaction' load or collaborative load.

During their learning process, learners reflect a cognitive load when they follow processes as understanding, memorizing and running the script. The script can force the
members of a group to interact and to solve problems in a non-natural way, bringing design strategies to be able to collaborate during a process set in the script. Therefore the design of new strategies increases the cognitive load in apprentices (Dillenbourg, 2002).

On the other hand, Dillenbourg, P. & Betrancourt, M. (2006) argued that the reduction of cognitive load can be accomplished through the division of the work. Blaye et al. (1991) indicated that this mutual regulation was increasingly internalized as self-regulation skills.

An example proposed by Dillenbourg, P. & Betrancourt, M. (2006) involved three students who have different roles during a collaborative process. Each student must handle his/her own set of arguments and detect when they are relevant. Whether any student would have to conduct the same reasoning individually, he or she would need to hold several sets of arguments, i.e., checking for each argument produced if there is an existing counter-argument. This recursive self-refutation process is predictable to encourage an upper cognitive load than mutual argumentation.

There are some pedagogical methods for group learning used in the division of work for reducing cognitive load (Dillenbourg, P. & Betrancourt, M., 2006) and during the learning of complex issues, a common collaborative script is to ask them to adopt controversial roles.

4.4 'Didactisation' collaborative interactions

During the process of solving problems in a collaborative learning environment, the risk, that the learners do not get the results that they expected or that they get inappropriate results, could occur. This risk presents situations where learners themselves play the role of teacher - student and sometimes this generates inappropriate knowledge. In a particular learning environment, teachers usually ask questions to learners, but many times the teacher already knows the answer and then he negotiates with the learner to produce new knowledge.

Learners know that these unusual interactions are part of a teaching contract, in which each plays his/her role of actor. The risk occurs when new knowledge is generated erroneously, because learners do not have enough knowledge to respond appropriately to the questions of other learners, that have emerged during the resolution of a problem in a collaborative script. In this sense regular coordination or supervision by the educator could assist and identify some misconceptions generated during the troubleshooting process. CSCL scripting is a very broad and interesting topic and there is still much to explore.

4.5 'Goalless' interactions

Through a common goal, the collaborative learning process can be better structured. The degree, in which learners understand each other, is in part determined by the rules of interaction, which regulates the interactions in the same way as a script of CSCL does. It is also important to determine the goals of the group, where learners will make their best effort, so that the group can reach the common goal (Clark & Brennan, 1991).

Shared goals are often referred to as an important criterion for defining collaboration (Dillenbourg, 1999), but it is a challenge for a teacher to specify the educational goals adopted by learner as their own goals. The risk with the script is that some learner cannot adapt to the shared objectives and cannot manage them properly. A possible solution to this
risk is the initial explanation of the instructions or goals to reach during a learning process, so that they are clear and precise for the learners.

5. Conclusions

Computer-supported collaborative learning (CSCL) has made possible to change the traditional learning schemes. Results obtained from works conducted by some researchers, which are identified throughout this article, show the positive and negative findings that have been obtained when working with this type of pedagogical approach. Likewise, these results indicate us the richness of the interactions and the possibility that has the student to construct knowledge in an active form, being aware of his/her own learning process. In terms of collaborative and interactive aspects of CSCL, the results and the overall processes depend greatly on individual abilities of the participants. Argumentation skills, language skills (in conditions of intercultural learning) and communication skills play the most important role in defining success of collaboration in general, and computer supported collaboration in particular.

To assist in the proper operation of CSCL, scripting can be structured, designed and implemented. This will allow the good performance of CSCL. However, in some cases the implementation of the scripting is not enough and problems arise that interfere with the successful completion of a learning process. Thus, prior to designing any kind of activity of scripting it is necessary to determine contemporary skills of potential collaborators. Only then good results in individual and group learning can be expected. Scripting collaboration has some risks or negative effects as disturbing 'natural' interactions, disturbing 'natural' problem solving processes, increasing cognitive load, 'Didactisation' collaborative interactions and 'Goalless' interactions, which were treated in this article and some possible solutions to these negative effects were indicated. During our investigation and search for solutions to problems and negative effects in CSCL scripting, it was identified that the scripts should be sufficiently flexible to permit the learner to adapt the script to his/her manner of collaboration. Additionally, the correct structure of the interaction and collaboration process, being achieved through the design and implementation of instructional methodologies, promotes and supports collaborative and participatory processes of knowledge construction (Dillenbourg, 1999, 2002). There are also some pedagogical methods for group learning used in the division of work for reducing cognitive load (Dillenbourg, P. & Betrancourt, M., 2006), and during the learning of complex issues a common collaborative script is to ask them to adopt controversial roles. In this sense regular coordination or supervision by the educator could assist and identify some misconceptions generated during the troubleshooting process. CSCL scripting is a very broad and interesting topic and there is still much to explore.

References


SOCIALLY SHARED METACOGNITION AND THE CHALLENGES OF TASK
IN CSCL ENVIRONMENTS

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Abstract In recent research attempts have been made to clarify the role of individual and socially shared metacognition in Computer Supported Collaborative Learning - CSCL contexts and to establish a definition of shared metacognition; but so far there is not a unique concept or term yet. The role of task in computer supported collaborative learning does not seem to be taken enough into account in these studies. This article tries to demonstrate the importance of task in computer supported collaborative learning and socially shared metacognition. Information about how task difficulty effects on group work process and outcome is essential for designing learning situations that help groups build a joint solution for a given task.

Key words: computer-supported collaborative learning, metacognition, socially shared metacognition, task difficulty

1. INTRODUCTION

The usage of pedagogical model of computer supported collaborative learning (CSCL) has increased at various educational levels. Students at schools and universities work as a group to solve a joint task by means of building a solution together. This requires them to monitor and control not only their individual cognitive processes but also their group work, that is to say, metacognition at individual and group levels. In current research, attempts have been made to clarify the role of individual and socially shared metacognition in CSCL context and to define the sharing of metacognition. So far, there is no a clear definition and neither a unique term to define metacognition in collaboration. The aspects of socially shared metacognition and the role of task in computer supported collaborative learning do not seem to be taken enough into account in these studies. This article tries to demonstrate the importance of task in computer supported collaborative learning and socially shared metacognition. Information about how task difficulty affects group work process and outcome is essential for designing learning situations that help groups build a joint solution for a given task. The role of the teacher in appropriately planning and scaffolding the learning in CSCL is also an important factor.

In literature, the intertwined role of cognition and metacognition has been acknowledged (Nelson & Narens, 1994). Although cognition is a known term, the understanding of its meaning can vary considerably among the different sciences. The American Heritage Dictionary of the English Language (2000) defines cognition as “the mental process of knowing, including aspects such as awareness, perception, reasoning, and judgment”. In the learning science, cognition refers more to the task to be done, the knowing how to interpret, perform and monitor the task. It includes mental processes as thinking and memorizing (Livingston, 2007). Metacognition is a complex psychological process and it is defined as “thinking about thinking”, and the regulation of the cognitive processes (Flavell, 1979; Brown, 1987).
Metacognition is the consciousness of one’s own abilities, for example, a child understands that he/she is able to read. By making use of metacognition people can regulate their learning processes. It refers to how the task is understood and how solutions are evaluated and monitored. It can be divided in metacognitive monitoring and metacognitive control (Flavell, 1979). Metacognitive activities refer to the use of information from a cognitive activity or to the control of a cognitive activity (Iiskala, Vauras, Lehtinen and Salonen, 2011).

Separating cognition and metacognition completely is hard because it is not possible for someone to be drawn apart of itself in order to observe one’s own cognitive actions (Veenman, van Hout-Wolters and Afflerbach, 2006). The connections between metacognition and cognition are represented in the model of Nelson and Narens (1990, 1994) showed below:

![Figure 1. Cognitive and metacognitive model by Nelson and Narens (1990,1994)](image)

The model expressed in Figure 1 shows that in control the meta level modifies the object level. Information flowing from the meta-level to the object-level either changes the state of the object-level process or changes the object level to either initiate an action or to continue or cease it. In monitoring, the meta level is informed by the object level. This changes the notion of the model of the meta level situation. That is, during monitoring the meta level uses information about the object level to update the meta level model of what is occurring at the object level (Nelson and Narens, 1990). It is important to remember that metacognition draws on cognition. It is unlikely to have adequate metacognitive knowledge of one’s competencies in a domain without substantial cognitive domain-specific knowledge.

Another inter-related concept to metacognition is self-regulated learning. Self-regulation is an essential process of learning that assists students in managing their thoughts, behaviors and emotions in order to successfully regulate their learning. In self-regulation students are assumed to master such learning skills as goal setting, planning and motivating strategies, regulating emotion and attention, flexibly using learning strategies, being able to self-monitor, seeking help appropriately and being able to self-evaluate (Zumbrunn & Roberts, 2011). Metacognition refers to higher order thinking, which involves active control over the cognitive processes engaged in learning, therefore activities such as planning how to approach a given learning task, monitoring comprehension, and evaluating progress toward the completion of a task are metacognitive in nature (Livingston, 1997). The nature of the
metacognitive monitoring and control processes used during learning is intricate but according to several models of Self-Regulated Learning (SRL), metacognitive monitoring foregoes control (Azevedo, Moos, Johnson and Chauncey, 2010). The interrelation between the concepts of SRL and metacognition is deep because providing students with knowledge and skills on how to self-regulate their learning helps them to self-initiate motivational, behavioral and metacognitive activities in order to control learning (Dignath & Langfeldt, 2008).

2. Socially shared metacognition in collaboration

Literature has largely advocated the concept of collaborative learning and the value of pairing and grouping students for the purpose of academic achievement (Gokhale, 1995, p. 1). Research proves that collaborative learning is more effective in achieving high learning results than individuals working alone (Järvelä, Hurme & Järvenoja, 2011). The efficient usage of metacognitive knowledge and skills is essential for successful learning (Veeneman et al, 2006) not only for individual but also for groups. Currently there is no unique accepted definition of socially shared metacognition and even this title is not used by all researchers, but some exploratory findings and suggestions have been made by means of adapting the ideas of individual metacognition theory into the social context. Some researchers in the field have made serious efforts to construct theories of socially shared metacognition. For example, according to Volet, Vauras and Salonen (2009), socially shared metacognition could be considered as the most inner mode of regulation since it refers to the individual metacognitive process functioning as a social entity, aimed at an objective that is the shared goal of the group in the given task. In other words, socially shared metacognition will take place when students regulate their metacognitive processes in the group level and make this regulation visible to other group members. More recently liskala et al. (2011) argue that socially shared metacognition has the following two functions: one is to facilitate the building of a shared representation of the problem by confirming the consensually reached of an understanding or by activating processes that can lead to it; and the second is to execute control processes, namely to inhibit inappropriate conceptualizations or representations of the problem and to turn attention to others.

2.1. Requirements of collaboration

Speaking of requirements of collaboration, we discuss high-level collaborative processes. The term high-level collaborative processes means the co-construction of meaningful knowledge and understanding in which the members of a group not only share information but are also engaged in representing each other’s mental activities used to process content knowledge (Volet, Summers, & Thurman, 2009). In order to be successful, learners must participate in the construction of joint cognitive products that require shared understanding. The importance of the quality of the interaction and collaboration has been highlighted by many researchers. The quality of social interactions refer to the cognitive content of the discussions, but also to features of the interactions that are metacognitive in nature, such as metacommunicative rules of the interaction, monitoring of the social level cognitive processes, regulative processes
related to the use of external representations of the tasks, and the regulation of collective memory (Iiskala, 2004).

Collaboration is seen as a challenging process that requires not only responsibility and creativity but cognitive, metacognitive, motivational and socio-emotional skills. These elements are referred with the term of self-regulated learning, that is an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the environment. (Pintrich, 2000). While self-regulated learning requires students to regulate the cognitive and metacognitive processes in their learning, activation of both is not enough for successful collaborative learning. As the core element of collaboration is getting shared understanding that could be reached by means of active and focused social interactions, it requires socially shared cognition and metacognition.

3. CHALLENGES IN CSCL AND TASK IN THE PROCESS OF METACOGNITION

Computer-Supported Collaborative Learning (CSCL) is an emerging branch in the interdisciplinary field of learning sciences. It is generally defined as collaborative learning, which is supported by a range of technological devices, platforms or tools (Kumar, Gress, Hadwin & Winne, 2010). CSCL is focused on how collaborative learning supported by technology can enhance peer interaction and work in groups, and how collaboration and technology facilitate sharing and distributing of knowledge and expertise among community members (Lipponen, 2002). CSCL has many variations, and it can be used in different situations, ranging from children to adult learning context. Regardless of situation, CSCL must be carefully designed, considering that the methods used, tools and environments depend on users’ age, group members’ backgrounds and the goal of the task.

As any other learning method, CSCL may have some setbacks. Some of the problems that may occur in CSCL are: little participation, little argumentative competence, cultural differences regarding learning styles and preferences, motivationally devastating group effects (e.g. free riding), satisficing (decision making strategy), superficial consensus building and knowledge divergence (Kreijins, Kirschner & Jochems, 2003). Previous studies show that the effectiveness of collaborative learning depends upon multiple conditions such as the group composition (size, age, gender, heterogeneity) the task features and the communication media (Dillenbourg, 2002). Further, according to Weinberger (2011, 2013) it is not easy for students to realize the full potential of CSCL. Scaffolding and designing learning task that requires transactivity can be used as a tool to help them to benefit more on collaborative work and problem solving. Transactivity is one of the central challenges in CSCL - learners build on each other’s reasoning and statements and achieve a shared understanding (Weinberger, 2011). Peer interaction provides more opportunities for transactivity than teacher-learner interaction, because it is easier to “struggle” about a topic with peers, than with a teacher (Weinberger, 2011). Transactivity can be supported for example by changing roles in the group (Weinberger, 2011).

Previous studies have presented that effective use of CSCL needs strong metacognitive skills in individual and group level. That’s why it is important to understand the metacognitive processes and how it can be supported in CSCL in order to improve the
successful learning outcomes and group level problem solving. One way of sustaining it is by scaffolding (Dillenbourg, 2002). Scaffolding is the support given during the learning process that is tailored to the needs of the student with the intention of helping the student achieve his/her learning goals (Sawyer, 2006). It is the intentional assistance provided so that the learning goal is reached. CSCL environments might provide effective tools for the sharing of task solution and enhancing the scaffolding mechanisms. The main aspects of effective scaffolding refers to fostering good behavior by asking explanations, clarifications, by giving examples and encouraging thinking; and by helping the transition of self- and other-regulation. These features of scaffolding are metacognitive skills that develop (Pifarre and Cobos, 2010). The scaffolding process is guided or assisted by the teacher and the learning process is designed to promote a deeper level of learning. Scaffolding provides possibilities to improve metacognitive skills and therefore it is an important way to support groups’ metacognition and problem solving in CSCL context. When designing the CSCL it is important to pay attention to scaffolding and scripting.

4. Socially shared metacognition and task

Shared knowledge structure supports problem-solving activities and integrates the goals and awareness of solutions relating to those (Iiskala, Vauras, Lehtinen & Salonen, 2010). In joint activities metacognitive experiences may offer important information to the learner and to others, having impact on cognition for the whole group, that is individual and group effect (Efklides, 2006). Most individuals in normal situations, with average intelligence, will make use of metacognitive skills and regulation when facing a challenging cognitive task. Some people are more metacognitive than others, due to the environment or the training received. Those who show more metacognitive skills tend to be more successful in their tasks but it is possible for everyone to learn how to better regulate the cognitive activities (Veenman et al, 2006 and Livingston, 1997).

Group members have to regulate their own learning process and the task to be done, besides regulating their collaborative activities (Saab, van Joolingen and van Hout-Wolters, 2009). There is some evidence that task characteristics and group member's shared intention to solve the task together is essential for group's success (Fransen, Kirschner and Erkens, 2010). The group has to create a shared understanding or a shared mental model of the task (Dillenburg, 2002). The shared mental models are condition for adequate mutual performance monitoring, since members’ performances need to be interpreted within the same shared perspective on team aspects and task aspects, this way all members have to make use of the same knowledge about the team and the task (Fransen et al, 2010).

Task difficulty is an important factor for bringing out the metacognitive process therefore they are related since the first is an instigator of the latter (Iiskala et al, 2011). Due to task difficulty some students fail to use their metacognitive knowledge (Venmann et al 2006). A study on socially shared metacognition of dyads of pupils in collaborative mathematical problem-solving processes by Iiskala et al (2010) shows a clear relationship between problem difficulty and socially shared metacognition. In their study it was noticed that metacognitive skills were activated by senior learners when the tasks were complex but still in the boundaries of their knowledge. The same was not noticed when tasks where easy or extremely
complicated. They concluded that in order to reveal socially shared metacognition in collaborative problem-solving processes, the task should be difficult and demanding. If the task is too easy for students, collaboration never takes place as all of the group members know how to solve a problem themselves. To provoke active interactions task should make students not only use their own knowledge and skills but identify a problem and chose a right strategy how to solve it by working together with the whole group. On the other hand, if the task is too challenging, the students can face problems with task interpretation and lose their motivation.

Fransen, Kirschner and Erkens’ model (2010) demonstrates that task characteristics are independent variables on their framework for testing team effectiveness in collaborative learning. Task characteristics influence the shared mental models and adaptability. In this same model their hypothesis (H2) that task characteristics influence shared mental models was accepted, although the influence was considered to be limited. They found that shared mental models seem to be the most important variable in adequate monitoring and feedback procedures. The model is showed in the picture below in Figure 2.

![Diagram of the model](image)

*Figure 2, Framework for testing team effectiveness in collaborative learning (Fransen, Kirschner and Erkens, 2010)*

Awareness of team and task aspects already in the initial stages of the collaborative work can minimize the effects of the lack of good procedures for mutual performance monitoring. When groups know what to do, how to do and who can do what, the discussions and questioning during collaboration are reduced. This reduction by its turn saves time and has a positive effect on the team work. In order for mutual performance monitoring to occur, it is necessary that team member’s information is shared among the team members and they all must be aware of context conditions, changes in environment, task aspects and goals. It is also important the distribution of sub tasks and roles and also being aware of time restrictions (Fransen et al, 2010).
5. Discussions and Conclusions

The main goal of the article was to better understand socially shared metacognition to demonstrate the importance of task in computer supported collaborative learning and socially shared metacognition. Toward this goal the article examined the process of metacognition from the individual and group perspectives. The role of task, especially regarding its difficulty, was explored related to socially shared metacognition. The influence of task difficulty is a neglected aspect of socially shared metacognition research. Socially shared metacognition will take place when students regulate their metacognitive processes in the group level and make this regulation visible to other group members (Volet, Vauras, et al., 2009).

The importance of the quality of the interaction and collaboration has been highlighted by many researchers. Janssen and his colleagues’ (2012) study shows that in collaborative learning group members put more efforts in regulating task–related activities than social ones. Their study also showed that in asynchronous learning environment, almost fifty per cent of the messages exchanged among students during the process was task related. The messages were about planning the task, checking the progress or asking questions about the task at hand. In addition to focusing on the task related communication, the group should also pay attention to the features of the interactions that are metacognitive in nature, such as metacommunicative rules of the interaction, monitoring of the social level cognitive processes, regulative processes related to the use of external representations of the tasks, and the regulation of collective memory (Iiskala, 2004). The way groups regulate the task may also be affected by the teacher communication with students about their deadlines, strategies and task progress (Janssen et al, 2012).

Understanding the role of metacognitive processes is essential for designing the CSCL and supporting the groups’ problem solving. As metacognition is the consciousness of one’s own abilities, by making use of metacognition one can regulate a group’s learning processes. Skillful learners also use both, metacognitive knowledge and metacognitive skills in their learning. If the task is difficult, group members are able to monitor and control their own learning processes. By making their individual thinking visible to the others it is possible for a more knowledgeable peer or a tutor to scaffold his own group. One way of scaffolding the process is by using scripting in designing CSCL. By designing CSCL carefully and improving and utilizing students metacognitive and self-regulation skills as well as group shared metacognition learning, the outcomes can be improved. Students need to regulate their learning processes, cognitive, metacognitive and social processes on the individual and group level. It is important to notice though that different kind of support will affect the regulation in a different way (Saab et al, 2012). For further research, it would be essential to examine task difficulty and socially shared metacognition in learning contexts and also in CSCL environments. In classrooms, the teaching-learning process is a complex social situation involving multiple participants, each with their own intentions and interpretations that can influence one another’s knowledge, opinions and values (Iiskala, 2004). The authenticity of the task and learning situation in classrooms is assumed to be an important factor that can facilitate higher order learning (Laru & Järvelä, 2004). When students and teachers are involved in shared tasks, with shared responsibility in
regulating learning and also when the tasks take place with appropriate scaffolding, students develop realistic self-regulation processes and products (Hadwin, Wozney, & Pontin, 2005). When planning CSCL activities, tools or environments it is important to take into consideration the role of task difficulty, scaffolding, and scripting so that collaboration can really take place because one part is not well planned or not taken into account, real collaboration will not occur due to the fact that the processes cannot be fully separated.

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How to Improve Socially Shared Metacognition During Problem-Solving in CSCL?

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Abstract Recent research on computer supported collaborative learning (CSCL) has identified shared metacognition as an important aspect of collaboration. Rooted in the individual metacognitive theories, socially shared metacognition appears in collaborative learning situations, especially during problem-solving. Although there is a growing number of studies focusing on the conditions for socially shared metacognition, there is a lack of research about pedagogical scripts that would support shared metacognition. The aim of this paper is to review the literature on socially shared metacognition and offer an example of a script that is designed to foster shared metacognition. The article offers a practical solution that future script designers and computer-supported collaboration researchers can benefit from.

Key words: computer-supported collaborative learning (CSCL), socially shared metacognition, scripts

INTRODUCTION

Computer-supported collaborative learning (CSCL) has received a lot of attention in various research fields during the last 15 years. CSCL systems, at their best, provide classroom-like environments where many of the classic classroom resources and activities (such as shared workspaces, online presentations, lecture notes, evaluation scores, and so on) are offered by software replicas (Kumar, Gress, Hadwin & Winne, 2010; Soller, 2001). Collaborative interaction in joint problem-solving does not happen by merely providing the necessary tools. According to Hurme, Palonen and Järvelä (2006) it requires individual and socially shared metacognition. Individual metacognition describes a student’s regulation and knowledge of his own cognitive processes (Flavell, 1976) whereas socially shared metacognition requires the regulation to be acknowledged and further developed by other group members (Hurme, Merenluoto & Järvelä, 2009). Current research has shown that socially shared metacognition is significant for effective collaborative interactions (Hurme et al., 2009). These studies, however, do not focus on the role of pedagogical design in supporting shared metacognition in CSCL. Support and guidance are needed in CSCL environments just as in classrooms (Soller, 2001). This article aims to clarify how socially shared metacognition can be supported by scripting.

Networked learning environments are assumed to support communication, collaboration, and comparative thinking between peers (Hurme et al., 2006). They provide tools allowing a group of students to discuss their learning strategies, their understanding, and their shortcomings with each other (Kumar et al., 2010; Soller, 2001). In collaborative learning situations, learning is expected to occur when students make their thinking visible by asking questions, discussing their differing perspectives, and providing explanations (Dillenbourg & Traum, 2006). However, research and field observations have shown contradictory evidence on the occurrence of collaborative interaction (Hurme et al., 2006; Kreijns, Kirschner & Jochems, 2003). CSCL may offer possibilities for interaction regardless of time and place (Weinberger, 2011), and when CSCL environments have an appropriate pedagogical design they may facilitate a natural setting for collaborative interaction and cognitive activities. This in turn may lead to higher-level processes of inquiry-based interaction (Weinberger & Fischer, 2006). However, there are also findings showing that collaboration is not always beneficial for interaction and regulation of group’s work. Hurme, Merenluoto and Järvelä (2009) identified several issues that may hinder shared metacognition and
**effective collaboration** by comparing the quantity and interconnection of specific types of contributions to the group’s result. For example, a group with members only sharing their own cognitive processes, working side-by-side and not answering other people’s comments (lack of transactivity) are expected to be less successful. A lack of conceptual knowledge concerning the given task can also be expected to hinder shared metacognition, as well as if task is experienced as being too difficult or if the participants are not able to phrase their arguments clearly.

**Socially shared metacognition in CSCL**

The recent research on metacognition has focused on the social aspects of metacognition. The concept of socially shared metacognition thus arises from the theories of individual metacognition. Metacognition refers to one’s knowledge about one’s cognitive processes and the products of such. It also entails the active monitoring and regulation of information processing activities in order to achieve some concrete goal (Flavell, 1976). As illustrated in Figure 1, Flavell (1979) subdivides metacognition into two domains: metacognitive monitoring and metacognitive control. The first one is further divided into metacognitive knowledge on the one hand, which involves declarative knowledge about characteristics of the learner, the task and strategies to solve the task, and metacognitive experience on the other, comprising feelings and estimates about success in problem-solving, the task’s difficulty and time/effort demands of the task.

![Figure 1. Two domains of metacognition: monitoring and control (Flavell, 1979).](image)

As far as metacognitive control is concerned, Flavell (1979) relates it to metacognitive skills or procedural knowledge about planning, evaluation, monitoring and resource management that the learner can apply at will. Metacognitive skills refer to the learner’s ability to use procedural knowledge deliberately to control cognition in the process of problem-solving. During the problem-solving process the learner plans the process, selects relevant knowledge and strategies to solve the problem, evaluates the correctness of the answer, monitors the conceptions and definitions, and allocates his efforts and time effectively.

**Socially shared metacognition** in CSCL environment was conceptualized by Hurme, Merenluoto, Salonen and Järvelä (2008) as occurring when a group member’s metacognitive regulation message is acknowledged and further developed by peers. In order for shared metacognition to occur, participants must formulate metacognitive messages with the intent of regulating the task solving process. Group members then give transactional responses to these messages. As socially shared metacognition is a relatively new concept, there is no clear-cut definition that has been accepted by the science community, however, there is a growing body of research focusing on the phenomenon (Hurme et al., 2006; Hurme et al., 2009; Hurme, Merenluoto, Salonen & Järvelä, 2011; Iiskala, Vauras, Lehtinen & Salonen, 2011).
To learn more about socially shared metacognition, research is conducted in computer supported environments, for example, in asynchronous communication systems (online forums). The group members usually work on a joint problem-solving task where researchers analyze the interaction and classify comments into different categories of contribution. This goes back to Hurme et al. (2009), who have indicated that efficiency in collaborative interactions does not only come from sharing solutions, but also from sharing the procedures about how to solve a problem and the argumentation about which approach is the better one to solve the current problem if the prior approach failed.

Hurme, Järvelä and Merenluoto’s (2009) exploratory research on problem-solving collaboration in a computer based environment has shown the significance of socially shared metacognition for effective collaborative interactions. The evidence from their study shows that socially shared metacognition reduces individual feelings of difficulty under certain circumstances. In return, the feeling of difficulty members experience can also influence the extent in which they achieve shared metacognition. If a task is too easy, participants might not express their metacognitive experiences and just solve the task quickly without discussing or achieving shared understanding. If the task is perceived as being too difficult, it might hinder group discussions as members give up without trying (Hurme et al., 2009).

THE ROLE OF MESSAGES IN METACOGNITION

In computer-supported collaborative learning environments collaboration can occur in text-based discussion forums where group members can contribute their ideas and thoughts visibly. Alternatively, some online environments enable recording interactions between students and viewing them afterwords (Kumar et al., 2010). These visualized threads, i.e. messages, allow the students to review their own and their peers’ cognitive processes and see them as objects of thought and reflection (Hurme et al., 2006). According to Hurme et al. (2009), the messages that the group members send to each other involve metacognitive, cognitive, and social messages.

The cognitive and social messages also play important roles in the collaborative learning settings. A cognitive message is defined as a note which relates to the problem-solving, but does not include any explanation. In the mathematical problem-solving process the cognitive message involves analysis, exploration, implementation, and verifying. The social message, on the other hand, contains statements that are not related to the problem, agreement, or disagreement without altercation (Hurme et al., 2009).

Shared metacognitive regulation in CSCL is complex (see e.g. Hurme et al., 2009). Mere exchange of ideas about possible solutions for a task is not sufficient. Socially shared metacognition requires not only ways to finish a task, but also comments, i.e. metacognitive messages, making each learner’s thinking visible. The group members’ messages must contribute “to the joint discussion about how to process a task” (Hurme et al., 2009, p. 503). In addition, in order for the metacognition to be socially shared, the arguments and comments shared by one learner need to be acknowledged by peers in ways that promote co-construction of solution, joint monitoring of solution and developing each other’s ideas further. Moreover, messages regulating metacognition should be connected to previous discussion and they should contain explicit arguments as to why the group should follow the suggested course of action. The purpose of metacognitive messages is to steer the discussion. Messages that have the intention of only presenting ways to solve a task are considered cognitive messages (Hurme et al., 2009).

The quality of interactions during collaboration affects the efficiency of the problem-solving process. Some kinds of interactions are less meaningful to the collaborative problem-solving process than others. For instance, it is considered less meaningful if a group member sends a metacognitive message to activate and encourage other members’ comprehension of the problem, but other group members do not reply to this metacognitive message or only supply a quick answer (Hurme et al., 2009). Otherwise, if the group members can share ideas and procedures about how to solve a problem, and communicate about which approach is accurate when meeting some difficulty, it is helpful and significant for the collaborative problem-solving process. In fact, the metacognitive messages can improve group members’ comprehension if their responses are providing rationale for their ideas and discussion in clear sentences (Hurme et al., 2009).

Metacognitive messages can help in achieving successful collaboration if certain conditions are met. This also depends on the individuals’ prior metacognitive knowledge and skills that can help group members to analyze the task, argue how to solve the problem, contribute to the discussion, and understand what the other participants are suggesting (Hurme et al., 2009). On the other hand, the lack of prior knowledge and skills may hinder group discussions and the problem-solving process and lead to negative emotion and a decrease in motivation.
SUPPORTING SHARED METACOGNITION

As Soller (2001) and Blumenfeld, Marx, Soloway and Krajcik (1996) have pointed out, merely asking students to stay in a CSCL environment does not lead to effective collaborative learning, since there are many possibilities that students struggle about the balance of participation, leadership, understanding, engagement, and encouragement. In order to alleviate this situation, Pifarre and Cobos (2010) illustrated a computer supported collaborative learning system called Knowcat, which is an effective software to support metacognition sharing. Knowcat provides a potential to support students in the development of metacognitive skills. It helps students collaborate through working with shared knowledge objects and to get assistance from each other in order to promote and construct the shared knowledge effectively.

Knowcat is one example of diverse CSCL systems designed to simulate real-world collaborations within software systems. Each system has its unique focus aiming at enhancing a specific aspect and type of collaboration. Unless carefully designed, the systems become passive, merely providing the interface for collaboration but not controlling the interactions in any manner. However, if designed correctly, they play an active role, effectively controlling the interactions (Kumar et al., 2010). CSCL systems are just one example for supporting various aspects of collaboration: collaboration in general and shared metacognition in particular can also be supported by scripting.

CSCL scripts help the participants cope with issues in the coordination of group interactions and engaging in the coherent and joint reasoning. They can be used to structure the social interaction and to guide the participants towards more effective learning and collaboration behavior (Weinberger, 2011). Scripts can be designed for the macro and the micro level. Macro scripts are used to support group forming and to define the conditions in the learning environment. For instance, a module description for a lecture in a study programme can be seen as a macro script. On the other hand, micro scripts are applied on the inner-group level to support interaction processes and group communication. For example, Weinberger, Fischer & Mandl (2001) used a peer-review script distributing different roles among participants in a discussion (analyst, critic) and thus shaping their communication behaviour. Dependent on their role, they were prompted some questions (as part of the micro script) - the critic was asked to point out the aspects that were not clear to him yet and give proposals while the analyst had to reply to these.

Weinberger & Fischer (2006) found that all of these scripts improved the targeted aspects of the interaction. Scripts are fairly efficient in supporting different aspects of the social interaction such as participation, epistemic activity, argument construction, argument sequence and transactivity. However, there are also downsides with using scripts: while improving the intended areas, some scripts negatively affected a different aspect of collaboration. For example, the epistemic script increased the quality of epistemic activity as intended, meaning that the participants concentrated and worked more on the given task and showed less off-topic activity. But at the same time it decreased the quality of argument construction and transactivity. So while improving one dimension, the designer of the script has to be careful not to interfere with other dimensions. In addition, the scripts might interfere with internal scripts the participants already bring with them, which not only impairs participants’ well-elaborated collaborative scripts, but also influences their learning motivation and exploratory thinking (Weinberger, 2011).

One of the ideas behind scripting is to help the participants internalize the processes that the script is supposed to scaffold. If the group members already have internalized scripts, there might be a risk to externalize them. On the other hand, if one of the members does not yet have well-established internal scripts, CSCL scripts should help him to build them up and therefore it is necessary that they interfere with the current processes. Using too much or not enough scripting are referred to as “over-scripting” and “under-scripting”, respectively. An approach to solve this problem is to create adaptive scripts that interfere if necessary but leave the learners alone if not. This can, for instance, be realized with computer support or with an attentive tutor. Otherwise, scripts might dampen the learners motivation by dictating the structure and pace of the learning process. The task of the designer here is to find a trade-off between letting the learner freely decide about how to work on the one hand and helping the group by giving structure on the other (Weinberger, 2011).
DESIGNING SCRIPTS TO SUPPORT SHARED METACOGNITION IN CSCL ENVIRONMENTS

The solution for improving metacognitive thinking in CSCL environments lies in improving the processes that are connecting the metacognitive and the cognitive level, metacognitive monitoring and control (e.g., Nelson & Narens, 1990). In collaborative tasks, these processes can be externalized and group members can comment on them so that the final outcome can be improved. Scripting can structure the interactions and help group members become aware of their cognitive processes and provide occasions to externalize them.

To demonstrate how scripting can be used to support shared metacognition in a CSCL environment, a script of design is presented. It is discussed how and why certain elements are incorporated and how these support shared metacognition. The scripts are presented within a course scenario to show how they can be implemented in practice. In the analysis of the script, the focus is on the parts that are expected to influence the metacognition, not on all aspects of the script.

COURSE SCENARIO

Topic
Research ethics for doctoral students

Learning outcomes
After the course participants are able to:

● define ethical values and principles, know relevant laws and policies
● understand the importance and purpose of ethics in research contexts
● take ethically conscious decisions when designing research
● critically analyze research plans from an ethical point of view

Content
The purpose of this course is to help doctoral students develop their understanding about ethical issues related to their area of research. The course is intended for beginner level doctoral students. During the course they will discuss their current understanding about ethics, consider their application in different scenarios and learn about the theory of ethics.

Implementation
The course is organized online to allow students from different universities to collaborate. Participants will be divided into small groups (3-5 students, depending on the number of participants) and they will be required to complete certain assignments either in the group or individually during the course.

The course will be organized around different cases provided by the instructor based on the Syllabus on Ethics in Research, covering different research related topics. Before the course starts, students receive training (for description see table 1). For each case they receive articles to read individually after which they meet in a synchronous online environment to discuss the case they need to analyze. After the discussion they continue working on the analysis in a synchronous editing tool that allows commenting. The last stage is receiving another group's analysis and giving feedback to it and receiving feedback to their own work.

In what follows, examples of macro and micro scripts of the course are provided. In Table 1, the macroscript of the course (design) is presented. In the second column, a rationale for the different scripting decisions is described. All methods chosen were selected carefully to support shared metacognition based on theoretical ideas presented earlier. In Table 2, the detailed microscript of the course is presented. In the second column, the theoretical ideas presented earlier.
column, an elaborated description of the reasons for the different scripting decisions can be found. All approaches chosen were selected carefully to support shared metacognition based on theoretical ideas presented earlier.

CONCLUSION

Shared metacognition is an important factor that influences the quality of the learning outcome during collaborative activity. In order to increase the usage of shared metacognition, CSCL environments can be seen as a tool that gives an opportunity to improve these processes during a problem-solving task. This improvement can be triggered and optimized by using dedicated methods, such as scripting. A practical example of designing a macro and micro script to support shared metacognition was provided. The scripts aim to improve and practice the use of metacognitive knowledge and experience and thus should, on the long run, also improve metacognitive skills.

As the context of the script a course for doctoral students was chosen who were asked to work on an ethical problem. During scripting, both the structure of metacognition and the opportunities and risks associated with scripts were considered. The micro scripts provide learners with questions about the strategies they apply (metacognitive knowledge) and their feelings and attitudes towards the task (metacognitive experience). The questions have different levels of abstraction: reaching from a question about the learner’s opinion in general, through their approach to the problem to the generation of more approaches. This approach acts as a scaffold for the reasoning processes of members with differing prior knowledge about similar tasks. Feelings of difficulty are also asked for, providing help if the learners perceive the task as being too difficult by exchanging these feelings with their peers. The socially shared aspect of metacognition comes into play because the questions are asked in a way that triggers social interaction, since the participants should talk about these metacognitive processes with their peers.

As far as the risks of scripting were concerned, certain countermeasures were integrated in the script to prevent over- and under-scripting and to overcome differences in prior knowledge and motivation of the learners Over- and under-scripting can be avoided by using adaptive scripts, minimizing the risk of interference with functional internalized scripts of the learners while offering scaffolding where needed (Weinberger, 2011). By assigning the role “prompter” in the case presented above, the participants are given the opportunity to use the prompts when needed. This is a fairly straightforward way to make a script adaptive. Concerning the differences in prior knowledge, two aspects were considered: prior knowledge about shared metacognition and about the topic. For the former the plan includes a training that takes place before the course starts, while the latter is handled by giving the learners articles to read, also before the start of the course, creating some common ground to work with. To keep motivation on a high level, the task difficulty can be adjusted. This way boredom on the one side and excessive demand on the other is avoided. Another issue with scripting is the possibility that a script that is intended to improve one aspect of the interaction worsens another aspect. This can, however, only be tested empirically and thus goes beyond the scope of this article.

For further research an evaluation study is needed to examine the effectivity of the scripts for improving socially shared metacognition and learning outcomes. In addition, a study focusing on how the scripts affect other aspects of the interaction would further elucidate the effects of the proposed design. The scope of future experimental studies can also be to explore how the concept of supporting socially shared metacognition through scripting in a computer-supported learning environment could be implemented in a real-life environment.
Table 1. Description of the methods used to create the macroscript and the goals related to them.

<table>
<thead>
<tr>
<th>Timing</th>
<th>Method</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginning of the course</td>
<td>Training shared metacognition</td>
<td>This is to ensure that participants can learn and understand about the importance of shared metacognition for successful collaboration and learning outcome. The training experience helps them know how to participate and share their metacognition in order to support engaging in the collaborative learning process effectively. As the participants are advanced students, they might have well developed metacognitive skills. However, even in this case reflecting on their own experiences can help raise their awareness to the importance of achieving shared metacognition.</td>
</tr>
<tr>
<td>Individual phase</td>
<td>Prior knowledge</td>
<td>This phase is to ensure that the participants would have similar conceptual knowledge before starting collaboration, because lacking of sufficient domain-specific and conceptual knowledge might hinder socially shared metacognition. Without a similar level of theoretical base metacognitive messages are easily on the responsibility of only the one participant that has the most knowledge of the domain, which in turn might have an effect on the participants’ motivation.</td>
</tr>
<tr>
<td>Before collaboration</td>
<td>Task difficulty</td>
<td>This is to ensure that the task’s difficulty is appropriate. How difficult a task is perceived depends on the prior knowledge and experiences of the participants and their metacognitive skills. However, difficult tasks also give more opportunities for discussion and achieving shared metacognition, which in turn can help the learning process. Research has shown that instances of shared metacognition occurred more often and were longer in duration when solving difficult problems as compared to easy and moderately difficult problems (Liskala et al., 2011).</td>
</tr>
<tr>
<td>During collaboration</td>
<td>Distribution of roles</td>
<td>There is a long tradition in CSCL scripts for assigning roles to participants to influence their communication behaviour (for examples, see: Leland, Fish, &amp; Kraut, 1988; Bhuiyan, Greer, &amp; McCalla, 1994; Dillenbourg, Mendelsohn, &amp;</td>
</tr>
</tbody>
</table>

During collaboration, participants will engage in the collaborative learning process and work on the case analysis, one with successful learning process and outcome which is explained by shared metacognition. In the other example it is shown how the learning process and the outcome suffer from the lack of shared metacognition. After the presentation the participants are asked to reflect how shared metacognition could have been improved in the latter example and how thoughts and feelings can be made visible in a CSCL environment. The participants are also asked to reflect how they have participated in shared metacognition in their previous collaboration experiences and how they could improve their own engagement in metacognition.

Before reading each case, the participants will be assigned a few key articles or legal documents to read as references.

After completing the background reading, participants will be asked to analyze the case provided based on their own understanding of ethics and the materials provided.

In order to pursue doctoral studies, participants are expected to have certain skills. Because all of our participants are advanced students, the collaboration task (i.e. the case to be analyzed) is chosen to be challenging.

After completing the individual reading and before starting to work on the case analysis, participants will receive the description of roles they will have to.

Before the participants start their collaboration phase, they will watch a video presentation demonstrating two examples of collaboration, one with successful learning process and outcome which is explained by shared metacognition. In the other example it is shown how the learning process and the outcome suffer from the lack of shared metacognition. After the presentation the participants are asked to reflect how shared metacognition could have been improved in the latter example and how thoughts and feelings can be made visible in a CSCL environment. The participants are also asked to reflect how they have participated in shared metacognition in their previous collaboration experiences and how they could improve their own engagement in metacognition.

Participants are asked to reflect how they have participated in shared metacognition in their previous collaboration experiences and how they could improve their own engagement in metacognition.
assume from the teacher, and prompt questions to help them achieve that role. Roles can be assigned depending on the topic and the group members. Possible roles are: critic, analyst, prompter, supporter. The roles would be changed during the discussion as decided by the team and they can be used either in synchronous discussions or while writing the analysis through commenting.

Schneider, 1994). Weinberger et al. (2001) for example assigned the roles of analyst and critic, assuming different roles help participants become aware of the significance of all three types of messages (cognitive, metacognitive and social).

The role of the prompter is to observe the problem-solving process and participate in the group conversation by asking for clarifications or further arguments from the other members. The prompter would be able to ensure the adaptability of the prompts by choosing to use only the ones needed in the group to achieve a shared metacognition.

The supporter as a social role, the person assuming this role would support and encourage the others and try to improve the team spirit. Individual learners are different and may have quite different cultural background and therefore they might not realize the importance of social messages or what it takes to actually engage in shared metacognitive regulation.

By not being prompted automatically at certain points of the collaboration, participants are given the task to prompt each other at appropriate moments. This way we ensure not overwriting their internal scripts for collaboration.

<table>
<thead>
<tr>
<th>After collaboratio n</th>
<th>Peer-review</th>
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<tbody>
<tr>
<td>When the analysis is completed, the participants will be assigned another groups’ analysis on the same topic for commenting, so every group will receive feedback from their peers.</td>
<td>By reading another group’s analysis the participants would be faced with a different way of solving the problem, which would help them become more aware of the reasons behind choosing their solution. By writing the feedback together, it will help the groups reflect together on their own processes. The feedback they receive can be incorporated in the metacognitive knowledge of all the participants and can serve as a common ground for creating shared metacognition during the next analysis.</td>
</tr>
</tbody>
</table>
Table 2. Microscripts for enhancing shared metacognition

<table>
<thead>
<tr>
<th>Prompt</th>
<th>The idea behind it</th>
</tr>
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<tbody>
<tr>
<td>What is your opinion? Can you explain it to your collaborators?</td>
<td>This prompt is intended to help the participants clarify his idea of the topic and to help the collaborators understand it.</td>
</tr>
<tr>
<td>What is your approach to solve the problem? Why do you think that is</td>
<td>With these questions the aim is to bring the reasoning process of the participants to the communication.</td>
</tr>
<tr>
<td>a good way?</td>
<td></td>
</tr>
<tr>
<td>Do you know other approaches? Why didn’t you choose them? Which other</td>
<td>Same as the preceding prompt, this one is meant to help the participants retrace each other’s reasoning on a group level. It could also be useful in case the prior knowledge differs among the participants.</td>
</tr>
<tr>
<td>approaches do your collaborators know?</td>
<td></td>
</tr>
<tr>
<td>Did you understand your collaborators’ approaches to the problem? If</td>
<td>This prompt is to encourage the participants to ask detailed questions about the strategies of the others.</td>
</tr>
<tr>
<td>you do not understand, what question do you want to ask?</td>
<td></td>
</tr>
<tr>
<td>How difficult is the task for you? How difficult is it for your</td>
<td>Part of shared metacognition also goes back to metacognitive experience. This prompt could encourage the participants to exchange their experience and motivate each other.</td>
</tr>
<tr>
<td>collaborators?</td>
<td></td>
</tr>
</tbody>
</table>
REFERENCES