Exploration to Model CSCL Scripts based on the Mode of Group Interaction

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This paper aims to investigate modeling scripts based on the mode of group interaction in a computer-supported collaborative learning environment. Based on a literature review, this paper assumes that group interaction and its mode would have strong influence on the online collaborative learning process, and furthermore lead learners to create and share significant knowledge within a group. This paper deals with two different modes of group interaction- distributed and shared interaction. Distributed interaction depends on the external representation of individual knowledge, while shared interaction is concerned with sharing knowledge in group action. In order to facilitate these group interactions, this paper emphasizes the utilization of appropriate CSCL scripts, and then proposes the conceptual framework of CSCL scripts which integrate the existing scripts such as implicit, explicit, internal and external scripts. By means of the model regarding CSCL scripts based on the mode of group interaction, the implications for research on the design of CSCL scripts are explored.

Keywords : modeling CSCL(Computer-Supported Collaborative Learning) scripts, mode of group interaction(distributed and shared interaction)

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Introduction

Collaborative learning depends on the richness and intensity of interactions engaged in by learners (Dillenbourg & Hong, 2008), in other words, it is not always effective unless it is triggered by active interactions. By means of group interaction, learners involved with collaborative learning activities have become aware of different perspectives to the problem and reached a common vision, and then built the shared mental model. Collaborative learning could ultimately be enhanced by providing interactive opportunities with which learners work together and accomplish group or team tasks, especially in an online learning environment.

However, learners rarely make spontaneous interaction (Kobbe et al., 2007), nor do online learning settings, of themselves, guarantee it (Makitalo et al., 2005). Participants in online learning courses often do not know how to learn and interact with one another. In order to minimize this problem, a 'script' has been developed and used to offer specific forms of interactional support such as elaboration, explanation, argumentation, mutual regulation and question asking (Dillenbourg & Hong, 2008; Kobbe et al., 2007; Makitalo et al., 2005). That is, it can directly or indirectly disburden learners from the constitution of their interactions in a collaborative learning process.

As Fisher et al. (2007) mentioned, there are various computer-supported collaborative learning (CSCL) scripts which have been designed and implemented to promote interaction along with different perspectives such as cognitive, computational and educational perspectives. CSCL scripts usually combine individual, group and class-wide phases into one structure and are moderated by a learner or a teacher. Learners may perceive, discover and respond uncertainty of online learning environments through group interaction induced by scripts. Thus far, however, little is known about CSCL scripts according to different forms of group interaction *per se*. It is necessary to further research with respect to CSCL scripts relative to multiple modes of group interaction.

Therefore, this paper aims to investigate the conceptual framework of CSCL scripts based on the mode of group interaction. To clarify and specify the mode of group interaction, we will borrow Stoyanova and Kommers'(2001) notion, namely distributed and shared interaction. In addition, based on a literature review of the existing CSCL scripts such as "internal and external scripts (Carmien et al., 2007)", "epistemic and social scripts (Makitalo, et al, 2005)", "macro and micro scripts (Ayala, 2007; Dillenbourg & Hong, 2008; Dillenbourg & Jermann, 2007; Haake & Pfister, 2007)", "implicit and explicit scripts (Runde, Bromme & Jucks, 2007)," this paper will explore to model CSCL scripts for distributed and shared interaction in a computer-mediated collaboration setting. Some research questions are explored as follows:

1. What are the differences between distributed interaction and shared interaction in terms of the mode of group interaction?
2. Which factors of CSCL scripts have been focused (individual or group) and oriented (content or format)?
3. What are the conceptual frameworks of CSCL scripts based on the mode of group interaction?

Modes of Group Interaction

Group interaction helps members to acquire a common vision or to solve the problems (or tasks) by fostering active participation. By means of group interaction, it is possible to provide opportunities for members to share a common understanding of their goals and related tasks, work habits and patterns, as well as each member's perspectives. The sharing of knowledge among members as well as the building of the group's own knowledge is accomplished interactively through group interaction. This shared process is related to the term "building collaborative knowing (Scardamalia & Bereiter, 1996)". Group members engage in multiple

activities of learning and cooperation such as individual meaning making and collective knowledge building in innumerable ways and modes.

This study adapts the notions of Stoyanova and Kommers'(2001) classification with regard to group interaction. According to Stoyanova and Kommers'(2001) study, group interaction is based on knowledge embodied in artifacts and knowledge in action. Sharing of the externalized knowledge (artifacts) creates a 'distribution interaction', while sharing knowledge in action is a reliable base for developing a 'shared interaction' That is, distributed interaction depends on the external representation of individual knowledge; on the contrary shared interaction is concerned with sharing knowledge in action. A distinction between distributed and shared interaction suggests different levels or modes of group interaction in a computer-supported collaborative learning environment, although people often fails to notice it (Stoyanova & Kommers, 2001). More detailed explanation is as followed.

First of all, distributed interaction focuses on the notion of shared external representation and accessibility of the other members' knowledge. A participant may have different expertise pertaining to a particular task. The difference between individuals' knowledge is a key factor with respect to distributed interaction. Due to different external representations each member has, it is easy for group members to communicate in a non-directive manner. During this natural interaction, members could eventually use each other's ideas, reasoning, explanations, and argumentations so as to construct and reconstruct their knowledge.

A member within distributed interaction solves the given problems independently at first and in turn produces intermediate artifacts embodying his/her ideas or thinking, which are passed to the other members. With a shared external representation in the background more productive interaction could be brought about than without any representation. The external representation has a considerable influence on the collaborative process through distributed interaction. Members cannot stop negotiating of meanings related to different external

representations until they reach a common vision of group tasks. According to this process, all group members can make themselves responsible for representing, creating and internalizing their knowledge (Stoyanova & Kommers, 2001).

Another mode of group interaction is a shared interaction. Shared interaction has been shown that by having members collaborate with peers, they may assign roles, monitor each others' activities, and negotiate meanings regarding group tasks. It makes it possible to guide members to participate in sharing in action and also help them to construct the shared meaning in a group. It requires that the individual common efforts be given in order to facilitate the process of shared interaction. In addition, it is needed to have mutual understanding of group visions and share interpretations of group tasks by synchronous activities. With regard to the collaborative activities, Salomon (1993) adopted the notion of 'interdependence'.

In pursuit of sharing knowledge, it may be very important to make something common through the collaborative action. That is, shared interaction focuses on the similarity within the process of group interaction. In the setting of shared interaction, group members can acquire a common frame of reference in order to communicate their individual perspectives. With this common lens in a group, individual ideas and knowledge will be meaningfully integrated in a common structure of members and be interpreted on the similar frame of reference. Collaborative activities of members are the individual inputs toward shared cognition (Stoyanova & Kommers, 2001).

This paper posits that the process and result of computer-supported collaborative learning would depend on the mode of group interaction. According to what mode of group interaction is developed, different solutions or knowledge concerning group tasks may be created and shared among members. If so, how could different modes of group interaction be unfolded in an online collaborative learning process? How could we attain diverse forms of group interaction which could enhance the computer-supported collaborative learning process?

Types of CSCL Scripts

In an online learning environment, learners often do not get accustomed to communicate with each other because they might be overstrained by dealing with the computer interface, might have less knowledge related to collaboration, or could loaf around cyber space without any fruitful interaction (Dillenbourg & Jermann, 2007). A script has proved to be a beneficial way to promote collaborative learning processes and the individual learning outcomes(Ayala, 2007; Carmien et al., 2007; Dillenbourg & Hong, 2008; Dillenbourg & Jermann, 2007; Haake & Pfister, 2007; Makitalo et al., 2005; Runde, Bromme & Jucks, 2007). To put it in other words, the specification of collaborative learning activities using scripts may improve group performance.
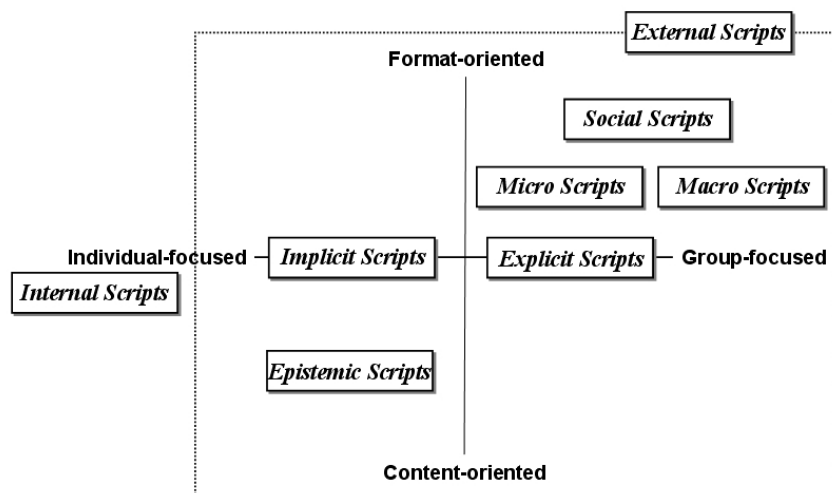

Figure 1. Types of CSCL scripts

Scripts have been applied to foster the computer-supported collaborative learning process between learners for the completion of their common tasks, by means of using specific phases, roles and activities. They mostly enable learners to

engage in productive interactions, for example, asking some kinds of questions, evaluating suggestions, elaborating explanations and justifications, and summarizing the ongoing discourse (Makitalo et al., 2005). The purpose of CSCL scripts is, that is, to "design interaction (Dillenbourg & Hong, 2008, p. 6)". There are various types of CSCL scripts which are classified 'from individual to group focused scripts' and 'from content to format oriented scripts' as Figure 1 illustrates.

Some researchers have postulated diverse notions of CSCL scripts such as internal and external scripts (Carmien et al., 2007), epistemic and social scripts (Makitalo, et al, 2005), macro and micro scripts (Ayala, 2007; Dillenbourg & Hong, 2008; Dillenbourg & Jermann, 2007; Haake & Pfister, 2007), implicit and explicit scripts (Runde, Bromme & Jucks, 2007). First of all, nobody has the same internal script in a group, because internal scripts are innate abilities and skills (Carmien et al., 2007). Individuals think and behave differently with different internal scripts that can be complemented by different external scripts (Carmien et al., 2007). It is needed to regard the interplay of internal and external scripts as a dynamic relationship. Most available scripts are involved in the area of external scripts which could offer specific prescriptions to facilitate the collaborative process.

Makitalo, et al.(2005) also distinguish scripts into what oriented supports for group interaction in an online learning environment. One type is the epistemic script focused on the content-oriented helps for the individual collaborative activities such as explaining, questioning and expert-liking problem-solving behavior, and the other is the social script with which online environments could trigger the emergence of collaboration. The research conducted by Makitalo, et al. (2005) showed that the former made learners seek less information than unscripted group learners because of reducing uncertainty, which resulted in less learning outcomes. On the other hand, the latter, the social script, fostered divergent thinking on the task with beneficial interaction patterns. After all, the forms of group interactions by CSCL scripts are considered important for different learners to engage in the collaborative learning process.

In general, social scripts consist of macro and micro scripts. Macro scripts are pedagogical approaches by modeling an overall sequence of group activities such as paring learners with conflicting opinions, while micro ones are dialogue approaches which can provide support for specific activities such as prompting a learner to respond to the argument of a co-learner with a counter-argument (Dillenbourg & Hong, 2008). Macro scripts usually involves the issues of group interaction regarding questions such as "Who collaborates with whom?", "What is the group's task?", or "What roles are distributed among the learners?", as opposed to micro scripts which usually provide support for detailed interactive processes (Fischer, et al, 2007). Both macro and micro scripts are required to be internalized by learners in an online collaboration setting.

Finally, there is a classification including implicit and explicit scripts. Runde, Bromme, and Jucks (2007) emphasize implicit scripts in contrast with explicit scripts related to group-focused and format-oriented approaches in a direct way. The evidence for the effects of implicit scripts by external representations among members was found (Runde, Bromme, & Jucks, 2007). This finding could be interpreted as a positive aspect of external representation of individual internal scripts in computer-supported collaborative learning settings. Runde, Bromme, and Jucks (2007) point out that there is a danger of explicit scripts which contain too specific prescriptions and hamper natural communication among learners.

This paper will mainly deal with CSCL scripts based on the mode of group interaction- distributed and shared interaction. In order to investigate CSCL scripts facilitating different forms of group interaction, this research integrates the existing CSCL scripts suited to the characteristics of distributed and shared interaction. The main assumption is that distributed interaction might be enhanced by the scripts with regard to representation and accessibility, and shared interaction be triggered by the scripts which structure group interaction.

Modeling CSCL Scripts based on the Mode of Group Interaction

Modeling CSCL Scripts based on Distributed Interaction

Distributed interaction depends on sharing of the externalized knowledge created by the individual representations. That is, it is necessary to produce intermediate artifacts embodying learners' knowledge at first, and then to share these representation resources amongst learners. How could this distributed interaction be facilitated by CSCL scripts? To respond to this question, this paper proposes the conceptual framework of CSCL scripts on the basis of distributed interaction [see Figure 2].
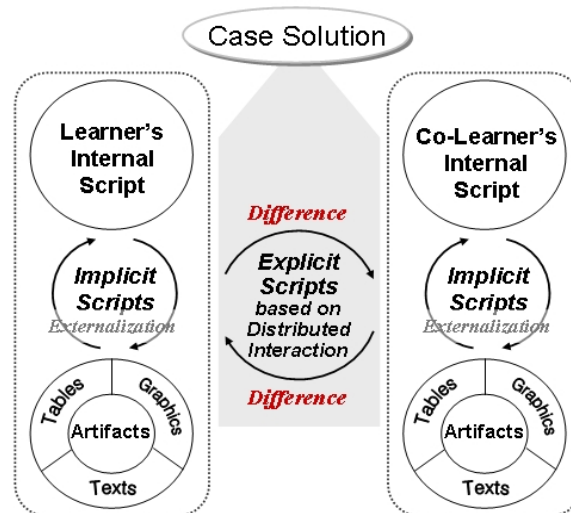

Figure 2. Modeling CSCL scripts based on Distributed Interaction

Distributed interaction is initiated by the externalization of a learner's internal script. Each learner carries on is/her learning activities with the distributed resources (intermediate formats) which are formed by the shared external representation. To transform an internal script an individual holds into the artifacts

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available to access to other learners, it is required to use implicit scripts for externalization. Externalization implies the fact that meaning is embodied in artifacts and sedimented in language (Carmien et al., 2007). An implicit script as a guidance for externalization has to do with facilitating an effective communication of the content in an computer-supported collaborative learning process.

According to Suthers and Hundhausen's (2003) study, collaborative learning processes as well as its outcomes are followed by different formats of representation such as texts, graphics and tables. It is a critical factor which format of artifacts could be chosen in a online learning setting, because a collaborative learning discourse or process depends on the specific formats of representation. For example, if the knowledge is presented and shared in graphics, learners might exchange their knowledge more vividly and diversely than learners using texts or tables. Suthers and Hundhausen (2003) argue that it is important to select the appropriate formats suited to a particular task within distributed interaction.

Depending on the shared external representations between learners, accessibility of collective knowledge could be enhanced and lead to improve the learning effectiveness in a computer-mediated learning process. Learners could continue to negotiate the 'difference' of meanings related to their tasks or problems until they acquire a group solution. By virtue of adopting the difference among learners, CSCL scripts fostering distributed interaction could make a spontaneous and open-ended collaborative learning process in a group. According to this collaborative process, explicit scripts for distributed interaction could make it easy to stimulate different ideas and perspectives between different learners and share individual's personality and knowledge.

It is essential to balance between the implicit scripts for externalization and explicit scripts toward internalization through the process of distributed interaction. CSCL scripts based on distributed interaction could help individual learners to construct and reconstruct individual knowledge and also obtain the group's vision without any coercion. They could function as a tool for creating and sharing

collective knowledge within a group which acknowledge different ideas and viewpoints different learners have. The content and process through distributed interaction might be determined by CSCL scripts for representing individual's knowledge and for sharing the external representations in collaborative learning situations.

Modeling CSCL Scripts based on Shared Interaction

In contrast to distributed interaction which focuses on the individual knowledge depending on external representations, shared interaction stresses the shared knowledge in action. Therefore, it is necessary that CSCL scripts on the basis of shared interaction give primarily opportunities to support all group members with structuring interactive learning activities. CSCL scripts within shared interaction might take into account making appropriate collaboration patterns directly, whereas CSCL scripts integrated by implicit and explicit scripts within distributed interaction might provide learners with supporting the processing of the task content indirectly. From this line of underlying thought, the conceptual framework of CSCL scripts based on shared interaction is suggested as Figure 3 shows.

CSCL scripts in the shared interactive process could regulate how learners interact with each other, for example, how a learner with his/her internal script relates his/her contributions to contributions of his/her co-learners in a collaborative setting. By means of these scripts, learners could define the shared goal, describe the sub-activities associated with the goals, sequence the sub-activities and cluster activities to roles (Carmien et al., 2007). Within the process of shared interaction, the explicit scripts can induce the way or order in which collaborative activities are arranged and presented.

External scripts based on shared interaction aim at encouraging learning processes among learners. Scripting of the interaction during shared interaction is designed so that the roles of participants, actions engaged in, and the sequence of

events, prompt specific cognitive, socio-cognitive, and meta-cognitive processes, thus ensuring that the intended learning takes place (Carmien et al., 2007). CSCL scripts containing too specific prescriptions could disturb the autonomous convergence of a group in an exaggerated manner concerning the so-called "overscripting effects (Weinberger, et al, 2005)" which might result in less learning effectiveness. Therefore much effort has been needed to internalize the CSCL scripts based on shared interaction in which learners depend on the structure of their internal script.
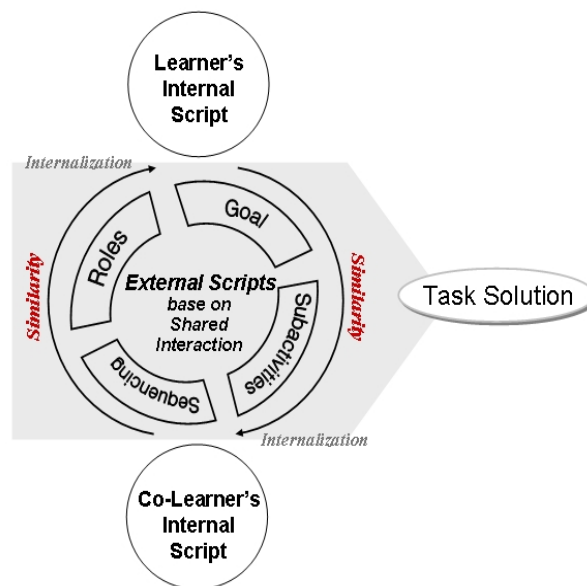

Figure 3. Modeling CSCL scripts based on Shared Interaction

External scripts do not always have to be as constraint-based or prescriptive, rather provide affordances for particular activities to be carried out by an individual without any clear instructions (Carmien et al., 2007). By means of affordances related to shared interaction, desired learning could be induced in a computer-supported collaborative learning environment, and then work out a common task solution. They might resolve contradictions which might arise in the collaborative

discourse or process while acquiring the similarity in the situation of shared interaction. As a consequence, CSCL scripts based on the shared interaction could remain a similar new situation over time to support individuals in accomplishing the task again and again.

CSCL scripts based on shared interaction could contribute significantly to forming task solutions in a group by regulating the sequence and timing of interactive activities; thereby learners might generate appropriate collaborative patterns and reconstruct their own knowledge. Learners could engage in the process of shared interaction guided by CSCL scripts. In order to improve the socio-cultural appropriateness of CSCL scripts within shared interaction, it is necessary that CSCL scripts change according as the situation of shared interaction changes, and be applied to the collaborative learning process.

Conclusions

This paper purports that the design of CSCL scripts take into account the mode of group interaction in itself in order to accomplish a specific task assigned to learners. The better we understand how the collaborative learning process within different forms of group interaction works, the more effective we can design the CSCL scripts. It assumes that group interaction and its mode have strong influence on the collaborative process of making the task solution, and furthermore lead learners to create and share significant knowledge within a group. In order to facilitate group interactions, this paper emphasizes the utilization of appropriate CSCL scripts, and then proposes the conceptual framework of CSCL scripts based on distributed and shared interaction in terms of the mode of group interaction.

This study suggests which modeling of CSCL scripts should be considered, which may offer a particular way in which both a group and its members could construct new dimensions or levels of mutual understanding within distributed and

shared interaction. Distributed interaction is formed by CSCL scripts for the shared external representation and accessibility available to each learner. Shared interaction through CSCL scripts are concerned with sharing knowledge in action. CSCL scripts based on distributed interaction focus on the difference between learners, in contrast to CSCL Scripts based on shared interaction toward the similarity in a group.

In order to investigate CSCL scripts facilitating different forms of group interaction, this paper integrated the existing CSCL scripts suited to the characteristics of distributed and shard interaction. Distributed interaction could be enhanced by implicit scripts with regard to external representation and explicit scripts enhancing accessibility, while shared interaction could be triggered by the interplay between internal and external scripts which structure the collaborative learning process. As mentioned above, it is essential to balance two extreme types of scripts for inducing intended group interaction. The development of distributed interaction should depend on both implicit and explicit scripts. Shared interaction should take into account internal and external scripts simultaneously.

Adopting CSCL scripts based on the mode of group interaction could give new insights into how CSCL scripts should be designed developed for better task accomplishment and thereby better learning. However, further case studies or examples of applying the conceptual frameworks in real learning settings are needed. It is necessary to have an empirical research into modeling CSCL scripts on the basis of the mode of group interaction, especially to investigate and differentiate between extreme scripts of distributed and shared interaction. In addition, with respect to learning effectiveness, it is needed to examine whether CSCL scripts based on the mode of group interaction could do more harm than good or not.

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