



Designing a role structure to engage students in computer-supported collaborative learning



Xiaoqing Gu^{a,*}, Yinjuan Shao^a, Xiaofeng Guo^a, Cher Ping Lim^b

^a East China Normal University, Shanghai, China

^b The Hong Kong Institute of Education, Hong Kong, China

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ABSTRACT

This study investigates the design of a role structure to engage undergraduate students in collaborative knowledge construction. A total of 72 students of an Instructional Design course were divided into 12 small groups, among which six roles of Starter, Supporter, Arguer, Questioner, Challenger, and Timer were assigned respectively. Group discussions of eight learning themes were recorded, which included approximately 1500 lines of messages. Taking group discussion as the unit of analysis, a two-dimensional coding scheme was developed to discover the extent to which the designed role structure facilitated the modeling of the group cognitive processes. The findings suggest that the role structure design supports the students in collaborative problem solving by modeling the joint collaborative activities and group cognitive processes. Therefore, mapping the designed roles of related cognitive components in a group discussion may develop group cognition in a collective problem-solving process.

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1. Introduction

Many learning science researchers have taken an interest in collaborative learning over the last two decades, guided by the belief that students must develop the ability to establish mutual understanding and gain new knowledge through the process of problem-solving in collaboration with their peers (Hogan, 1999; Scardamalia, Bereiter, & Lamon, 1994; Yu, 2004). Effective collaboration requires positive interdependence and individual accountability of each group member (Johnson & Johnson, 1989). However, placing students in groups does not necessarily lead to improved understanding and performance within a collaborative knowledge construction context (Karakostas & Demetriadis, 2011; Weinberger, Reiserer, Ertl, Fischer, & Mandl, 2005). This phenomenon may be due to the lack of a diffusion of engagement in groups and responsibility for the joint tasks (Morris et al., 2010). Effective collaboration requires an environment that promotes positive interdependence and individual accountability, thereby ensuring that all members contribute to the meaning-making process.

In facilitating collaborative learning, computer-supported collaborative learning (CSCL) systems may serve as tools to support the building of shared knowledge and negotiation of such knowledge (Stahl, 2003). To address the issue of interdependence and individual accountability in collaborative learning, role-assigning methods are frequently suggested

as a means of structuring CSCL design (De Wever, Van Keer, Schellens & Valcke, 2009; De Wever, Keer, Schellens, & Valcke, 2010; Schellens, Van Keer, De Wever, & Valcke, 2007; Strijbos & Weinberger, 2010). The underlying assumption is that interdependencies and individual accountability can be promoted and enhanced through the proper division of labor. Therefore, structure design has become a research focus in the field of CSCL (Kapur & Kinzer, 2008), within which the role-structuring process is typically realized by assigning a student with a stated responsibility. Such responsibility consists of multiple activities, thus forming a pattern of acts normally performed by a specific group member (Spada, 2010; Strijbos & De Laat, 2010).

Based on an undergraduate Instructional Design course offered in a Chinese university, the current paper examines how a role structure design models the group cognitive processes of collaborative learning to engage students in this learning process. This course consists of a series of CSCL units and weekly face-to-face classroom sessions. The major challenge faced by tutors in this course is student engagement: not all students are fully engaged in the course activities, especially when the course is delivered using CSCL. Here, roles are assigned to the students to better engage them in group interactions and help them achieve high-quality collaboration. Therefore, the main research question of the current study is as follows: How and to what extent can the designed role structure model the joint cognitive process for the students to engage in CSCL? The sub-research questions are given below.

- How and to what extent do students enact the assigned roles?
- How and to what degree do the designed roles support students in

* Corresponding author at: Department of Educational Information Technology, East China Normal University, 3663 Zhangshan Road North, Shanghai 200062, China. Fax: +86 21 62232838.

E-mail addresses: xqgu@ses.ecnu.edu.cn, guxqecnu@gmail.com (X. Gu).

group cognitive processes?

- How and to what degree do the designed roles model the group cognitive process to engage students in collaborative problem solving?

Although there are a number of studies on role assignment in the CSCL context, most of these are focused on the effects of roles on participation rates (Seo, 2007), interaction patterns (Morris et al., 2010; Strijbos et al., 2004), and knowledge construction levels (Schellens et al., 2007). The current study intends to engage students in a collaborative learning process by designing roles to model the joint cognitive process. This problem has remained a challenge for students when the cognitive process takes place at the group level (Stahl, 2006). Roles are structured and assigned with the specific aim of modeling the group cognitive process so as to condition students to actively participate in the meaning-making process.

2. Literature review

As an emerging topic in CSCL research, the use of roles (i.e., stated functions and responsibilities that guide individual behavior and regulate group interaction) aims to facilitate group learning (Strijbos & De Laat, 2010) by promoting individual accountability and positive interdependence. These objectives constitute the core of collaborative learning. Furthermore, scholars have developed the emerging view of considering groups as information processors in the development of group cognition (Hinsz, Tindale, & Vollrath, 1997; Stahl, 2006). In this approach, interaction among members is the key mediator facilitating the co-construction of shared understanding and the creation of new knowledge as a group. Through this discourse, knowledge or ideas are constructed, negotiated, and created (Lamon, Reeve, & Scaredamalia, 2001). To shift the focus of discourse toward knowledge creation and co-construction, rather than knowledge sharing in a group activity, learners are usually encouraged to produce cognitive artifacts, such as interpreting or reasoning their ideas. This process involves critically reflecting upon the contributions of other group members and building on one another's ideas. However, a new learning approach and high cognitive engagement lead to complexity, which may hinder the development of group cognition. In response, role assignment may reduce such complexity and facilitate group cognition development because, using this approach, learners can maximize their participation based on their assigned roles.

2.1. Roles in participative stance

Studies on group dynamics reveal that “individual accountability” and “positive interdependence” are important factors that ensure the smooth functioning of any group, and therefore, to the principles of the CSCL approach (Forsyth, 1999; Strijbos, Martens, Jochems, & Broers, 2007). Individual accountability refers to the extent to which students are individually accountable for joint tasks or duties, whereas positive interdependence is the degree to which the performance of a single group member depends on the performance of other members. Assigning roles for different group members can improve coordination and promote group cohesion and interdependence (Brush, 1998; De Wever, Schellens, Van Keer, & Valcke, 2008). Research in this area reveals that the positive effects of role assignment foster positive interdependence and individual accountability. These effects include helping students focus on their responsibilities in the group and on the quality of their contributions, thus raising group performance awareness among group members; stimulating individual contributions (Strijbos et al., 2004, 2007); ensuring organized division of tasks, coordination and integration; and alleviating problems related to non-participation or domination of interaction by one group member (Cohen, 1994; Strijbos & De Laat, 2010).

Roles can be classified based on different perspectives, such as functional versus cognitive roles (Palincsar & Herrenkohl, 2002; Strijbos et al., 2007), product versus process roles (Strijbos & De Laat, 2010), and other dimensions, such as group size and efforts invested by the different roles (Pfister & Oehl 2009, Strijbos & Weinberger, 2010).

Functional roles focus on supporting the “doing” of a task by classifying and assigning particular functions, whereas cognitive roles support the “thinking” of the task by classifying and assigning relevant types of cognitive engagement required in performing the designated roles (Morris et al., 2010). Classic functional roles include data collector, recorder/note taker, or editor (Slavin, 1995). For example, in the studies of Strijbos et al. (2004, 2007), the roles of project planner, communicator, editor, and data collector are assigned with task-oriented functions, resulting in improved coordination and overall group efficiency. By contrast, the roles of feedback provider, summarizer, theoretician, and process reflector are typically aimed toward cognitive engagement (De Wever et al., 2010; Schellens et al., 2007).

Roles are originally used to structure group processes, which are mainly product- or process-oriented or the combination of both (Strijbos & De Laat, 2010). Typical examples of product roles are the starter and wrapper, who initiate and summarize the online discussion tasks (Hara, Bonk, & Angeli, 2000), respectively, as well as the explainer and listener who are the ones designated to support the task outcomes (Ertl, Fischer, & Mandl, 2006). On the contrary, process roles are used to manage the task activities; therefore, participants who take such roles often act as project planner, communicator, and task manager (De Laat & Lally, 2005; Strijbos et al., 2004, 2007). More commonly, the combined roles of both process and product orientation can be used to facilitate the online collaboration process, through which participants can remain focused on the issues discussed as they participate and proceed with the tasks (De Wever, Van Keer, Schellens, & Valcke, 2007; Pilkington & Kuminek, 2004; Strijbos et al., 2004, 2007). In general, roles are based on the participative stance of each individual, either in the product or process of collaboration. When taking group cognition as the unit of analysis, the emphasis is on the cognitive process of a group, of which roles are components of the process and are rarely scripted as independent components.

2.2. Roles in the group cognitive process

In an in-depth review of group information processing, Hinsz et al. (1997) suggest that the processes involved in group task performance represents the combination of two domains, namely, individual contributions based on individual participative stance, and the integration of the contributions in the production of group-level outcomes. Damart (2008) has indirectly shown the importance of role structure in group-level cognitive processes. Individual cognitive involvement in a collaborative effort is the basis for group cognition, which integrates individual cognitive processes to produce a collective product, thus implying that better group cognition is achieved if participants are better able to perform the roles meant to cover the functions of a cognitive process. By integrating the concept of “organizing participation” (P506), Damart (2008) has applied a cognitive mapping technique to organize how participants interact in a problem-solving activity. Interaction is a structured process, which entails performing different cognitive roles of exploring thematic areas, identifying actions, assessing actions, prioritizing actions, and choosing actions. However, that study (Damart, 2008) focused on the methods and tools of the collective problem-structuring process and not on group cognition as the unit of analysis.

By distinguishing dialogue from interaction, Wegerif (2013) proposed looking at dialogues from the inside, thus revealing a new window through which the interaction and the group cognitive process can be examined. The internal view (i.e., the group is a dialogic space) assumes that meaning emerges from the interplay of different perspectives. These perspectives have been suggested in more detail by Stahl

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