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Reciprocal Kit Build Concept Map: An Activity Designed to Encourage Learning at Boundary in Collaborative Situation

Lia SADITA*, Tsukasa HIRASHIMA, & Yusuke HAYASHI
Department of Information Engineering, Hiroshima University, Japan
*lia@lel.hiroshima-u.ac.jp

Abstract: In a collaborative situation, learners must actively interact with their peers to have meaningful discourse, not only co-present. Researchers have shown that employing a concept map as a representation tool was useful to construct and maintain group shared knowledge, rather than a dialogue only communication setting. The use of concept map positively affected students' learning outcomes as well as their attitudes. Moreover, prior studies have extended the collaborative concept map activity with individual externalization, concept map sharing and reviewing activity to trigger cognitive change through conflicts. The current study introduces a new extension of collaborative concept mapping activity with Reciprocal Kit Build (RKB). The RKB allows learners in pair to create an individual and collaborative concept map, exchange ideas through reconstruction, and discuss it facilitated by shared and difference maps. Unlike existing studies, our design activity is aimed to promote learning mechanism at boundaries, by boundary-crossing and utilizing boundary objects. This paper explains how the RKB may potentially provoke conceptual changes during collaboration.

Keywords: collaborative learning, concept map, boundary-crossing, boundary objects

1. Introduction

Researches highlight that interaction between learners plays a key role during peer-to-peer collaboration. Scripts, scenarios, or representational tools have been designed to assist students while interacting in a collaborative situation. Productive discussion requires learners' active participation and awareness of each other's knowledge (Fischer & Mandl, 2002). A concept map, which has been popularly used as "external representation" of individual thinking, plays an important role in the sophistication of internal representation. Concept map also can be used to communicate ideas and maintain shared focus during a discussion. Various studies were conducted to employ a concept map for computer-aided collaborative learning (Fischer & Mandl, 2002; Gracia-Moreno, Cerisier, Devauchelle, Gamboa, & Pierrot, 2017). Employing concept map during discourse has positively affected students learning outcomes as well as their attitudes (Gracia-Moreno et al., 2017; van Boxtel, van der Linden, Roelofs, & Erkens, 2002).

Previous works have extended the collaborative concept map activity with the externalization of individual prior knowledge and concept map sharing and reviewing to trigger active inquiry (Basque & Lavoie, 2006; Engelmann & Hesse, 2010; Roschelle & Teasley, 1995). The creation of individual maps before collaboration and knowledge awareness of group members have affected the knowledge acquisition process and results. The individual phase has influenced learners to explain their ideas better during a discourse. The students have elicited more information that is relevant to their uncertainties. Awareness of collaborator's knowledge can reduce miscommunication and help them to collaborate more efficiently (Engelmann & Hesse, 2010). Reviewing other individual maps have also positively influenced the broadness of the collaborative map (Stoyanova & Kommers, 2002). However, the externalization of individual thinking in own private space did not necessarily enable knowledge exchange and elaboration during collaborative construction of a concept map. Learners have faced difficulty to integrate different perspectives over a shared problem (Gracia-Moreno et al., 2017).

To promote productive discussion where individual knowledge is acknowledged and elaborated during concept map sharing and reviewing, we introduce a learning activity at the boundary. Boundaries are socio-cultural differences leading to a discontinuity in action or interaction (Sanne F.

Akkerman & Bakker, 2011). Boundaries are not seen as barriers to learning, but also “spaces” with potential for learning (Sanne F. Akkerman & Bakker, 2011). The boundaries can be crossed by people, or by objects or by interactions between actors of different practices. Boundary crossing refers to the process of “negotiating and combining ingredients from different contexts to achieve hybrid situations” (Engeström, Engeström, & Kärkkäinen, 1995). Objects that cross boundaries are often referred to as boundary objects. Some potential learning mechanisms at boundaries are identification, coordination, reflection, and transformation (S. F. Akkerman, 2011).

Boundary objects can be abstract or concrete things, such as repositories, rules, forms, or maps. A map represented one’s perspective is a type of boundary artifacts used for communication among different community of practices. Moreover, the map components such as nodes or links can also be boundary objects to help students to get started. By providing the same map components, individuals can create concept maps with different structures to illustrate own thoughts. These components serve as a reference point to identify similarities and differences in understanding. Coordination and reflection of those components are potential to promote mediation and negotiation of meaning during the discourse, further trigger the transformation of knowledge.

A Kit-Build (KB) approach is a type of re-constructional concept mapping activity where students are requested to build a concept map based on the specified components (i.e. nodes and linking words) defined by a teacher (Hirashima, 2018; Hirashima, Yamasaki, Fukuda, & Funaoi, 2015). Students need to find the map structure by themselves, then those of reconstructed map structures will be compared with their peer’s map or with the teacher’s map. KB system will display similar propositions as a shared map, as well as dissimilar propositions composed only by students or a teacher as a difference map. Hence, the teacher can assess students’ understanding of learning materials instantaneously and provide prompt feedback.

Our proposed activity, named as RKB, exemplifies the KB approach for peer-to-peer communication. Predefined nodes or linking words will play a role as a boundary object to encourage boundary-crossing. We aim to evaluate whether our proposed activity can support potential learning mechanism at the boundary during collaboration. The following research questions guided our study:

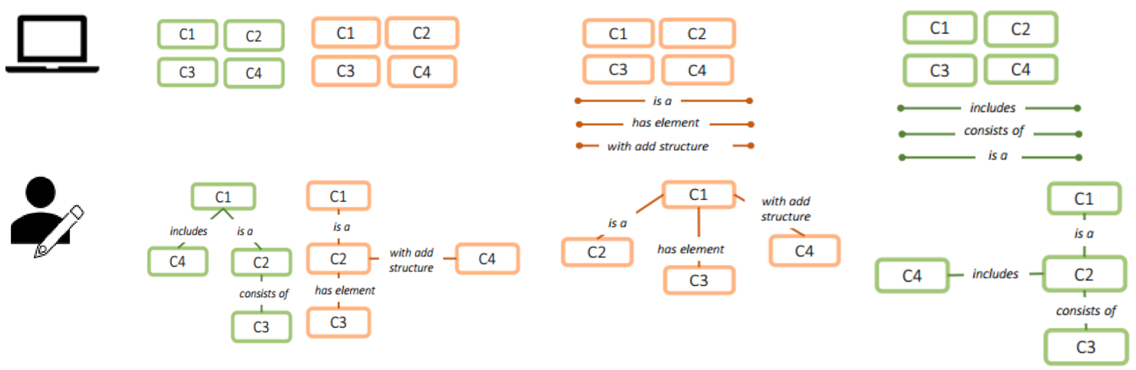
a) Whether and to what extent do the RKB approach improve students’ learning achievements after collaborative concept mapping activity?
b) Whether and to what extent do the RKB approach affect the quality of the collaborative product?
c) Whether and to what extent do the RKB approach affect students’ metacognition on the group level, specifically, group regulation of cognition?
d) How is the knowledge convergence between members in a group prior to, during, and after collaboration following the RKB?

2. Research Methodology

2.1 The Learning Activity: Reciprocal Kit Build

We design a learning environment for dyads to co-construct a concept map with two different phases, i.e. individual and collaborative phase.

(1) Initial map construction (individual) *(2) Re-constructional map building (individual)*



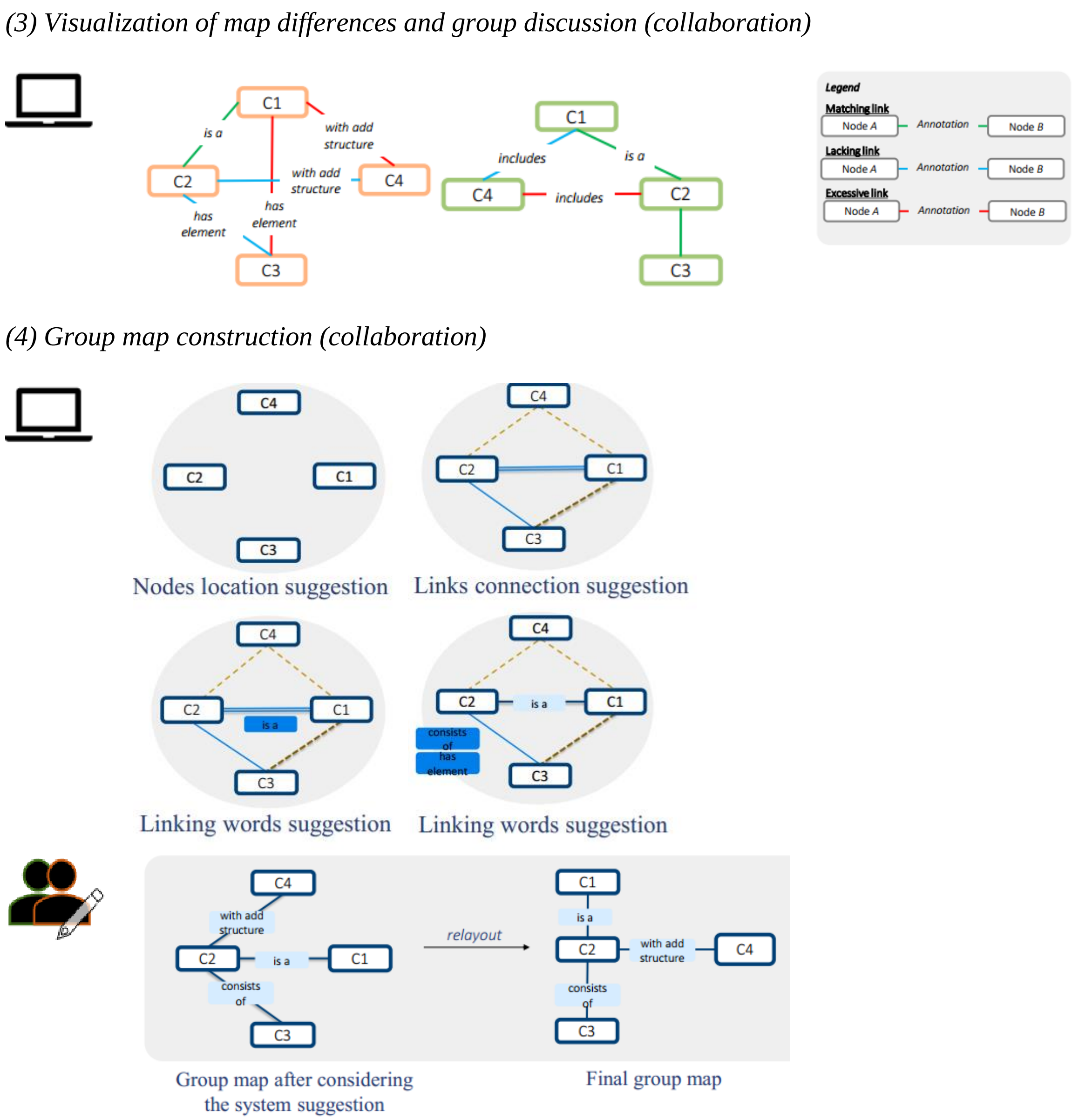


Figure 1. The Reciprocal Kit Build Design Activity in collaborative settings.

2.2 Data Collection Procedures

The collected data consist of concept maps, activity logs, questionnaires, and audio discussion. The concept maps and learners' activity data will be collected through a web-based RKB system. The constructed concept maps during individual and collaborative phase are continuously recorded while learners are progressing throughout the activities. We will also gather individual post-collaboration maps a week after the experiment session. The sequence of activities and the discussion while building the maps will be recorded and analyzed to investigate the process of collaborative knowledge construction. After the collaboration, we conduct a survey on group metacognition scale for online collaborative learning proposed by Biasutti and Frate (2018).

Based on the data, we will measure students' learning outcomes and the knowledge transfer from individual-to-group and from group-to-individual (during and after collaboration). There are two types of learning outcomes; at a group and individual level. The group learning outcomes will be measured from the collaborative map, while the individual learning outcomes will be evaluated based on the score gain from initial maps to the post-collaboration maps. Knowledge convergence prior to, during, and after collaboration are assessed based on the similarity of group members' initial maps, the individuals' maps with the group's map, and the group's map with post-collaboration maps. The similarity of maps may represent two types of knowledge convergence measures, i.e. knowledge equivalence and shared knowledge (Weinberger, Stegmann, & Fischer, 2007). As a process, the knowledge convergence within a group will be analyzed from the discourse and the log data. We will investigate students' metacognition on the group, specifically, we are interested to analyze items related to the group regulation of cognition (Biasutti & Frate, 2018).

3. Conclusion

We propose a Reciprocal Kit Build approach to extend the collaborative concept map construction in a pair. We also describe the system design and how it potentially supports the creation and evolution of active boundary objects during collaboration, i.e.: afford individual reflection and exploration, create awareness of each other's work, enable co-creation, and allow participants to build on the work of others. Our approach is unique since we are integrating some best practices on collaborative concept mapping activities and situate the learning process with different types of boundary objects, e.g. maps, nodes, and links. Further, we need to realize the system design, conduct some experiments, and evaluate the results.

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