Collaborative Knowledge Construction Mediated by Technology

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Abstract: Collaborative knowledge construction is a complex process and entails many forms of communicative and social interactions. This preliminary, qualitative case study attempts to understand collaborative knowledge construction processes when learners share both physical and virtual environments to create digital structures. The results show four techniques in which the participants engage to advance the digital creations. This study provides educators with insight of how to capitalize on opportunities to use technology and support collaboration.

Keywords: knowledge construction, collaboration, informal environments

Introduction

Collaboration has been strongly emphasized as a means of helping students in educational school systems to thrive in an era of technological acceleration. Virtual environments provide unique opportunities for participation in and practice with collaborating in the creation of artifacts, solutions, and play (Gee, 2007). In considering creative knowledge work, it is essential that students have experience in building knowledge to serve two purposes: practical purposes and conceptual understanding (Scardamalia & Bereiter, 2014). Doing this, of course, results in heightened challenges for educational institutions integrating such technology into classrooms. Students in school use technology at the request of teachers to participate in a structured, supervised, directed and often perform given tasks individually. Contrarily, young people at home have developed habits and expectations of how to utilize technologies to participate in unstructured, non-supervised, and collaborative ways to pursue interests (Clark et al., 2009). If educators are to capitalize on opportunities to use technology to support collaboration in classrooms, there is a need for a more nuanced understanding of natural collaborative interactions and knowledge construction like those that take place in home environments. Three-dimensional virtual learning environments (e.g., *Minecraft*) offer rich tools and features that support collaboration and facilitate group tasks in a way that leads to rich and effective collaborative learning. To study collaborative knowledge construction, we need to consider the context in which group activity occurs. Collaborative knowledge construction takes place when team members contribute to the accretion of shared understanding through seeking and integrating information, which leads to the transformation of the shared representation within the specific context (Suthers, 2006). Hence, this study aims to explore how elementary school students incorporate ways of knowing and acting to advance knowledge construction as they use iPads to engage in collaborative digital production within *Minecraft*'s virtual environment, while at the same time sharing a physical environment.

Methods

I conducted the study in the home of two siblings who usually invite friends over to play together. The participants engaged with *Minecraft* in two phases. In the free play phase, the participants engaged in planning, designing, and constructing the digital structures without being asked to meet specific requirements. The semi-structured play phase included ill-structured design scenarios that I had created with specific requirements to satisfy. The study lasted for nine weeks, from April to June 2018. The collected data is from three groups of elementary school students (third-, fourth-, and fifth-graders) who are siblings or friends. A variety of data sources were collected: weekly video sessions of *Minecraft* group digital constructions (a total of 24 sessions), produced artifacts, and individual interviews. For the purposes of this paper, I draw on data collected from one group (two male fifth-graders). The members in the selected group have the strongest friend relationship and more *Minecraft* experience among the other groups. To analyze the collected data, I used the analytical framework that was developed by Borge et al. (2015) as a basis to assess the quality of online collaborative discourses. Because the framework focuses on the dialogical aspect of social interaction, I expanded the framework to include other interactions like gestures, body movements, and interaction with the iPad. The group video-recording sessions were coded and analyzed at the micro level using interaction analysis. Two coders coded 20% of the total data. Inter-rater reliability was Kappa= 0.80 ($p<0.001$). Upon reaching good level of agreement, I coded the rest of the data.

Findings

The data analysis identified four techniques that the participants employed to advance the digital structures.

Utilizing the screen's presentation with talk responses

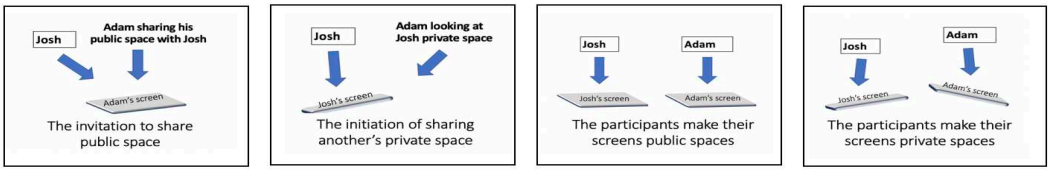
Six primary forms of talk response emerged from the interactions: joint idea-building, questioning, justification, task management, reflection and judgment, and claiming. These techniques made for a remarkable contribution in constructing group knowledge. One example is when the participants expanded the original idea of their project, the mall, to include a beach next to it. The participants advanced their ideas and moved from the focus on the mall to the focus on the area surrounding the mall and how the mall should provide and serve as a supplemental organization for the people who visit the beach area. The generation of this thoughtful new understanding was as a result of joint idea-building and understanding and iterative judgment.

Presenting meaning through embodied knowledge and gestures

In addition to verbal speech, gestural and body conceptualizations were essential tools for the group in displaying tacit knowledge and explaining the abstract concept. These types of expressions support the construction of shared meaning between individuals, facilitate the comprehension of abstract concepts, and bridge the gap between individual knowledge and group cognition.

Switching the screen between public and private spaces

The participants often shared their iPad screens with each other to share content, seek help, obtain confirmation, or request clarification. The participants' frequent transitions between private and public spaces reveal four different patterns (see Fig. 1). As the participants made their iPad screens as part of their dialogue and switching between their public and private spaces, the socially constructed meaning of their ideas was affected.



(a) (b) (c) (d)

Figure 1. Four different patterns of switching iPad screens between group members.

Workspace awareness: The presence of links between physical and virtual locations

The participants frequently employed strategies, including self-awareness and group-awareness, over the course of the projects to maintain the presence of links between their physical and virtual locations. These critical strategies help the team members navigate each other's work and provide each other with updated information about current co-constructed work, which eventually leads the team to achieve the desired objectives.

Conclusion and implications

The study shows how learners engage in multimodal interactions to advance the creation of artifacts. To maximize the quality of collaboration, students need to know what each other is doing, keep track of the group work, and recognize what relevant features of the used materials and technology. Educators can play the role of facilitators who help students possess this required knowledge. Educators also can plan instruction to help students learn and experience the processes of constructing knowledge. Nevertheless, this study sheds light on the need for models and best practices that support the engagement in such processes.

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