Exploring the Peer Interaction Effects on Learning Achievement in a Social Learning Platform Based on Social Network Analysis

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ABSTRACT
The benefits of social learning have been recognized by existing research. To explore knowledge distribution in social learning and its effects on learning achievement, we developed a social learning platform and explored students’ behaviors of peer interactions by the proposed algorithms based on social network analysis. An empirical study was also conducted on a college course to investigate the correlation between peer interaction and learning achievement. The experiment results show that the students who tended to actively contribute knowledge to peers on the social learning platform had better learning achievements than the students who were used to the passive reception of knowledge. Besides, the knowledge transmitters and intermediaries performed better in learning achievement as well, and the knowledge contributors had closer interactions with their peers. The implications derived from the findings can inspire instructors/researchers to facilitate effective social learning, and provide suggestions to develop effective algorithms to analyze social interaction behaviors.

KEYWORDS
Collaborative Knowledge Construction, Collaborative Learning, Peer Interaction, Social Learning, Social Network Analysis

INTRODUCTION
With the blooming development of social media, the use of social media in the field of education has recently begun to receive scholarly attention (Ranieri, Manca, & Fini, 2012). Students can share knowledge and have discussions with peers to gain new knowledge through a social networking mechanism. However, how learning is influenced in a social learning environment still needs to be investigated in detail. Much research discusses how peer interactions affect social learning (Cho, Gay, Davidson, & Ingraffea, 2007; Moreno, Gonzalez, Castilla, González, & Sigut, 2007; Pear & Crone-Todd, 2002; Puntambekar, 2006). It was suggested that the interaction situation affects the way the students distribute knowledge, for instance, how students give and receive their knowledge (Pear & Crone-Todd, 2002), which of the members involve in the interaction (Moreno et al., 2007), how interactions happen for foster learning (Puntambekar, 2006), and whether different interaction
styles affect learning (Cho et al., 2007). To understand more about the effects of peer interaction on learning, increasing research focused on trying to explore behavioral patterns of peer interaction (Liu & Tsai, 2008; Hou & Wu, 2011). Most of them analyzed peer interaction types based on statistical methods (Hou & Wu, 2011; Moskaliuk, Kimmerle, & Cress, 2012) or content analysis (Puntambekar, 2006). However, by only employing those methodologies, the ability of mining students’ static (topologies) or dynamic (distribution) interaction characteristics will be very limited. Therefore, social network analysis (SNA) grows into an emerging computing paradigm, which can mine structural and topological features from the social network by leveraging more effective algorithms (Firdausiah Mansur & Yusof, 2013; Huang, Li, & Chen, 2005).

Instead of applying traditional methodologies, Cho et al. (2007) explored the relationships between peer interaction styles and learning performance by utilizing SNA indexes. In addition, Chen and Chang (2012) applied SNA to identifying students’ interaction types in a problem-based learning (PBL) environment by deriving peer interaction indexes from their interaction situation, based on which the recommendations of learning partners for supporting collaborative PBL were provided. The developed peer interaction indexes can mine students’ behaviors more accurately and objectively. However, in addition to the partner recommendation and the PBL environment, SNA may have the potential to be applied to address more general issues in social learning. Increasingly, recent research (Firdausiah Mansur & Yusof, 2013; Lu & Churchill, 2014) has started to apply SNA to explore the effects of peer interactions on learning. However, such research about the students’ peer interactions in a general social learning environment is still lacking. Therefore, in this research, the effects of peer interactions on social learning in terms of learning achievement were investigated by employing SNA techniques. We developed SNA algorithms to analyze students’ peer interactions. Accordingly, in order to examine this issue in a more general social learning environment, a social learning platform with general social functions was carried out for examining the students’ peer interactions in social learning.

LITERATURE REVIEW

Social Learning and Peer Interaction

Social learning theory (Bandura, 1977) suggested that most human behavior is learned through modeling, by which people are able to construct an idea of how a new behavior is performed by observing peers’ behaviors. Social constructivism (Vygotsky, 1978, Wells, 1999) claimed that knowledge is constructed through interactions, which are refined gradually and developed collaboratively into a common idea with a shared meaning. With the recent development of computer-supported collaborative learning (CSCL), more research has been devoted towards collaborative knowledge construction in the CSCL environment (Onrubia & Engel, 2009). It was suggested that divergence and incongruity observed in the social learning environment have significant impacts on learning performances (Moskaliuk et al., 2012; Puntambekar, 2006). Therefore, it is important to investigate peers’ interactions when divergence of their ideas, opinions, or cognition becomes apparent. Puntambekar (2006) discusses how peer interactions are developed over time during social learning and how it was found that students constructed their own understanding based on their interaction with others. Onrubia and Engel (2009) studied social learning processes and addressed the importance of further research on analyzing how interaction patterns affect learning processes. However, research about the factors that influence social learning is still limited and this needs to be further explored.

Social media platforms such as the wiki, Facebook, and Twitter are increasingly being used in education (Schroeder, Minocha, & Schneider, 2010), which provides a more interactive social learning environment. Thus, the interactions of students in such interactive social learning environments have attracted more attention in recent times (Chang & Chu, 2009; Cho et al., 2007; Heo, Lim, & Kim, 2010; Hou & Wu, 2011; Kimmerle, Moskaliuk & Cress, 2011; Liu & Tsai, 2008; Moreno et al., 2007;