Contemporary Educational Psychology 41 (2015) 83–97

Contents lists available at ScienceDirect

Contemporary Educational Psychology

journal homepage: www.elsevier.com/locate/cedpsych

Social influences on children's development of relational thinking during small-group discussions

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ARTICLE INFO

Article history:
Available online 16 December 2014

Keyword:
Relational thinking
Friendship
Peer status
Social network
Proximal development
Dialogic interaction

ABSTRACT

This microgenetic study strived to understand instantaneous peer influences on the moment-by-moment and session-by-session development of relational thinking within and across dialogic small-group discussions using an approach called Collaborative Reasoning. An analysis encompassing 32,511 turns for speaking during 176 discussions indicated that peer support and refutation influenced the development of relational thinking within (micro-level) and across (macro-level) discussions, and was mediated by friendship and peer status. Support was mainly mediated by friends and children with high status. Observing reciprocated friends' supportive talk encouraged students to generate confirmational relational thinking in the next turn for speaking. Refutation was mainly mediated by children with high status. Quiet students generated less refutation. The study documents the proximal effects of peer status and friendship on the social and cognitive dynamics of collaborative discussions.

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1. Introduction

Relational thinking is the ability to perceive, construct, and manipulate relations between concepts to form coherent schemas (Holyoak, 2012). Understanding the mechanisms by which this ability develops is crucial to understanding cognitive development, as relations are the building blocks of all kinds of knowledge (Dumas, Alexander, & Grossnickle, 2013). Previous studies of relational thinking highlight the importance of individual cognitive factors (e.g., Halford, Andrews, Dalton, Boag, & Zielinski, 2002; Gentner & Rattermann, 1991). So far, however, social influences on the development of relational thinking have received little attention.

The major goal of this study was to capture instantaneous social effects on moment-by-moment cognitive development during and across collaborative small-group discussions. The general working hypothesis was that large-scale changes in thinking depend upon many small steps that are made possible by recurrent patterns of productive dialogic interaction. The study modeled the time course of support and refutation that students offered each other during the give-and-take of a socially-supportive, cognitively-engaging small-group discussion approach called Collaborative Reasoning (Chinn, Anderson, & Waggoner, 2001), examined whether these elements of discussion were associated with the micro-development of relational thinking, and explored whether effects were mediated by peer relationships. We theorize that Collaborative Reasoning (CR) discussions provide a context where students can socialize their relational thinking through a dynamic co-construction and co-evaluation process (Anderson et al., 2001); the emphasis on social support in CR reinforces positive peer relationships, which contribute to socially harmonious and cognitively invigorating interaction.

Studies of cognitive development typically evaluate students' growth in terms of change in pre- and post-intervention assessments, which does not shed light on *how* and *when* students' cognitive skills progress, and especially what types of interaction bring about change. Little is known, for example, about whether friends are more willing to support or oppose each other, and

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http://dx.doi.org/10.1016/j.cedpsych.2014.12.004
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whether popular students contribute to or hinder group processes. The study employs the microgenetic method (Siegler, 2006). An essential feature of the method is that the density of observations is high relative to the rate of change in the phenomenon under investigation. As Siegler (2005) explains, "Learning tends to follow irregular paths involving regressions as well as progress, short-lived transitional approaches, inconsistent patterns of generalization, and other complexities. Because of this complexity, the only way to determine how children learn is to follow them closely while they are learning" (p. 770). The present study involved additional layers of complexity, beyond those in most previous microgenetic studies (e.g., Kuhn, Goh, Iordanou, & Shaenfield, 2008; Siegler & Svetina, 2002). Instead of the behavior of individual students, the collective action of groups of students was tracked. Instead of discrete trials under the control of the experimenter, the students freely controlled their own behavior.

1.1. Relational thinking in collaborative discussions

Relational thinking involves the ability to appreciate how things are connected (e.g., predator–prey relationship, kinship relationships), the ability to identify common structures among things with distinct surface features (Chi & VanLehn, 2012), and the ability to manipulate these relations to form systematic concepts or schemas (Hummel & Holyoak, 2005). The ability to recognize and manipulate complex relations enables students to perform many higher-order thinking functions, such as drawing inferences between premises and conclusions to reach logical coherence during reading, generating analogies in argumentation, identifying abstract mathematical principles, associating theory and evidence in scientific discovery. Relational thinking is fundamentally important to knowledge transfer and conceptual change (Holyoak, 2012; Schwartz, Chase, Oppezzo, & Chin, 2011).

Many individual cognitive factors have been found to contribute to developmental change (Gentner & Rattermann, 1991; Goswami, 1991; Halford et al., 2002; Loewenstein & Gentner, 2005; Richland, Chan, Morrison, & Au, 2010; Richland, Morrison, & Holyoak, 2006). Less is known about moment-by-moment development during a social process, how interpersonal factors influence the process, and how micro-level development contributes to macro-level development over days, weeks, or months.

Dialogic interaction is argumentative discourse in which participants all have rights to formulate arguments to support their own viewpoints and probe others to better understand or refute opposing viewpoints (Reznitskaya et al., 2009). A supporting argument embeds relational thinking when it involves reasons or evidence that justifies a claim. Similarly, a refutational argument is relational when counter-reasons or counter-evidence are provided. To generate a supporting or refutational argument, the learners must have some understanding of how ideas can be connected. Means for connecting ideas can be secured by appropriating relational thinking strategies encountered in dialogic talk.

We hypothesize that when students observe peers engage in a relational thinking strategy judged to have explanatory power or persuasive force, they are likely to emulate the strategy. We assume that students who frequently and successfully generate relational thinking serve as models for those who seldom do or do so less effectively. Subsequently, we suppose that as less-skilled students attempt relational thinking strategies, they are often provided with support by more competent peers. Exposure to various points of view prompts students to compare and contrast perspectives and identify gaps in understanding, which in turn is assumed to advance students' relational thinking. The current study explored the moment-by-moment time course of the emergence of relational thinking in order to evaluate the hypothesized social process. Our theory is that instantaneous social events that embody modeling, support, and refutation are the precursors of growth in relational thinking in the long run.

1.2. Peer relationships in small group discussions

Small group discussion can be conceptualized as two interweaving networks: an argumentation network in which individuals are expressed as nodes and the connections between individuals' expressed ideas are denoted as ties; and, a social network in which individuals are connected by ties of friendship or status in the classroom social network. Dynamic cognitive and affective ties, involving disagreement, support, power, or friendship, represent multiple dimensions of co-regulation or co-ordination among group members (Vauras, Salonen, & Kinnunen, 2008). Although the idea of a dual-space framework is not new (e.g., Barron, 2003; Olivera & Straus, 2004), the majority of collaborative learning research focuses on one dimension or the other (Van den Bossche, Gijselaers, Segers, & Kirschner, 2006). There is not yet a consensus as to how the cognitive and social facets of collaboration interlace (Ladd, Kochenderfer-Ladd, Visconti, & Ettekal, 2012). Particularly, the role of peer relationships in collaborative learning contexts is still unclear (Tolmie et al., 2010).

Previous studies suggest that progress in cognitive development depends upon positive peer relationships. Students prefer to interact with or seek help from peers who are popular, have more good ideas, or share many characteristics with them. These selection processes thus may influence when and how learning takes place. For example, Azmitia and Montgomery (1993) found that friends are more likely than acquaintances to evaluate, justify, and criticize each other's ideas, which in turn improves their cognitive performance. According to this line of research, peer relationships are a determinant of cognitive development during peer collaboration. However, Tolmie et al. (2010) argued that optimal peer relationships at best establish "sufficient minima to permit further growth as part of productive activity" (p. 188).

Research suggests that social structures can alter individual behavior. A meta-analysis by Roseth, Johnson, and Johnson (2008) concluded that social contexts featuring a cooperative goal structure, as opposed to competitive or individual goal structures, affords greater opportunities for individuals to cultivate positive peer relationships and improves academic achievement. Other studies indicate that an egalitarian social norm can promote positive social behavior, whereas a rigid social dominance hierarchy may foster peer rejection or aggressive behavior (e.g., Chang, 2004; Cohen & Lotan, 1995). Cohen and her colleagues developed an approach in which children were taught that intellectual abilities are multidimensional, such that everyone is gifted in some way, and in which the teacher made a point of publicly recognizing the intellectual contributions of low-status children. Similarly, Boaler (2008) taught students to be respectful of each other and to fairly consider various points of view. These interventions successfully fostered students' interpersonal accountability and positive interdependence and promoted learning, suggesting that micro-level social learning is determined partly by macro-level social structures (Vauras et al., 2008).

The current study therefore assumes that positive peer relationships can have sustaining facilitative effects on cognitive development provided positive social norms such as respect and support are embraced. Consistent with previous research (Faris & Felmlee, 2011), we assume that students who have higher status in the classroom are more likely to take a leadership role by conforming to the collaborative social norms, modeling desired cognitive and social actions, and supporting classmates who conform to norms. Based on these assumptions, this study examined the influence of two important facets of peer relationships – friendship and status in the

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