International Society of the Learning Sciences

Negotiating Accountability and Epistemic Stances in Middle-School Collaborative Discourse

Asmalina Saleh, Chen Feng, Haesol Bae, Cindy E. Hmelo-Silver, Krista D. Glazewski
asmsaleh@iu.edu, carrfeng@iu.edu, haebae@iu.edu, chmelosi@indiana.edu, glaze@indiana.edu
Indiana University

Seung Lee, Bradford Mott, James Lester
sylee@ncsu.edu, bwmott@ncsu.edu, lester@ncsu.edu
North Carolina State University

Abstract: Group discourse has often been examined in computer-supported collaborative learning environments to develop adaptive scaffolds for students and intelligent cognitive assistants for teachers. This study leverages work in accountable talk and transactivity to focus on epistemics, or how participants establish, negotiate, and reproduce knowledge claims in collaborative discourse. We examined online chat data from 7 groups of middle school students who engaged in a game-based learning environment. Findings indicate that the framing of the game-based activities influenced how students interacted with one another. When attending to turns at talk, a combination of 1) epistemic status, 2) epistemic gradient, or the relationship between more and less knowledgeable persons, and 3) attention to norms of accountable talk generated more transactive discussions among students.

Background

Computer-supported collaborative learning environments (CSCL) are effective in supporting inquiry processes and associated learning outcomes (Chen et al., 2018; Jeong et al., 2019). Central to the success of collaborative learning is transactivity, which refers to the actions of students building on the ideas presented by others in discourse (Berkowitz & Gibbs, 1983). In the CSCL literature, transactive reasoning has been used effectively to support automated collaborative learning, conservational agents, and scripting (Dyke et al., 2013). Transactivity has also been adopted in other contexts, such as classrooms. Accountable talk for instance, shares similar concepts of reciprocity, holding students responsible for their reasoning, knowledge, and to the learning community (O'Connor & Michaels, 2019). Our work draws on these traditions to understand how knowledge is distributed in small group conversations as students engage in a collaborative game-based learning environment.

Accountable talk, transactivity, and epistemics

Accountable talk is a form of discursive classroom practice intended to support students in engaging in argumentation (O'Connor & Michaels, 2019). Although students can engage in discussion, they might not always participate equally in conversations. Accountable talk distributes responsibility among students by attending to accountability to knowledge, reasoning, and community. Accountability to knowledge refers to holding student responsible for grounding their knowledge claim whereas accountability to reasoning emphasizes the process of argumentation. Finally, accountability to the learning community includes valuing each student's contribution, distributing responsibility, and structuring group thinking. Similarly, Berkowitz and Gibbs (1983) define transacts as transactive reasoning that builds on prior actions from others. According to the authors, there are three types of transacts, representational, operational, and hybrid transacts. Representational transacts utterances that re-cast the prior contribution but does not modify it. This includes request for feedback or paraphrasing prior utterances. Operational transacts on the other hand, refine, or extend the prior contributions. Hybrid transacts are transacts that are in-between representational and operational transacts.

Taken together, the transactivity and accountable talk frameworks are concerned with epistemics, or how participants assert and negotiate knowledge claims through interactions with others (Heritage, 2012). In conversation, participants often demonstrate varying degrees of knowledge. The relative position between a less knowledgeable person (K-) and a more knowledge (K+) partner is referred to as *epistemic status*. This status is a jointly recognized among participants and establishes who has access to information, ability, and rights to the information. *Epistemic stance* refers to how a participant positions themselves through the design of turns at talk (Heritage, 2012). Although epistemic stance is influenced by one's epistemic status, they are not always the same. As a conversation progresses, one's relative epistemic stance shifts moment to moment because of the dynamics of interaction. For example, a teacher, with typically high epistemic status, might choose to start the discussion by taking a less knowledgeable epistemic stance, and ask questions about a concept, "Can someone explain what

dissolved oxygen means?" This epistemic stance elicits participation from students, allowing students to adopt a more knowledgeable epistemic stance when responding. To explore knowledge generation in a game-based learning environment, we address the question, how do participants establish, negotiate, and reproduce knowledge claims in collaborative discourse?

Methods

Participants

Participants were 28 students (6th and 7th grade, 10 females, 18 males) in a public school in the United States. Of those who participated, 3 students identified as African/Americans, 4 as multi-racial, 2 as Asians/Pacific Islanders, 1 as Hispanic/Latinx, 1 as Native American/American Indian, and 17 as White. Students worked in groups of four and engaged with a game-based learning environment, CRYSTAL ISLAND: ECOJOURNEYS in two 120-minute sessions. Each group of students was assigned a facilitator who scaffolded collaborative inquiry discussions using accountable talk, such as marking information, eliciting participation, and revoicing student contributions.

Setting

In CRYSTAL ISLAND: ECOJOURNEYS, students arrive on a fictional island in the Philippines where they meet a fish technician, Jasmine, who has a problem: her tilapia are falling sick at an alarming rate. Students engage in two major inquiry activities, collecting information, and then brainstorming ideas about why the problem was happening. To share and negotiate data with their peers, students use an in-game collaborative brainstorming board (Saleh et al., 2020). At the board, students move notes to the columns that align to components that the tilapia fish needed to survive. Students then vote on whether the notes are relevant to the associated component. The votes on each note are represented visually: the note turns green when all students in the group agree or the note turns red otherwise. Throughout the activities, students use an in-game chat to discuss ideas with their peers.

Data sources and analysis

Data for this analysis was derived from all the group's in-game chat data. To analyze the data, we first segmented the chat according to the two major tasks presented to the students, collecting data and brainstorming. We segmented the chat data based on these inquiry phases and determined the topic of discussion in each segment. Drawing on interaction analysis (Jordan & Henderson, 1995), we focused on the temporal sequence of activities and turns at talk to determine how participants demonstrated their knowledge stances during their conversational turns. Based on our analysis, we found that one-minute intervals between the last utterance and the next utterance established the relevance between speakers. To understand how knowledge is generated in collaborative inquiry, we examine the relationship between less and more knowledgeable persons.

Results

Table 1 highlights the topic or framing of the discussion for each task in the inquiry cycle. In general, most of the discussion that occurred was centered around the brainstorming board tasks.

Table 1: Overview of topics categorized by group in each inquiry tasks

Tasks	Main topic of discussion	Groups
Exploration 1	Off-topic discussion	A, B, D
	Accountability to community: Describe tasks and content	C, E, F, G
Brainstorming session 1	*Accountability to reasoning, knowledge, and community*: Vote on relevance of notes to abiotic factors and eliminate factors that may not cause fish illness	All groups
Exploration 2	Off-topic discussion	A, B
	Accountability to knowledge and community: Describe tasks and content	C, E, F, G
	Limited chat	D
Brainstorming session 2	*Accountability to knowledge and community*: Discuss abiotic factors	A
	Accountability to reasoning, knowledge, and community: Discuss the abiotic factors and how they are related to one another	B, C, D, E
	Accountability to reasoning, knowledge, and community: Discuss the abiotic factors and how they are related to one another and the problem	F, G

Across all the discussions, we observed two ways that accountable talk framing influenced how participants established, negotiated, and reproduced knowledge claims in collaborative inquiry discourse. First, the group's orientation to accountable talk shaped how students approached their own knowledge across all the inquiry sessions. In the first exploration session, four groups demonstrated accountability to their learning community, by discussing the tasks that needed to be done and describing their in-game interactions with their peers. These groups continued to be focused on task knowledge in the first brainstorming session. At the start of each brainstorming session, all groups focused on the goal of the activity and the task that needed to be completed. The facilitator typically started conversational sequences by presenting the groups with information about what to do at the start of each phase. This meant that students' less knowledgeable (K-) stances usually involved task-oriented questions about the placement of notes on the board and who had the notes on the location of the notes. Facilitators often reframed these task queries into requests about what the content of the note is. From an accountable talk perspective, this reframing signals to students that they need to reflect on the information that is provided and justify their reasoning before moving the notes. In the second brainstorming session, groups discussed information associated with abiotic factors such as organic matter, dissolved oxygen, and cyanobacteria. With the exception of group A, most groups were able to discuss the relationships among these factors. Group A's progress may be related to the fact that the students engaged in off-topic discussions during both exploration phases.

Second, tracking the knowledge relations among participants, or the epistemic gradient was critical to understand collaborative inquiry and accountability in the group. For example, requests from teachers may appear to be a known answer or initiation-reply-evaluation format (Mehan, 1979), but our data reveals that these knowledge relations may be more nuanced. Specifically, when student requests for information are re-voiced by the facilitator, these requests bolster students' epistemic status, suggesting that answers are more likely to be answered. Additionally, collaborative inquiry involves sharing information that contributes to the knowledge community, even if it appeared as if students were minimally responding to one another. Although it may seem crucial for student to respond to one another, students sometimes pick up threads of conversations later in their discourse. We observe the following, when a student provides information, peers responded (1) with less knowledgeable stances (e.g., I didn't know that), (2) corroborate the information being shared (e.g., I found that out too, I agree with what they said), or 3) build on this information (e.g., I agree because …, I don't think so because …). By sharing information or indexing a more knowledgeable position in their collaborative discourse, students begin to generate a corpus of knowledge that all members can then access and in turn, support collaborative and individual understanding.

Accountable talk and epistemics in action

Because of space constraints, we present a short excerpt from group F to illustrate how accountable talk shape how participants establish, negotiate, and reproduce their knowledge claims (Table 2). In the first session, Turtle was present at the beginning but was called away for other school activities. As a result, Turtle had missed both exploratory phases. Fortunately, there were notes available for Turtle to review during the brainstorming session.

Table 2: Excerpt - Group F Facilitator (Wizard) requests information

	Time	User	In-game chat
1	09:58:53.1	Wizard	if you have to write an explanation, what would it be?
2	10:01:16.3	Turtle	i don`t (know) that much but isnt it obvious that too much organic matter is the problem
3	10:01:34.8	Jeepney	Yes.
4	10:01:37.0	Wizard	why is it obvious?
5	10:01:42.9	Sun	it just is
6	10:01:50.3	Turtle	also coronavirus isn't funny it is just a overused joke
7	10:01:52.2	Jeepney	But dont forget about the oxygen problem.
8	10:01:53.4	Wizard	explain it to me ;)
9	10:02:07.5	Eagle	Because all of the other problems connect and go back to organic matter
10	10:02:32.8	Sun	not the oxygen one
11	10:02:55.4	Eagle	ok, most of thhe problems
	[…]		
12	10:05:03.2	Wizard	but if she wants to know why, what would you say?

	[…]		
13	10:06:33.1	Turtle	so to much organic bacteria means more cyanide and that means competition for oxygen
14	10:06:47.3	Turtle	cyanobacteria i mean not cyanide

Prior to the excerpt, Turtle had made multiple interrogative requests, "I didn't do this yesterday", "I am confused", "Who is Jasmine?", "Where is her problem?", "I am very confused because I do not know anything about Jasmine." Students in the group responded to his request (accountability to the learning community). This knowledge is then leveraged by Turtle in above in response to the facilitator (accountability to reasoning). Although Turtle's utterance begins with a hedge, "I don't (know) that much", he follows up with "isn't it obvious" (line 2), students in the group either corroborate or extend his claim (lines 5, 7, 9, and 10). In addition, his multiple requests for clarification allowed Turtle to draw on his peers' prior contributions to provide a more nuanced response about why the tilapia might be sick highlighting the group's commitment to accountable talk.

Conclusion and implications

In this work, we examined how epistemics can support our understanding of how collaborative knowledge building occurs in a game-based learning environment. Knowledge positions are similar to transactive actions, but also accounts for the power relations between speakers and how adherence to norms may support group accountability to productive discourse. Groups that took longer to adopt norms associated with accountable talk were less transactive than groups who did attend to such norms. On the other hand, groups that appeared to value all dimensions of accountable talk were more transactive, even when considering off-topic discussions. Ultimately, attention to epistemics in student conversations and how it contributes to group discussion will set the stage for the development of computational models of collaborative learning and support the development of intelligent cognitive assistants for teachers.

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Acknowledgments

This work is supported by the National Science Foundation through grants IIS-1839966, and SES-1840120. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.