Characterizing Knowledge Building Discourse

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Abstract: Knowledge building (KB) discourse is one of the 12 principles of Knowledge Building (Scardamalia, 2002). However, it is not clear what it is like and how it mediates knowledge building. In this paper, our goal is to characterize KB discourse by analyzing students' online and face-to-face talk as they worked together to advance the science knowledge in a nature learning activity. Arguing that collaborative argumentation is an important form of discourse in science knowledge building, we draw upon argumentation framework (Walton, 2000) to identify and demonstrate how different forms of argumentation discourse observed in this nature learning activity support knowledge building. Implications to forms of scaffolding knowledge building discourse, including technology-based environment, are drawn from the study.

Introduction

Studies on knowledge-based communities such as science seem to indicate that argumentation plays a central role in their advancement of knowledge (Bell, 2004; Knorr-Cetina, 1999; Latour & Woolgar, 1986). While this term may conjure images of aggression and opposition that might not augment well with the common values and goals that characterize knowledge-creating communities, there are other forms of argumentation that could potentially mediate the process of knowledge building. In science community, members engage in argumentation by proposing, justifying, and evaluating knowledge claims in order to legitimize claims put forward by members of the community (Latour, 1987). Andriessen (2006) refers to such forms of argumentation as *collaborative argumentation*.

However, there is little known about how such discourse type mediates advancement of knowledge. Especially in knowledge building classrooms that place knowledge creation at its center, the lack of characterization of how collaborative argumentation supports knowledge building can be problematic. Teachers may have difficulty in orchestrating argumentation or scaffolding students in this dialogic process of knowledge building. Thus it is the goal of this paper to seek a deeper understanding of what types of collaborative argumentative discourse mediate knowledge building. The research question we seek to answer in this study is "what were the collaborative argumentative discourse types that mediated knowledge building during an elementary science nature learning activity?" We draw upon argumentation framework by Walton (2000) to study face-to-face and online discourse of a group of elementary students participating in a nature learning activity as an after-school program. We identified four types of argumentation dialogue types, namely, information-seeking, deliberation, persuasive and inquiry, in the students' talk. While each individual form of argumentation may seem superficial in supporting knowledge building by itself, it is the integration of the different forms that made the advancement of knowledge possible.

Theoretical Framework

The argumentation framework by Walton (2000) is based on dialog theory by Grice (1975) to study formal and cooperative dialog. Taking argumentation as a form of formal dialog involving two people attempting to reason with each other by challenging, rebutting, questioning, building on and exploring ideas, with the goal of settling some disputed issues between two parties, it consists of three key dialogic process - opening, argumentation and closing. The opening stage frames the initial situation – the participants, the goals of dialogue and participants', the type of dialogue. In the argumentation stage, the participants make their moves either by attacking an argument, supporting an argument and raising critical questions about it. Closing stage marks the achievement of their goal. In other words, an argument can be analyzed according to the following components: participants, type of moves, sequence of moves and the goal achieved. Six types of argumentative dialog – persuasion, inquiry, negotiation, information-seeking, deliberation, and eristic, were identified. A summary of the description of the argumentation types is given in Table 1.

Table 1: Types of argumentation dialogue.

Type of dialogue	Initial Situation	Participant's goal	Goal of dialogue
Persuasion	Conflict of opinions	Persuade other party	Resolve or clarify
Inquiry	Need to have proof	Find and verify evidence	Prove (disprove) hypothesis
Negotiation	Conflict of interests	Get what you most want	Reasonable settlement

			Both can live with
Information-seeking	Need information	Acquire or give information	Exchange information
Deliberation	Dilemma or practical choice	Co-ordinate goals and actions	Decide best available course of action
Eristic	Personal conflict	Verbally hit out at opponent	Reveal deeper basis of conflict

Using the above framework for evaluating argumentation, we analyzed the discourse of a group of elementary students participating in a knowledge building activity about the decomposition of meat. We want to find out what types of argumentation dialogues supported knowledge building in a group of elementary school students.

Research Method

In this study, we looked at a group of six primary five (equivalent of Grade 5) boys from a local primary school in Singapore, taking part in an after-school enrichment program based on the pedagogical approach, Knowledge Building (Scardamalia, 2002). In one of their activities, they wanted to find out what happened when meat rotted.

Taking a case study approach in this study, this group of students was chosen for demonstrating productive knowledge advancement during their NLC activity. Video data of the students' discourse and the database of Knowledge Forum form the key sources of our data. We made use of the four factors – exchange, types and sequence of moves, and goal – that characterize formal dialogue/argumentation to analyze the dialogic exchanges taking place.

Findings

Students' ideas were found to advance from a simple idea about meat decomposition to a detailed and generalizable description about its products (e.g., smell, liquid). The process included activities such as observation of decomposition, discussion of observation, raising puzzling questions, investigations and resolution. Face-to-face show-and-tell and online forum (Knowledge Forum) mediated their social interaction. Four types of argumentative dialogues were found to have mediated the advancement of knowledge about decomposition of meat – *information-seeking, deliberation, inquiry, and persuasion dialogue.* We will describe how these four types of argumentative dialogues mediated this knowledge advancement in one example about the liquid found in the container of rotting meat.

Information-Seeking Dialogue

The KB activity was triggered by the presentation of the observation of decomposition of a piece of chicken meat. The presentation was mediated by the teacher's and peers' questioning about their investigation during an information-seeking dialogue. An information-seeking dialogue describes the situation when one participant wants to get information that another participant possesses. Excerpt 1 shows teacher T trying to find out what the students did when they investigated the rotting meat.

Excerpt 1: Information-seeking dialogue.

Turn	Speaker	Content
1	T	Is the container closed or is it open?
2	D & A	Closed.
3	T	So you left it closed throughout the six days?
		.
		.
		.
9	HR	I opened it like during the third day.
10	T	You opened it sometimes.
11	HR	I wanted to see what was under (…)
12	T	Shhh… sorry, I didn't get you.
13	HR	I wanted to see what was under the cover as it was wet.

Here, the teacher's skepticism about the reliability of the information given by the students (see turns 1 and 3) as she questioned them about what they had done. These turns of talk by the teacher made it necessary for the students to provide clarity (turn 3) and justification (turn 13) for the actions they had taken in the

investigation. The criticality of ideas led participants to be engaged in deciding whether the information asked for was valid or relevant or not. From the perspective of Knowledge Building, such critical disposition is an embodiment of one's epistemic agency as one articulates questions and decides on criteria to evaluate the information given in the achievement of the community's goal of how the meat rotted in this case study. This critical dialogue around the observation led to puzzling questions to be identified, in this case, the presence of liquid.

Persuasion Dialogue

With the observation of "wet" meat highlighted during the presentation, one of the areas of contention is the origin of "water" (See excerpt 2) found with the rotting meat. What ensued was a persuasion dialogue as student SZ tried to convince the other students that the "water" comes from water vapor trapped in the box. A persuasion dialogue is adversarial in that its goal is to win over the participant(s) with the other side of the argument. Thus we see student SZ trying to justify for his claim that the liquid was from water vapour that had condensed by firstly countering student A's disagreement that it is "not water vapour" (turn 65) with a repair move that "I mean water that condensed" (turn 66) and that "water vapour can condense" (turn 66). He further defended this premise by highlighting that "it (the container) has been shut" (turn 67), thus justifying that "water vapour was kept inside" (turn 68). The result of a persuasive dialogue was an expansion of a simple claim to include premises as claims/premises made were challenged.

Excerpt 2: Persuasion dialogue.

Turn	Speaker	Content
55	S1	And what was the water?
		.
		.
		.
61	T	I think we don't call it water because we don't know whether it is water. What is the liquid actually?
62	D	I don't know whether is it discharge from the maggots or something like that.
63	A	I thought it is
64	SZ	I think it's water vapour.
65	A	No. not water vapour.
66	SZ	I mean water that condensed. Water vapour that condensed. Water vapour can condense.
67	D	But it has been shut.
68	SZ	Water vapour was kept inside.

Inquiry Dialogue

While persuasion dialogue is adversarial, inquiry dialogue is cooperative. The goal is to prove that a statement designated at the opening stage true or false or if there is insufficient evidence to prove a claim, which makes it different from a deliberation dialogue which does not carry the burden of proof.

In the case example, the inquiry dialogue arose as the discussion about the origin of "water" continued, as shown in excerpt 3. With continued uncertainty expressed over the source of "water" found with the rotting meat (see turns 78 – 86), the teacher highlighted the need for an investigation when the students casted doubt into their own hypothesis (turn 86). What follows after this exchange was an investigation planned and conducted to find out if the liquid was water, among other hypotheses they wanted to verify. In the second investigation, they used two pieces of dry meat, one placed in an open box and another in a closed box, and found that both boxes had liquid in them after two weeks. In a note they posted on Knowledge Forum, they reported that the meat in the closed box "turned gooey" while meat in the opened box "remains intact except smaller". They thus concluded that "the liquid is not formed by the maggots compared to the last experiment" and that "this experiment shows that decomposition produces liquid …"

Excerpt 3: Orchestrating inquiry.

Turn	Speaker	Content
74	T	Ok. I think Y has a very good question. What is that water? How is it Initially it was dry right I suppose … And there is liquid there?
		.
		.

		.
86	SZ	Maybe it's the water vapour that condenses?
87	T	Ok yah. Like you said 'maybe'. That is a hypothesis, so you actually have to go and find out …

Deliberation Dialogue

Another dialogue type observed in the students' talk as they advanced their knowledge is deliberation. Here, the students collectively steered group actions towards a common goal by agreeing on a proposal that can solve a problem affecting all parties concerned while taking their interests into account. Excerpt 4 shows the online discourse as students were deciding on the number of meats to use as they investigated the process of the decomposition at the start of knowledge building. With different ideas proposed on the number of meat to use (see turns 7, 23, 27), it was finally decided that "2-3 meats" would be used after deliberating on the different options.

Excerpt 4: Deliberation dialogue.

Note	Author	Date/ Time	Title	Scaffold	Content
7	HR	28 Aug 09/ 3:20 pm	Another reply		Good idea, maybe we should get several pieces of meat to observe on.....
23	D	28 Aug 09/ 3:48 pm	Several pieces of meat?	I need to understand	Why is there a need for several pieces of meat when you need only a piece of meat?
27	SZ	28 Aug 09/ 3:50 pm	D's question		what if 1 of the meat fails to rot ok thats stupid but to get more better conclusion we should get 2-3 meats

In such as instance, the goal is to merely decide on the best course of action, thus the discourse in not adversarial. A justification deemed logical to the other students was sufficient. Thus criticality of ideas put forth engages students to build their argument more convincingly with justifications without the need for aggression. What is also interesting in this excerpt is that the questions asked by student D in turn 23 was answered by student SZ instead of student HR whom the question was directed at. Such turn taking could demonstrate that the students were working on ideas rather than against each other in this argumentative discourse.

Discussion and Conclusion

This case study identifies four forms of argumentation dialogues – information-seeking, persuasion, inquiry and deliberation that mediated the advancement of knowledge about the decomposition of meat. These argumentation dialogues provide the platforms for students to put forth their ideas even if they are different or opposing (e.g., in persuasion talk whereby different hypotheses about origin of "water" was put forth), exercise their epistemic agency by deciding on criteria to judge information given (e.g., in inquiry dialogue as the criterion for evaluating hypotheses was set up), take up collective responsibility as they work collaboratively to consolidate diversity of ideas (e.g., deliberation talk over the number of meat to use) rather than hit out at their opponents, and work on improving ideas as they work through diverse and uncertain ideas (e.g., inquiry talk as they sought to find evidences to support their hypothesis). The findings did not, however, identify negotiation and eristic argumentation dialogues in the knowledge building interaction. Such dialogue types, according to Andriessen (2006), do not carry the goal of working with one another toward a common goal, and thus do not contribute much to education or knowledge building. The absence of these dialogue types could perhaps explain the productive advancement of knowledge observed in this group of students as they worked collaboratively to construct their understanding of decomposition.

The findings show that the four argumentative dialogue types observed in this case study mediated knowledge building in different ways (e.g., persuasion was to convince their peers of that the liquid was water while taking into account other's ideas and inquiry was to produce evidences to address uncertainty). By itself, it did not seem to advance the knowledge of the community much, but collectively, their whole was larger than the sum of the individual process. For example, in working on what the liquid observed in the rotting meat box was (refer to excerpts 2 and 3), teacher T's information-seeking question engaged students in putting forth different ideas (i.e., "discharge from the maggots" in turn 62 and "water vapour" in turn 64 of excerpt 2). This discourse quickly turned into one of persuasion as a result of doubts casted by a few of the students and the teacher on the claims made (refer to turns 65, 67 of excerpt 2). As the proponents defended their claims when they were continually challenged, uncertainty about their own claims was expressed, which in turn shifted the

discourse to one of inquiry as they found the need to verify their hypothesis. According to Walton (2000), such dialectical shift in which an argument that starts out framed as one kind of dialogue shifts to another as the argumentation proceeds need not be a bad thing. The subsequent dialogue that follows the former could help it move along its larger goal. In this case, we see that the outcome of this series of argumentative dialogue in the case study helped the students advance the knowledge of the community as they eventually found out that the liquid did not come from water vapour or discharge of maggots but from the meat itself when it decomposed.

An implication from this study is thus the need to orchestrate such dialogue types and its shift in Knowledge Building classrooms. The knowledge advancement we see in this case example might not have been possible if the students were left on their own accord to argue. In this case example, the teacher had played an instrumental role in orchestrating the argumentative talk and the shift from one form of argumentative dialogue to another. Here the teacher would repeat the question a student asked (e.g., excerpt 1) to elicit diversity of ideas, model criticality by evaluating information given by students (e.g., excerpt 1) or challenge students' claims or premises (e.g., excerpt 3), and ask questions to encourage students to elaborate and clarify their ideas/premises (e.g., excerpts 1 and 3). She also orchestrated the shift in dialogue types as she highlighted the students' uncertainty with their claims which moved the dialogue into one of inquiry (e.g. excerpt 3). In other words, the teacher in a Knowledge Building classroom need to model the attributes of Knowledge Building discourse by engaging in a collaborative argumentation discourse with the students, yet at the same time, they need to facilitate the argumentation discourse by encouraging students to put forward their claims, elaborate on their arguments, think critically about the ideas put forth, gather evidences to support their claims and to facilitate the shift in the discourse type as the situation is appropriate. With few online argumentation dialogue ending with a clear resolution or dialectical shifts taking place, this study also suggests that the current scaffolds in the form of sentence openers (i.e., I need to understand, My theory, This theory cannot explain, New information, A better theory) may not be sufficient to support the fluid and dynamic nature of the argumentative talk. For example, it is important to capture the premise of the other party and to build on it in a persuasive talk or to shift to another form of dialogue when the need arises (e.g., from persuasive to inquiry when different participants are uncertain of their ideas). One future direction to this study is to study ways to support collaborative argumentative dialogue in online platform more effectively.

In conclusion, this study examines the discursive practices of a group of students in a Knowledge Building community and explores the characteristics of Knowledge Building discourse through the perspective of argumentation dialogue. It argues that an integration of certain types of argumentation dialogues, such as information-seeking, deliberation, inquiry and persuasion dialogue, can mediate knowledge building activity and these dialogue patterns represent the collaborative and progressive Knowledge Building discourse as knowledge work is carried out to seek continual advancement. We acknowledge that this work on unpacking Knowledge Building discourse is merely scratching the tip of the iceberg, which we hope that there could be future build-on to this work on characterizing Knowledge Building discourse and how it can be better supported through online and physical means.

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