Cross-Community Interaction for Knowledge Building in Two Grade 5/6 Classrooms

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Abstract: This study explores cross-community interaction in two Grade 5/6 knowledge building communities. The two classrooms studied human body systems with the support of Knowledge Forum over a 10-week period. As the students conducted focused inquiry and discourse within their own community, they reviewed productive threads of ideas and posted syntheses in a cross-community space, as synthetic boundary objects. A set of idea thread syntheses from previous classrooms studying human body systems was also posted in the cross-community space. Qualitative analyses of classroom videos, online discourse, and interviews provide a rich description of how the students conceived, generated, and interacted around the synthetic boundary objects for knowledge building across communities.

Introduction

In a knowledge-based society, schools need to engage students in sustained inquiry and knowledge building discourse by which ideas are continually developed, refined, and built upon, giving rise to higher-level goals (Scardamalia & Bereiter, 2006). Collaborative online environments provide students with shared spaces where their ideas can be contributed, examined, refined, and built upon in sustained discourse. Knowledge that grows in a community through members' ongoing interactions represents the community's collective knowledge (Scardamalia & Bereiter, 2006), which leverages personal understanding. In real-world knowledge creation, the trajectory of sustained inquiry and discourse in each community is further supported by interactions across communities that work as an interconnected field (Csikszentmihalyi, 1999). A creative field leverages the work of all communities and their members by accumulating a shared, easily accessible knowledge base, represented using various inscription systems, facilitating dynamic idea contact and cross-fertilization (Csikszentmihalyi, 1999; Sternberg, 2003). Such cross-community interactions help to sustain productive knowledge building over time across generations, with newcomers learning from the existing ideas, practices, and role models and further making novel contributions. Fostering cross-community interactions for sustained knowledge building is a new challenge and opportunity for collaborative learning research.

Existing designs and research of collaborative learning focus on micro-level discourse; new advances are needed to support and understand emergent interactions at the higher social levels (Stahl, 2013). With online systems automatically preserving student discussions and supporting virtual sharing (Reil, 1994), it becomes feasible and important to use "the persistent record of interaction and collaboration as a resource" (Stahl et al., 2006, p. 419) for sustained knowledge building across the boundaries of different communities. Several researchers have made initial explorations to engage students in interactions across knowledge building communities. A common strategy is to have each community directly share its online discourse space with other communities. In a study conducted by Lai and Law (2006), two classrooms from Hong Kong and Toronto, respectively, engaged in collaborative knowledge building supported by Knowledge Forum, a collaborative online environment for knowledge building (Scardamalia & Bereiter, 2006). Students in each classroom had access to the online discussions of their partner classroom. As a benefit of the cross-classroom sharing, students learned from the productive practices (e.g. questioning) of the partner classroom to improve their own work. Another noteworthy design experiment was conducted by Laferrière and colleagues (2012). They engaged teachers and students from three international sites in collaborative knowledge building focusing on global warming. Each classroom gave other classrooms access to their online discourse space so they could read their notes and respond, supplemented with periodic video conferences. The cross-community collaboration led to productive classroom changes. Meanwhile, difficulties arose for students to understand and build on other communities' extended discourse without a clear sense of the contexts. New designs of boundary-crossing support are needed to make knowledge progress accessible across communities.

This research designs cross-community interaction using a multilevel emergence approach, focusing on interactions mediated through boundary objects. "Boundary objects" are artifacts (e.g. reports, tools, models) used to bridge the boundaries (discontinuities) between different social worlds (Star, 1989). Wenger defines them as "forms of reification around which communities of practice can organize their interconnections." (Wenger, 1998, p. 105) Objects from a community often have contextual meanings not accessible to other communities. What makes boundary objects effective for bridging different communities of practice is their interpretative flexibility as a "means of translation" (Star & Griesemer, 1989): they have a structure that is common enough to make them recognizable across the different social worlds and allow different communities

to interact and work together. As Akkerman and Bakker (2011) suggest, interactions with shared boundary objects help members of different communities to identify, understand, and reflect on their different practices, leading to an enriched view within each community and potentially the creation of new, in-between practices.

As noted above, raw distributed online discourse records are hard to be used as boundary objects to bridge the boundaries between different knowledge building communities. In this study, following a multi-level design, students generate synthetic boundary objects for cross-community sharing on the basis of the extended knowledge building discourse within their own community's space. The synthetic boundary objects take the form of idea thread syntheses framed using shared structures of inquiry. Students in each community engage in focused inquiry and interactive discourse within their own community's space, with small-groups formed and reformed to address emergent problems of inquiry. As progress is made, students working on the various areas selectively review and synthesize fruitful threads of inquiry emerged from their discourse. The selective reviews and syntheses of inquiry threads can facilitate peer learning and build-on across inquiry topics within each classroom (Zhang et al., 2015); they may further be shared as boundary objects to enable cross-community interaction. Students from another classroom (or a subsequent student cohort) can use the syntheses of idea threads to view into the discussions and understand the extended journey and progress of inquiry.

To support students' reflective review and structuring of distributed online discourse, our team developed Idea Thread Mapper (ITM) (Zhang et al., 2015). ITM interoperates with Knowledge Forum (Scardamalia & Bereiter, 2006) and potentially other platforms that support online knowledge building discourse. Using ITM, students identify focal objects of inquiry addressed by their collective discourse and select important discourse contributions related to each focus. The discourse entries with a shared focus are displayed on a timeline, as an idea thread, extending from the first to the last entry. Each idea thread has a "Journey of Thinking" synthesis. Students review their idea progress in the thread and co-author/update the "Journey of Thinking" synthesis. In line with the focus of knowledge building on continual idea improvement through progressive problem solving (Scardamalia & Berieter, 2006), we designed a set of scaffolds for Journey of Thinking synthesis, including (a) overarching topic and problems, (b) we used to think…now we understand… and (c) deeper research needed. ITM has been used by a set of classrooms that studied various science topics, with a rich set of idea threads and Journey of Thinking syntheses archived.

This research explores cross-community interactions mediated through idea thread syntheses, as synthetic boundary objects. Given the exploratory nature of this research topic, we used qualitative methods to provide a rich description of a purposefully designed case of cross-community interaction in a multi-iteration design-based study. As the first iteration, we conducted a pilot study in a grade 5/6 classroom that studied human body systems. Students read idea threads and syntheses of previous classrooms studying the same topic. They identified valuable questions, insights, and inquiry strategies (e.g. experiment) to deepen their own inquiry. As a critical challenge encountered, it was difficult to make the archived idea threads and Journey of Thinking syntheses from previous student cohorts interesting and relevant to students. Therefore, the current research tested cross-classroom interaction in two partnering classrooms. Students not only had access to archived idea thread syntheses from previous cohorts but also generated idea thread syntheses based on their ongoing work and shared the syntheses with their partner classroom. Our research questions ask: (a) How did the teachers and students conceive the nature of synthetic boundary objects in the form of idea tread syntheses? (b) How did the students generate synthetic boundary objects based on their community's knowledge building discourse and inquiry work? (c) How did the students interact with the synthetic boundary objects from other communities for knowledge building, with what support from the teacher?

Method

Classroom Contexts and Designs

This study tested cross-community interaction in two Grade 5/6 knowledge building communities. The two classrooms were taught by two teachers: Mr. B and Mr. M. Both teachers had multiple years of teaching experience, and Mr. B was more experienced with teaching grade 5/6 science using knowledge building pedagogy and technology. There were a total of 24 students in Mr. M's room and 23 students in Mr. B's room, with a total of 39 students consented to participate in this research. The two classrooms studied human body systems with the support of Knowledge Forum over a 10-week period. On an ongoing basis, students in each classroom contributed and built on one another's ideas in their own classroom' Knowledge Forum views (workspaces). Cross-community interaction was supported through a "Super View" on Knowledge Forum where students accessed and posted idea thread syntheses. A visual was added to the "Super View" to facilitate the sharing process: two trees with a number of branches where Super Notes about various inquiry topics could be placed (see Figure 1). Each classroom had its own "tree of knowledge," and students could take a look at their peer classroom's knowledge at any point of the knowledge building process for mutual learning and idea connection. Online posts to share idea thread syntheses in the Super View were called "Super Notes" by the teachers and students. Each Super Note was organized using the Journey of Thinking scaffolds of Idea Thread

Mapper that interoperates with Knowledge Forum. Prior to this study, a set of classrooms from two schools had used Idea Thread Mapper to organize their knowledge building discourse about human body systems and created idea thread syntheses. Based on these syntheses, an initial set of Super Notes (idea thread syntheses) was posted to the Super View, each framed using the scaffolds: Our research topic and problems, We used to think…Now we understand…, We need deeper research. The teacher in each classroom first introduced the Super View in the third week of the inquiry when their students had generated their own questions and conducted initial research about the various topics related to the human body. Students read the Super Notes from the previous classes and reflected on what they could learn from the questions and ideas. With deeper research conducted in each classroom in the next two to three weeks, students working on various themes started to create Super Notes to summarize their progress for sharing with their own classmates as well as with the other Grade 5/6 classroom. Students from the two classrooms read each other's Super Notes and discussed insights gained. An intensive whole class meeting was organized in each room for students to reflect on what they had learned from their peer classroom and the prior classes and planned for possible deeper research.

Figure 1. The "Super View" for Sharing Journey of Thinking Synthesized by Different Classrooms.

Data Sources and Analyses

The data sources included observations and video recordings of classroom discussions, online discourse in each classroom's regular views and the shared Super View, and student and teacher interviews. The video records and related observation notes captured major classroom episodes (seven lessons of Mr. B and six lessons of Mr. M) in which students were introduced to the Super View, discussed information learned from the Super Notes of the other classroom, and created Super Notes based on their own work for cross-classroom sharing. We interviewed the two teachers and 13 students at the end of the unit. The students were asked how a "Super Note" was different from other notes, how they decided what specific ideas should be included in their Super Notes, and how was reading the Super Notes of other classrooms helpful for their knowledge building. The teachers were asked how the cross-community interaction helped their students and how they facilitated such interactions. The interviews were video-recorded and transcribed for analysis.

Guided by each of the three research questions, we conducted detailed analysis of the classroom videos and interviews in connection with student discourse in the shared Super View and their own regular Knowledge Forum views. Specifically, to develop an overall sense of the student-generated Super Notes in connection with their knowledge building discourse, we conducted content analysis (Chi, 1997) to code student notes in their regular Knowledge Forum views based on the inquiry topics reviewed by their Super Notes. Two coders independently coded 81 notes (22% of the total notes) resulting in an inter-rater agreement of 98%. Following procedures of grounded theory analysis (Strauss & Corbin, 1998), the researchers read and re-read the transcriptions of the classroom discussions and interviews, created open codes, which were then clustered into primary themes to capture prominent patterns addressing each of the three research questions. The authors then co-reviewed the open codes and initial themes and discussed any disagreements. The themes were further validated through checking data against the themes, relating and comparing the themes identified from student and teacher data, and triangulating the identified themes across the data sources. The refined coding themes are elaborated in Results under the three research questions.

Results

How Did the Students and Teachers Conceive the Nature and Role of Synthetic Boundary Objects from Other Communities?

Qualitative analysis of student interviews revealed interrelated themes about how the students conceived the nature and role of the Super Notes (see Table 1).

Table 1: Students' conceptions of the Super Notes captured in the interviews.

Themes of conceptions	Class	Examples from the individual interviews
Super Notes as a summary of "big idea" and knowledge basis.	Both classes	"I think it is to focus on the entire idea of the topic you are focusing on and not just the tiny details you wanna share with the whole class." [….] "So it's just I think the basic basic idea."
Super Notes as refined and "verified" knowledge	Both classes	"Well, we definitely did not include like the information that we did not know much about, because that would mean that.. like if you were not sure if that was right or not, then it would not be good to include it because that would mean that you are technically making a Super Note, which is partially not true…"
Super Notes as a journey of thinking	Mr. M's class	" It's like one huge note that reflects on all of your ideas, and what you used to think and what you now know. So I thought it was a great idea rather than making a bunch of notes on your progress of learning a topic."
Super Notes as knowledge for others	Mr. B's class	"…it's kind of to let everybody know what you are researching, but without having to read like all the stuff that you've read and having the basic knowledge of that topic."
Super Notes as well-phrased and polished ideas	Mr. B's class	"When you look at normal notes, it's kind of hard to understand: there maybe some spelling errors, and maybe some like grammar errors… If you look at Super Notes that are amazingly written and they are really simple and they help people understand what is the main focus of this Super Note."

Both teachers conceived and presented the "Super View" as a higher-level space of discourse that required students to formulate and summarize "big ideas" investigated so far. Unlike regular KF notes, the Super Notes needed an additional level of reflection and refinement: both teachers asked students to show them the final draft of their Super Notes before posting to the Super View. While sharing this common conception, the two teachers gave slightly different emphasis. Mr. B, who were more experienced with knowledge building, explicitly emphasized that the Super Notes were about sharing the "journey of thinking" rather than specific information. The goal was to show how their understanding and thinking had evolved during the course of the inquiry. Therefore, the Super Notes had a metacognitive layer that was weak in regular notes. The teachers commented that the Super Note scaffolds played a crucial role in making this metacognitive layer visible by framing the process of thinking from "what you used to think" to "what you understand right now" with "an eye on helping someone." While both teachers emphasized using the scaffolds as a way to structure the Super Note, Mr. B underlined the importance of clarity, so the Super Notes could be understood by students from a different classroom, who lacked the knowledge about the classroom contexts. For Mr. M, the Super Note was about pulling out the important ideas from their regular KF views and bringing together "important points or discoveries that everybody should know about." Unlike Mr. B, he did not explicitly emphasize that the Super View was intended to be a communal place shared with the other classroom. During the interview, Mr. M commented that some of his students were somehow afraid or hesitant to take the leap into the "super level."

How Did the Students Generate Synthetic Boundary Objects?

This question was investigated through tracing student online discourse in relation to their Super Note topics as well as qualitative analysis of the video-recorded classroom interactions and student reflections captured in the interviews. Figure 2 reports the Super Note topics covered by the two classrooms and the number of regular Knowledge Forum notes/posts related to each topic. Mr. B's students created a total of ten and Mr. M's students created six Super Notes. Their Super Notes addressed both shared and unique topics of inquiry. While some of the Super Note topics had intensive discussions on Knowledge Forum, a few other topics had only been addressed by very few regular notes. These topics were very specialized (e.g. allergies, heart stroke, and scariness) but were identified as interesting and helpful for other students in the classroom discussions. Another related factor, according to the teachers, was that some of the inquiry work was documented in students' personal notebooks and shared face-to-face, therefore, not reflected on Knowledge Forum.

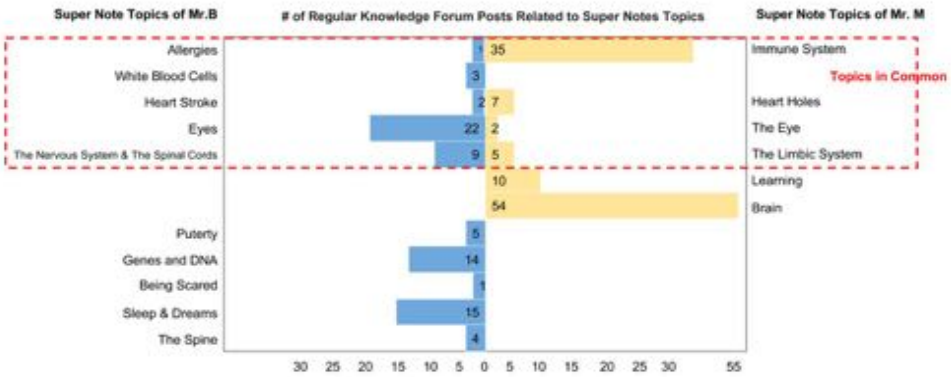

Figure 2. Super Notes Created by the Two Classrooms in Relation to Regular Knowledge Forum Notes.

The qualitative analyses of videos and interviews revealed essential processes that went beyond simple summarization of information to including high-level reflection on progress and gaps, rising above distributed ideas and information sources for coherent understandings, and selective integration of "juicy" ideas for cross-classroom sharing. The specific processes are elaborated below.

(a) Whole class discussion to identify productive areas of inquiry and form specialized groups. In each classroom, the teacher asked his students to reflect on their inquiry work in various areas about the human body and form into small group based on specialized interest to generate Super Notes.

(b) Reviewing previous Knowledge Forum posts and personal notes to identify knowledge advances, in small groups. Prior to the Super Note intervention, students wrote in their regular Knowledge Forum views to share specific questions and ideas, explore information from authoritative sources (e.g. books, videos), and discuss findings from experiments. Students also took personal notes about their research. The teachers encouraged their students to review their online posts and personal notes as a starter for the Super Notes. For instance, in the group focusing on DNA, four students first updated their personal notes taken in MS Word and shared their documents by passing around each other's computer. Summarizing four separate long documents was challenging, so Mr. B, noticing the challenge, approached the group and suggested to choose one person to type the big Super Note. The small group discussed what should be included in the Super Note.

(c) Deepening research using authoritative sources, as groups and individuals. Reviewing and analyzing existing work and ideas, students noticed questions and issues that needed to be clarified. This pushed the students to conduct further research using information from books, videos, and websites. Some of the sources were beyond the students' level of reading. The teachers worked as a co-learner and helper to interpret the information, explain scientific terms, and model rephrasing ideas using simpler terms.

(d) Combining each other's ideas and expertise for coherent group understanding. To understand the complex mechanisms underlying the topics (e.g., DNA, immune system, heart holes), students worked collaboratively to develop specialized understandings and further combined the information to elaborate the full picture. As a student from Mr. M's class reflected: "*I actually worked with a friend on this [topic about heart holes], and she was mostly working on where heart holes are, like I told you they are on septum, and I was working on how they heal. And she asked a question on the regular view on "how the heart holes heal?" so I've researched that and we kind of combined our ideas, and put [them] in a Super Note.*" The Super Note created by these two students is shown in Figure 3.

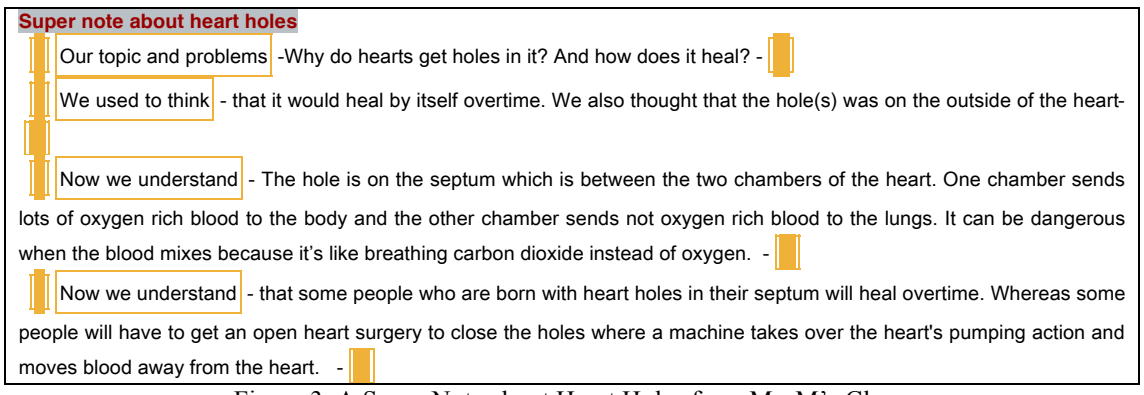

Figure 3. A Super Note about Heart Holes from Mr. M's Class.

(e) Selecting ideas for sharing through group and individual reflection. In light of the diverse ideas reviewed, students in each group decided on what should be included in their Super Note. The analysis of the interviews identified a number of criteria that the students had in mind when selecting information: consistency, importance, depth of understanding, and relevancy. For example, a student said: "*Well, we definitely did not include like the information that we did not know much about... So we've looked at things that we've seen consistent… that we all knew.*"

(f) Summarizing "big ideas" using accessible language with the Super Note scaffolds. Both teachers encouraged students to use the Super Note scaffolds to summarize ideas: start with "we used to think," continue with "now we understand," and finish with "we need deeper research." Both classrooms analyzed Super Notes from previous classrooms to illustrate the use of the scaffolds. Students, reminded by their teacher, took conscious efforts to present the information in a simple and clear way to make it accessible to students from other classrooms. As a student working on DNA put it during the interview: "*we used simpler words so people would actually understand, because the people who do not work with… like they have not done much on genes and DNA, they would not know a lot about it… So you have to use simpler words, try to simplify… like break down the parts of words, if you can't replace it with something else*."

(g) Sharing the Super Notes with the teacher before posting. Both teachers asked students to show their final drafts of Super Notes before posting them to the Super View. Doing so encouraged students to write careful Super Notes and ask their teacher for advisory input.

How Did the Students Interact with Synthetic Boundary Objects?

On average, each of the Super Notes from archived idea threads of prior classrooms was read by 19.83 students. Students read their peer classroom's Super Notes more actively (34.6 users per note) than those from the prior classrooms. Beyond individual reading, each classroom had a whole class discussion about the information from the Super Notes, followed by further small group discussions. Through qualitative analysis of the video records of the whole classroom discussions and student interviews about how they approached the Super Notes, we identified specific patterns of interactions, which were further clustered around three themes, as elaborated below.

(a) Identifying knowledge from other classrooms for possible connection. In whole classroom discussions, students identified Super Notes from other classrooms that were relevant and interesting and contained new information, such as by saying "*I am interested in K's note about allergy.*" They related the Super Notes to their own understanding in order to comprehend the topics and enrich their learning.

(b) Comparing knowledge work between communities triggering student reflection. Students discussed how new and unique ideas from the Super Notes helped them to go beyond the limitation of their own knowledge. The teachers facilitated the discussion by raising deeper questions for reflection. For example, Mr. B asked: "*What was the idea that came from the Super Notes that you hadn't thought before and that pushed your thinking further?*" A student responded: "*Well I never really thought about what side of the brain controls what side of the body, while I already know, but it turns out that, your left side of the brain controls the right side of your body*". Similarly, Mr. M asked his students: "*What topic either strikes you as new information or something that you'd like to pick up as a thread and go deeper into?"* Two students responded that they learned from the Super Note about allergies, a topic investigated by Mr. B's students but not covered by the students of Mr. M. Another student pointed out a deep concept learned from a Super Note of Mr. B's class related to their own work: "*Me and J are doing immune system,… and we saw these notes about white blood cells, and that was really cool 'cause white blood cells were part of your immune system. We don't really know about them individually…Yeah, it was really helpful for us…*"

In addition to reflecting on new knowledge and information gained from the other communities, students further adopted the epistemic form of reflective thinking: "we use to think…now we understand…" and talked about their journey of inquiry accordingly. In Mr. B's class, student EL reflected: "*I used to think, there was a person and then they had a brain, and then the brain told the body what to do and that was the end of it, and now I understand that like each part of the body has its own little system.*" Student L responded: "*Everything is…part of like a system, like everything is like I can say work together.*"

(c) Integrating knowledge across communities to develop complementary perspectives and deep understanding. The Super Notes from each classroom were written by students specialized in the related inquiry topics to selectively synthesize key problems and ideas using simple language. When reading the deep questions and ideas from their partner classroom's Super Notes, the students needed to unpack the information to understand the journey of inquiry presented, detect gaps of understanding, and bring together the knowledge from their own and from the other community to address the gaps and problems. With their teacher's facilitation, students engaged in extended discourse to collaboratively solve problems and develop explanations. For example, students in Mr. B's room discussed the Super Note about heart holes written by Mr. M's students (see Figure 3), which highlighted why heart holes can be dangerous. The students in Mr. B's room indicated interests in this topic and discussed the specific reasons and mechanisms.

[16] K: like the heart hole, I heard of them, but I didn't know how that really works.
[17] S: if you can have a hole in your heart, without it, like, immediately, you exploded.
[18] Teacher: Well, but what was the problem if you have a hole in your heart?
[19] D: It's like really dangerous if the blood mixes.
[20] Teacher: Right, the blood mixes, but why is it bad if the blood mixes?
[21] B: Because if they mix together, if they mix, they will be as bad as like breathing carbon dioxide.
[22] Teacher: A, do you want to build on?
[23] A: Because the blue side like that has no oxygen.
[24] Teacher: This side, no oxygen (writes "no oxygen" on the blue part of the figure on the Smart Board).
[25] A: And other part has oxygen.
[26] Teacher: This does have oxygen. So if they mix, it's like you are breathing air with no oxygen in it, it will be like suffocating.
[27] S: (reads the Super Note) It says the hole is on the septum, which is between the two chambers of the heart. One chamber sends lots of oxygen rich blood to the body and the other chamber sends not oxygen rich blood to the lungs...
[28] Teacher: I think a lot of people might have thought the heart pumps blood to the body, but it's more complicated than that. What does it actually do?
[29] S: I am pretty sure that the blood comes through without oxygen can go around the body, and then it goes through and then it collects oxygen, gives it to the body, it comes out the other way, it keeps going around in the cycle.
[30] Teacher: Do you want to build on that, M?
[31] M: Well, it goes through all four chambers, well in the right chambers, its deoxygenated the blood in there, and its goes through of the heart, which pumps oxygen inside the blood and then it gets sent out through the body.
[32] Teacher: So it's working with oxygenated blood, and blood with no oxygen. C?
[33] C: While, pretty much blood with no oxygen goes to the lungs, and the lungs give it oxygen, and then it circles back to the heart, and the heart pumps out.

In line 18 in the above excerpt, the teacher rephrased student K's question of "how that really works" as "what was the problem if you have a hole in your heart?" He invited and facilitated interactive input from his students, who brought knowledge about the respiratory system and circulatory system to analyzing the impact of heart holes. Building on student input, in line 28, the teacher highlighted that the function of the heart is more than pumping blood to the body and invited students for full explanations. In lines 29-33, students S, M, and C built on to one another to elaborate the explanations. Following the above discussion, the teacher and his students improvised a participatory simulation to demonstrate how the blood travels to collect and transmit oxygen. The teacher played the heart, and three students played the blood cell, lungs, and the rest of the body, respectively, with the whole class involved in discussing where the blood cell should go, and with what changes in the process of traveling.

Discussion

This study analyzed a designed case of cross-community interaction mediated through synthetic boundary objects. As the findings suggest, the fifth- and sixth-graders showed complicated conceptions of the Super Notes for cross-community interaction, which are in parallel with features of boundary objects as described in the literature (Star & Griesemer, 1989; Wenger, 1998). They conceived that Super Notes should present "big ideas" and refined (verified) knowledge potentially relevant and interesting to other communities, and that knowledge and ideas should be structured consistently as a journey of thinking (in line with the Super Note scaffolds) and well-phrased and polished, so students from other classrooms could understand. Such conceptions of Super Notes were demonstrated in students' practices to generate their Super Notes. They reflected on productive areas of inquiry emerged from their community's discourse and inquiry work; reviewed diverse ideas from their online posts, personal notes, peers' input, and authoritative sources; selected information based on importance, depth, consistency, and relevance to others; and summarized and phrased their Super Note content using the scaffolds to make their knowledge readable and accessible for students from the other classroom. As the students commented, their peers' Supper Notes "are amazingly written, and they are really simple and they help people understand what is the main focus of this Super Note." The analyses of the classroom discussions and student interviews suggest that the students engaged in active and substantial interactions with the Super Notes from other classrooms, with more attention paid to the Super Notes created by their partner classroom than those from prior classrooms. The patterns of interactions support productive mechanisms of boundary crossing suggested by Akkerman and Bakker (2011). Specifically, students identified

relevant and interesting Super Note topics from other classrooms, compared the different perspectives and inquiries, triggering deep reflection on their own journey of inquiry and extended discourse to integrate and build new knowledge across communities. The cross-community interaction was far beyond writing and reading summaries but served to foster deeper intentionality in each community and expanded/integrated understandings in-between. In the processes of creating their own Super Notes as well as the processes of interacting with others' Super Notes, students engaged in deep reflection as individuals, groups, and a whole community to review, reframe, and "rise above" (Scardamalia & Bereiter, 2006) their collective knowledge progress and carried out personal and group efforts to address gaps and limitations. The teachers framed the Super View as a higher-level discourse space that required high-level thinking and reflection; supported group processes to identify, select, and summarize "big ideas;" and facilitated knowledge building discourse to identify, compare, and connect knowledge across communities for deep understanding.

Taken as a whole, the results suggest productive patterns of cross-community interaction around synthetic knowledge objects. Implementing cross-community interaction is challenging for both students and teachers. To better support students and teachers, we recently designed a cross-community collaboration platform based on ITM. A multi-year design-based research will be conducted in an international network of classrooms to examine the processes and impacts of cross-community knowledge building.

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Acknowledgments

This research was sponsored by the Cyberlearning Program of National Science Foundation (IIS#1441479). We thank the teachers and students at Dr. Eric Jackman Institute of Child Study in Toronto for their creative work enabling this research.