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Idea Transference and Growth between Offline and Online Knowledge Building Discourse

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Abstract: Knowledge Building is a deep constructivism approach that advocates students take collective responsibility to continually improve community ideas through offline class discussions (i.e., Knowledge Building Circles) and use of an online platform (i.e., Knowledge Forum). Given the complexity of collecting and analyzing offline discourse, previous studies mainly focus on analyzing online discourse while providing classroom observations to enrich context descriptions. How ideas are transferred and developed between offline and online learning environments remains under-investigated. This study analyzed offline and online student discourse during a grade one science class over a period of seven weeks. Results indicate that indicators were found regarding the implementation of each Knowledge Building principles, and the community was more likely to introduce less productive threads discussed in Knowledge Building Circles to Knowledge Forum. These results provide implications for how to facilitate the positive learning experiences across offline and online spaces of young students.

Introduction

An idea is the basic unit of thought and can be treated as a real object/thing for inquiry and improvement in its one right (Locke, 2015; Scardamalia & Bereiter, 2003). Ideas are placed in the centre of Knowledge Building, a socio-constructivist approach that advocates students take collective responsibility for improving community ideas (Scardamalia & Bereiter, 2014). Students improve ideas by engaging in progressive Knowledge Building discourse that takes places in offline Knowledge Building Circles (Reeve, Messina, & Scardamalia, 2008) and online Knowledge Forum software (Scardamalia, 2004). Ideas generated out of Knowledge Building Circle discussions may be recorded in Knowledge Forum for continual improvement by all community members, and ideas in Knowledge Forum that need further discussion may be reintroduced in Knowledge Building Circles. An inquiry thread is a conceptual thread of speaking content or written notes which aim to address the same principal issue (Zhang, Scardamalia, Lamon, Messina, & Reeve, 2007), such as "*how do butterflies get their colour*" and "*what are butterflies' wings made of*." Each inquiry thread can be coded as a productive thread or a thread that needs further improvement based on if students improve their explanaitons within the thread. However, it is unclear how ideas are transferred and developed in Knowledge Building Circles and Knowledge Forum because in previous studies, Knowledge Forum discourse is usually the focus, while classroom observations and descriptions are usually used to inform research context.

As an attempt to addressing this gap, we investigated two research questions in this study:

1. What are the indicators that the class adopt a Knowledge Building approach?
2. What idea threads are transferred between Knowledge Building Circle and Knowledge Forum, and how does idea transference relate to idea productiveness?

To answer these questions, we recorded grade one classroom Knowledge Building Circle discussions over seven weeks. Each classroom discussion involved 23 students and one teacher. We transcribed the video recordings of the classroom discussions. The students also used Knowledge Form software to record and develop their understandings of the topics being discussed. We analyzed the transcriptions of the Knowledge Building Circle discussions and the notes stored in Knowledge Forum to identify speaking turns, idea improvement, the main ideas discussed. We also coded the threads for productiveness and tracked if the idea threads were discussed in both spaces and how.

Literature review

Knowledge Building is a socio-constructivist approach with theory, pedagogy and technology aligned. It advocates that students take collective responsibility for improving community ideas by engaging in progressive Knowledge

Building discourse (Scardamalia & Bereiter, 2014). Progressive Knowledge Building discourse is about identifying weakness and achieving greater explanatory coherence of ideas through the broadening and deepening of explanations (Thagard, 2007). Just as what scientists do, in Knowledge Building context, students engage in knowledge creation process through high-level knowledge work such as setting their goals, engaging in long-range planning, using different ideas to spark and sustain ideas, monitoring idea coherence and assessing their work. The knowledge created by students is new to their community, but not necessarily new to the world. The twelve principles proposed by Scardamalia (2002) define Knowledge Building and distinguish it from task-based approaches or more traditional instructional approaches.

Knowledge Building discourse takes places both in face-to-face Knowledge Building Circles and online Knowledge Forum. Ideas are improved through progressive Knowledge Building discourse. In a Knowledge Building Circle, a teacher and students sit in a circle in which everyone is equal and welcome to participate in peer-to-peer discourse that allows the community to develop norms and build ideas collectively. Knowledge Forum is a software environment developed to support Knowledge Building practice. Knowledge Forum supports students to contribute to a shared space, to read and build on ideas, to introduce authoritative resources and to rise above diverse ideas. Knowledge Forum also provides epistemic markers/sentence starters such as "I am wondering", "this theory cannot explain", "new information", and "put our knowledge together" to help students engage in high-level knowledge processes and work with emergent knowledge improvement needs (Scardamalia & Bereiter, 2003). These markers can be customized and co-constructed by students and teachers.

The importance of investigating both the Knowledge Building Circle and Knowledge Forum discourse has long been recognized. For instance, to provide qualitative information about students' metacognitive abilities, Resendes, Scardamalia, Bereiter and Chen (2015) examined the recorded videos of a grade 2 class engaged in Knowledge Building talks about the visualizations of the scaffolds and words they used in their notes. Yang, van Aalst, Chan, and Tian (2016) conducted classroom observations when students were engaged in inquiries related to Knowledge Building. Along with video-recordings of reflective-assessment sessions, student interviews and artefacts, the classroom observation data helped identify the critical events of reflective assessment. Lossman and So (2010) compared the Knowledge Building Circle and Knowledge Forum discourse and found that in Knowledge Forum, there was a higher demand to ask each other to clarify ideas and questions than that in classrooms; and more diversity of ideas and questions were found in Knowledge Forum while in the classroom, there were clear signs of Initiation-Response-Evaluation patterns of discourse in which students responded to teacher-initiated questions. Halatchliyski, Hecking, Göhnert, and Hoppe (2013) introduced the scientometric analysis of main path analysis, a quantitative measurement of scientific work, to analyze the evolution of ideas in knowledge building communities.

Overall, collecting and analyzing Knowledge Building Circles discourse is tedious work, and previous studies of knowledge building discourse have focused more on Knowledge Forum discourse (Lossman & So, 2010). Classroom observations are usually conducted to provide qualitative information and descriptions to help understand the contexts so as to inform the interpretation of Knowledge Forum discourse analysis and results. Knowledge Building Circle discourse has been rarely examined with scrutiny, and how ideas are transferred and developed between online and offline learning environments remains under-investigated. Therefore, the goal of this study is to understand idea transference and improvement across offline and online Knowledge Building Environments.

Methodology

Participants and learning context

Mixed method design (Tashakkori, Teddlie, & Teddlie, 1998) was adopted to collect and analyze data. Twenty-Three grade one students (age 6-7) and their teacher at a school located in an urban area of Canada participated in this study. The school and the class represented the city's diversity in terms of multi-ethnic, economic and gender balance. Prior to commencement, this project was given ethical approval by the school and the university's review board. Consent forms were signed by the parents/guardians of the participants. The teacher had more than fifteen years of experience applying the Knowledge Building approach in her class with young children. The students had limited previous experiences with iPads and computers in school and did not use Knowledge Forum software before. The learning objective of the science course was to understand the life stages of butterflies. In order to do so, the

class participated in offline Knowledge Building Circle discussions (see Figure 1), contributed ideas in Knowledge Forum (see Figure 2), observed the growth of caterpillars/chrysalises/butterflies in a cage in their classroom (see Figure 3), and sometimes sat around the smartboard and discussed face-to-face to rise above their written notes in Knowledge Forum (see Figure 4).

The Knowledge Building session took place twice a week and lasted approximately one hour each time. The study lasted for seven weeks. Overall, in the first three weeks, the students mainly worked in Knowledge Building Circles. In the fourth and fifth weeks, they worked online with the teacher's simple instruction at the very beginning. In the last two weeks, the students and teachers transferred between online and offline discussion as needed. Through the process, the students observed the growth of the larva in their classroom, which served as a kind of authoritative resources to help them verify their theories regarding the life stages of butterflies. During the Knowledge Building Circle sessions, all students as well as the teacher and a researcher simultaneously sat in a circle and participated in Knowledge Building discourse. However, students were required to take turns for online knowledge work on Knowledge Forum as there were only six computers available. In addition, the grade one children were novices to Knowledge Forum and typing. As a result, they needed assistance. The teacher and researcher were unable to work with many students at once. The students were divided into four small groups and when one group of children worked on Knowledge Forum, the other groups of students would be assigned to the special education program or to do some independent reading. Therefore, each student had about 15 minutes to work on Knowledge Forum each session. Seven Knowledge Building Circle discussions were recorded, and 104 notes stored in Knowledge Forum were extracted.

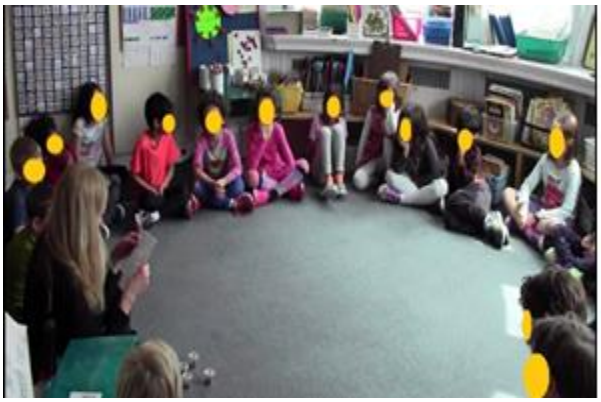

Figure 1. An example of Knowledge Building Circle Discussion

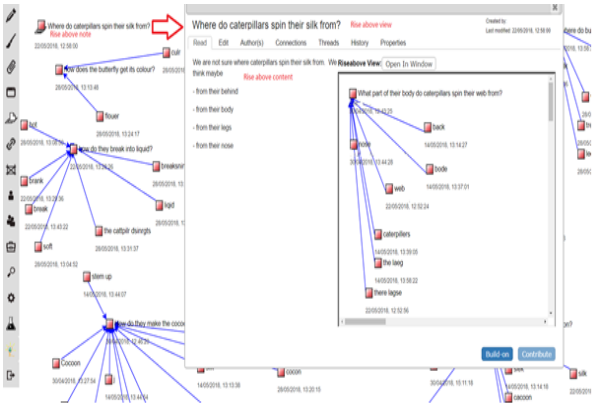

Figure 2. The interface of Knowledge Forum, notes and rise-above.

Figure 2. An example of observation of the life stages of butterflies.

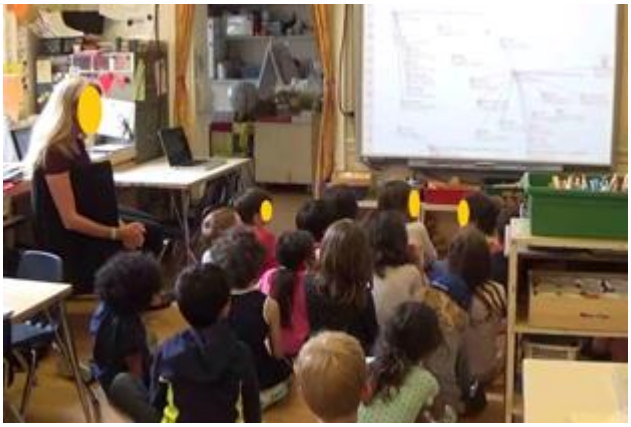

Figure 3. An example of rising above Knowledge Forum notes as a community.

Data analysis

The Knowledge Building Circle discussions were transcribed verbatim. The teacher and student speaking turns were recorded using the Qualitative Data Analysis Tool (Zhu et al., 2019). Typos in students written notes have been corrected, and each student has been assigned a pseudonym in this study. To understand the indicators whether the community adopted Knowledge Building approach (research question 1), we looked for evidence to support each of the twelve Knowledge Building principles in the transcripts of Knowledge Building Circles and Knowledge Forum notes.

To respond to the second research question concerning idea transference between Knowledge Building Circle and Knowledge Forum and their productiveness, we first applied an idea improvement coding scheme to the transcripts of Knowledge Building Circle discussions and Knowledge Forum notes. As shown in table 1, the coding scheme includes the categories of "fact-seeking question," "explanation-seeking question," "simple claim, appraisal, or paraphrase," "partial explanation or elaboration request," "explanation," "new idea," "synthesis," and "classroom management." It was revised based on a content analysis framework (Yang et al., 2016). Regarding the transcripts, one researcher coded all the speaking turns, while a second trained rater coded 57.90% of the speaking turns. The disagreement between the two raters was discussed and resolved. Then the first rater went through the left speaking turns and made relevant revisions to the coding based on the new shared understanding. Both researchers coded all the 104 Knowledge Forum notes using the same idea improvement coding scheme. Similarly, the difference was resolved, and an agreement was achieved. Then we identified various inquiry threads out of the Knowledge Building Circle transcripts and Knowledge Forum notes. Each inquiry thread was analyzed as a unit to track when and where it was initiated, to what extent it was developed and improved, by whom, through what kinds of idea improvement moves, if it was transferred to different spaces (e.g., from Knowledge Building Circle to Knowledge Forum), and how transference between spaces related to the productiveness of the thread.

Table 1. Coding framework for idea improvement analysis of Knowledge Building Circle and Knowledge Forum discourse

Coding categories	Sub-categories	Description
Questions	Fact-seeking	Questions on the definition of terms or concepts, or seeking factual Information.
	Explanation-seeking	Questions seeking open-ended responses with elaborative explanations.
Ideas	A simple claim, appraisal, or paraphrase	Opinion without any elaboration or justification, indicating shared or different opinions or understanding, or a restatement of the previous idea.
	Partial explanations or elaboration request	Expressing alternative ideas with partial explanations; requesting the previous author to elaborate; adding details to previous ideas. The explanations may include some misunderstanding.
	Explanations	Reasons, relationships or mechanisms elaborated. The explanations are scientific.
	New ideas	Introducing ideas/concepts that not previously exist in the community with elaboration or justification.
Community	Synthesis	Connecting or comparing different ideas.
	Classroom management	Regulating community norms such as title writing, spelling, responding behaviors, turn taking, etc.

Findings

Adoption of Knowledge Building approach

Evidence was found to support each Knowledge Building principle. The class began from *authentic questions* students cared about such as why caterpillars grow so fast and why newborn butterflies are wet. Students provided different theories to these questions, built on and improved community knowledge by asking explanation-seeking questions and using *authoritative resources* such as books. Students not only discussed butterflies at home as revealed by a student who brought milkweed plant seeds to school after discussing butterflies with his father but also recalled previous butterfly experiences such as seeing a butterfly migration in California. This suggests the *Pervasive Knowledge Building*. The teacher managed class norms by making sure everyone had access to Knowledge Building Circle including those who rarely spoke. Students collectively synthesized their ideas to different conceptual themes and created rise-above notes. Furthermore, they evaluated their knowledge, identified knowledge gaps and planned for next steps such as looking into books and observing the class caterpillars and chrysalises.

Idea transition and productiveness between Knowledge Building Circle and Knowledge Forum

The inter-agreement reliability of idea improvement coding between the two raters is 90.81% for Knowledge Building Circle transcripts and 85.58% for Knowledge Forum notes. All the disagreement has been and resolved, and an agreement has been achieved. In the Knowledge Building Circles over seven weeks, 61 idea threads were identified. The idea threads discussed each week were visualized according to a sequential order in Figure 5. Eight of the idea threads are about classroom management. Examples of classroom management include when the teacher managed classroom norms, showed the students how to log in Knowledge Forum and explained what to do in Knowledge Forum, saved a bookmark of Knowledge Forum on each computer, assigned tasks for each group, and wrapped up at the end of each session. Two of the idea threads were related to technical issues—the teacher could not find her contributed note in Knowledge Forum, and the projector did not work. The other 51 idea threads were conceptual ideas directly related to butterflies and rise-above processes.

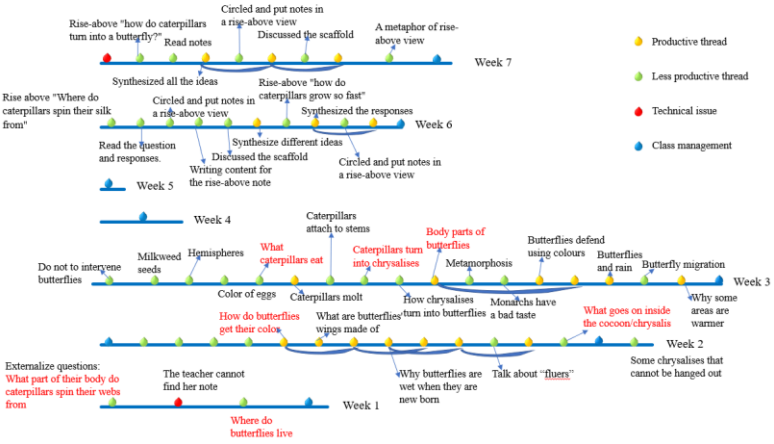

Figure 5. Idea transference and productiveness in Knowledge Building Circles over seven weeks.

Among the 51 ideas threads, 19 are productive, indicating the students improved their explanations in these threads or the teacher and students made collective effort to rise above these ideas. The following is an example of a productive idea thread:

S12: I heard butterflies are wet when they are from their cocoon.

T: You mean when they first come out?

S12: Yeah.

T: Do you know that they are?

S12: Yeah, because I have seen a butterfly flap its wings, and it said in a book. I looked in a book, and it said, "Butterflies get dry by flapping their wings."
T: Oh, ok. So you are thinking they come out wet.
S12: Yeah, because that is what it said in the instructions.
T: Ok, so you are wondering why they are wet?
S12: Yeah.
T: Oh, do you have a theory about that, S12?
S12: I think it is wet in the cocoon.
T: Do you have a theory? No? Does anyone have a theory about why the butterflies might be wet when they come out? What do you think, S3?
S3: It is wet in the cocoon.
T: Oh, yeah. What do you think, S4?
S4: Because they are wet when they are in the cocoons. So when they come out, they are covered in liquid so when they flap their wings, so they get dry.
T: you are back to that idea about there being liquid in there.
S18: And the caterpillar actually has liquid on it so when it is in … I am building on S4's. It… umm… it comes out with liquid all over it so that it has to dry out and flap its wings.
S9: Maybe the stalk is wet.
…[The students contributed different theories why new-born butterflies are wet]
T: Oh, does it turn brown? Ok, S10?
S10: Umm. Because it comes out fresh! Because they are new, that is why.
T: You say 'they' but I do not know what you are talking about.
S10: Because like, when the caterpillars come out, they are wet. They are new. So maybe that is why.
T: Do you mean, when the caterpillars are born?
S10: Yes, because maybe when they are a caterpillar, they are wet so when they are a butterfly they are wet.
S13: Maybe it is some liquids in their body that they do not need any more and it somehow comes out of their body.

In the above excerpt, S12 introduced the *authentic question* of why butterflies are wet when they come out from chrysalises because he saw a butterfly flapping its wings and read related information in a book. Then S3, S4, S9, S10, S12, S13 and S18 built onto this question with different theories such as the butterfly is wet in the cocoon, when a butterfly comes out it has liquid all over it, butterflies shed their skin and may use their tongue to bite their skin off, and some liquid acid butterflies do not need comes out of their body. The students' collective efforts to deepen their explanations are obvious—from it is wet in the cocoon, to the improved explanation that some liquid that butterflies do not need comes out of their bodies and makes them wet when changing from chrysalises to butterflies.

Thirty-two idea threads were identified as needing further improvement, suggesting these ideas were not developed to a satisfying degree. The following is an excerpt of an idea thread that needs further work.

T: I do not know if scientists have really figured out exactly what goes on inside the cocoon or inside the chrysalis. It is kind of magical, to think that one thing can turn into another thing, like a caterpillar into a butterfly. So we will see if some of our books can help us with this a little bit. And also we will look closely at our chrysalises and see if we can notice anything over the next week or 10 days or so before they hatch.
S18: Umm... One of the … what we have said about the chrysalis turning green, that is actually one of the stages.
T: So that all is from that book you showed us yesterday?
S18: No, from a different book.
T: Ok, so that is normal for it to turn green.
S20: It would be really cool to see them get out.
T: Well it could happen. It could happen while we are here. Or it could happen on the weekend or at night. So we are just going to have to hope….
S20: I hope it happens while we are here.
T: I really hope it does.

Indiscernible student: … maybe it will come out like 8 in the morning.
T: Do you think S15's will come out at a different time? Yours might come out at a different time. Because it went into the chrysalis a little bit later.
S15: Like a couple of hours.
S21: Maybe hers is the tiniest!
T: Yeah, well we will not know whose is whose now though because I had to put tape on the lids to tape them to the cage so you cannot see the lids at all. I forgot about that. So we do not know whose are whose now.
Indiscernible student: What if we look on the bottom?
T: You cannot. You cannot see.
Many students: I saw! I saw! I saw!

In this idea thread, the community shifted from why new-born butterflies are wet and began to discuss what goes on inside chrysalises. The teacher suggested they might look at books and observe their chrysalises to achieve a better understanding of what goes inside chrysalises when they turn to butterflies. Then S15, S18, S20 and S20 joined in the conversation and wished they could see the process of chrysalises turning into butterflies. Overall, the community did not try to theorize in this process but mainly made plans for what to observe and what to do next, which is also essential to continual idea improvement.

Seven idea threads were identified in the Knowledge Forum notes. They are *caterpillars to cocoons*, *cocoons to butterflies*, *what part of their body do caterpillars spin their web from*, *how do caterpillars grow so fast*, *how does butterfly get its colour*, *where do butterflies live*, and *what are butterflies' predators*. Only one idea thread was considered productive in which one student responded to the community question "*How do they make the cocoon with the stem up*" with "[*Butterflies*] *put silk on a branch. The caterpillar goes into a J shape. Then it curves up and then it attaches itself to the branch, and then it turns into a cocoon*." The previous responses to the question were "*the silk pad they spin silk in a circle*" and "*It comes out of their bum*", which were not as comprehensive or coherent as the improved one.

The text highlighted in red as shown in Figure 5 indicates the idea threads were also discussed in Knowledge Forum, such as "*What part of their body do caterpillars spin their webs from*", and "*where do butterflies live*". The idea threads discussed in the first three weeks in Knowledge Building Circles were likely to be transmitted to Knowledge Forum for further development. This is especially true for the less productive idea threads since five of the seven idea threads discussed in the Knowledge Forum were idea threads that had been discussed in the Knowledge Building Circles but still needed further improvement.

The students also introduced some productive idea threads from Knowledge Building Circles and continued working on them in Knowledge Forum. For example, in the second week in the Knowledge Building Circle, S18 introduced a new idea about "*How do butterflies get their colour?*" S21 questioned why caterpillars are brown, but butterflies come out of caterpillars have different colours. S18 responded that new-born butterflies get new skins which give them different colours. In the final week, the same student, S18, introduced the same question in Knowledge Forum. S3, S15, S21 and S22 built onto this question with theories like because the silk is green, they go to each flower, the liquid makes the colour, and caterpillars break down into the green liquid. Their ideas were not the same as those proposed in the Knowledge Building Circle and became shorter. Possible explanations are that the thread was introduced in the final week, so the community did not have enough time to improve their theories, and the students" typing ability might not enable them to write complex theories.

Discussion

The community transferred some idea threads from Knowledge Building Circles to Knowledge Forum for further discussion. They were more likely to introduce less productive threads discussed in Knowledge Building Circles to Knowledge Forum, which indicates that the community had a sense of which ideas needed further development. However, the less productive idea threads discussed in Knowledge Building Circles and later introduced to Knowledge Forum may not end up being productive. The students might be able to improve their idea threads in Knowledge Forum if they had a better understanding that ideas belong to the community, if they could type better and if they were given enough time. In addition, how students perceive the functions of Knowledge Building Circle discussions and Knowledge Forum discourse might influence their discourse and behaviour of contribution. For instance, if they consider Knowledge Forum as a place to constantly improve their ideas either have been discussed in Knowledge Building Circles or not, they may build on and deepen their understanding. However, if they treat the

Knowledge Forum as a place to record what they have discussed in the Knowledge Forum, they may just recall the ideas discussed in Knowledge Building Circles and convert them to written notes. While coding students' Knowledge Forum notes, we found their responses to the same idea threads in Knowledge Building Circles, and Knowledge Forum tended to different, and that the previously written notes by the community influenced their following notes. For instance, S22 responded to the question "*why does the cocoon turn green*" posted in Knowledge Forum with "[*It*] *is because the caterpillar break[s] down into the green liquid*." Before S22's response, the community discussed liquid in the Knowledge Building Circles and wrote lots of notes related to liquid in Knowledge Forum. This phenomenon suggests the integral role of Knowledge Building Circle and Knowledge Forum discourse and ideas transference within and across offline and online spaces.

Our results are drawn from a small sample of grade one students working with a teacher who had practised Knowledge Building for about fifteen years. The teacher's practice, time spent on Knowledge Building Circles and Knowledge Forum, students' familiarity with the technology, student typing skills and so forth may all influence the results. There is a need for future work to study idea transition and productiveness with a larger sample of students who are at different grade levels and work with teachers of various levels of experiences. Longer duration of data should also be collected since idea improvement is a continual process while in this study the students did not really start working in Knowledge Forum until the fourth week.

Another direction we will tackle is engaging students in meta-discourse of their participation and investigating its effects on students learning. Previous studies suggest that students can benefit from reflecting on their online discourse supported by assessment tools (Resendes et al., 2015; Yang et al., 2016). The analysis in this study may help the teacher, and students better reflect on their participation, and idea improvement moves both in the offline and online environment to support their learning. We plan to make idea transference and productiveness explicit to students to help them better decide how to use their time and devote efforts.

Conclusion

This research studied grade one students' overall participation in offline Knowledge Building Circles and online Knowledge Forum, how ideas are transmitted across the two spaces, and how the transition relates to the productiveness of idea threads. We found the community successfully adopted Knowledge Building approach, as suggested by evidence to support each Knowledge Building principle; that the offline and online spaces enable the students to make complementary contributions; and that the community was more likely to introduce less productive threads discussed in Knowledge Building Circles to Knowledge Forum. Future work will be focused on replicating the study with a larger sample and extending the time span of data collection. Also, we will investigate how to implement supportive pedagogical and technical designs based on the results of this study to foster idea improvement, for example, highlighting the idea threads that need further improvement.

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