Teacher Learning in a Professional Learning Community: Potential for a Dual-layer Knowledge Building

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Abstract: This study is situated in the field of knowledge building and teacher professional learning community (PLC). It describes a case study of eight elementary school teachers working on lesson design using knowledge building pedagogy to enhance student learning. The research question is: "How is knowledge building accomplished among teachers within a PLC?" The main method employed is the analysis of teacher's discourse in the PLC. Results indicate that although not cognisant of it, these teachers functioned as a reciprocal layer of knowledge builders over their students' work. Critically, teachers' knowledge building was enabled by working with authentic classroom problems, embracing idea diversity and demonstrating epistemic agency in their knowledge advancement. Future work can focus on building teacher's awareness of this layer of knowledge building and scripting creation of knowledge artefacts among teachers to mediate and record their collaborative inquiry.

Keywords: knowledge building, teacher learning, professional learning community

Introduction

This paper is derived from a study on teacher learning as the teachers engaged in advancing their students' knowledge building. It uncovers a tight coupling of teacher and student knowledge building – teachers engaging in building knowledge on their professional practices while attempting to design for their students' learning using knowledge building pedagogy. This study is an attempt to address two intertwining research gaps in knowledge building and in teacher's professional learning community.

Knowledge building is generally understood as a discursive activity intended to enhance collective understanding (Bereiter, 2002). Members in a knowledge building community construct and progressively improve on ideas through knowledge artefacts. Knowledge building is based on the assumption that members engage in specific discourse activities where content of the discourse is related to the construction of coherent and consistent knowledge (Greeno, 2003). Several principles, or what Scardamalia (2002) regarded as socio-cognitive determinants, are needed to support knowledge building. Idea-centric approach and participants' epistemic agency, are principles relevant to this study. In knowledge building, teachers focus on helping students learn through collaborative improvement of ideas on a topic and following the trajectory of idea development, rather than trying to cover topics in a pre-determined sequence. To achieve that, students need to work on authentic knowledge problems that arise from their attempts to understand the world; they need to identify knowledge problems and articulate them as ideas. In a group, there will usually be diversity of ideas among members because of their prior experience and their different strengths and expertise. This provides the natural impetus for discussion about the ideas, leading to collective improvement of their ideas. By improvement of ideas, we mean improving the coherence, quality and utility of ideas. Continual engagement in idea improvement process may lead to rise above, when students are able to integrate several ideas or frame the inquiry using a higher level principle or theory. This process of negotiation requires enabling conversational moves such as asking questions, and making statements elaborative or regulatory in nature. It also requires the participants to take collective responsibility for learning what they need to know as they engage in deep discussions centered on problematized content. Students show epistemic agency when they display ownership of their collective inquiry: using knowledge criteria to negotiate a fit between their own ideas and those of others and use the differences to catalyse knowledge advancement. Much research has been conducted with respect to students' experiences in knowledge building (Scardamalia & Bereiter, 2010), yet this cannot be said for teachers doing knowledge building as part of their professional learning.

In terms of research gap in teacher professional development, traditionally, the predominant mode involves formal courses, workshops or seminars offered by external agencies, which has limitations in terms of the real impact on how teachers can address problems encountered in their classrooms (Lieberman & Mace, 2008). This mode of professional development may lack nuanced sensitivity to the classroom challenges and does not provide contextualised learning opportunities for teachers to reflect on and improve their classroom practices (McLaughlin & Talbert, 2006). In recent years, professional learning community (PLC) (DuFour et al., 2006) is

gaining traction for its affordances for teachers to engage in collaborative investigation of classroom practices specific to a school setting so as to enable more direct impact on student learning (McLaughlin & Talbert, 2006). However, research is relatively silent on how teachers learn in PLCs that can transform student learning. Using cultural historical activity theory as a lens, Lee (2015) studied two PLC activities in a Singaporean elementary school where 13 teachers engaged in book study and lesson study over two semesters. Lee reported several disturbances to teacher learning in the book study sessions, which include the lack of preparation for assigned readings, teachers' reservations about the ideas in the selected book, teacher's struggle with competing activities in the school, and extensive focus on content coverage and recall rather than application of the ideas. Teachers were more engaged in the lesson study sessions, but there were still disturbances attributed to challenges in logistical arrangement for observation and post-lesson colloquia.

There are potential values in integrating teacher's knowledge building and professional development. Currently, existing cultures and discourse communities in many schools do not value or support critical and reflective examination of teaching practice (Putnam & Borko, 2000). Educational reformers have argued that for teachers to be successful in constructing new roles, they need a platform to participate in a professional community that "discusses new teacher materials and strategies and that supports the risk taking and struggle entailed in transforming practice" (McLaughlin & Talbert, 1993, p. 15). PLCs offer fertile ground to study knowledge building practices in teacher community. When teachers come together in a discourse community, they draw upon and incorporate each other's expertise to create rich conversations that offer new insights into teaching and learning. As teachers share their expertise in a PLC, they construct new knowledge about instruction and content (Little, 2003; Stoll et al., 2006). In fact, collaborative work in teaching involves problem posing and the articulation of practice (Horn & Kane, 2015). Teachers are positioned to learn from talking with colleagues and there are opportunities for learning constituted in teacher workgroups.

This study examines teacher learning opportunities and possibilities residing in teachers' PLC meetings and addresses the research question: "How is knowledge building accomplished among teachers within a PLC?" There were studies about how teachers and facilitators work together for knowledge building (Orland-Barak & Tillema, 2006), but less is written about how knowledge building proceed when teachers come together in a PLC to improve classroom practices for enhancing students' learning. Importantly, the teachers in this study adopt knowledge building pedagogy (Scardamalia & Bereiter, 2015) that focuses on engaging students in solving scientific problems and in writing. With the current gap about knowledge building in PLCs, our work aims at contributing to the understanding of how PLCs afford opportunities for teacher learning and innovation in knowledge building practices. Second, focusing on the content of teacher talk, it offers insights into how conversations may be a source of knowledge building for teachers. Overall, this study has the potential to update collective repertoire of practices (Allaire, Laferrière, & Gervais, 2011) as we surface how principles of knowledge building can supply intellectual, social and materials resources for teacher learning and innovations in practice.

Methods

Instrumental case study (Stake, 1995) approach was used in this study as the focus was on gaining insights into how teachers learn as they participated in a PLC rather than an intrinsic interest in the PLC per se. Examination of the interactions is critical, thus, video recording was used as the main data collection method. We video recorded the PLC meetings by directing a video camera at the teachers seated around the meeting table to capture their talk. In this way, we were also able to zoom in on teachers' gestures as well as images projected on a projector screen in front of the meeting table if any. This resulted in 20 hours of video-recorded meetings that captured the interactions between the teacher participants of the PLC meetings. Pseudonyms are used in this report as a preemptive measure to protect the identities of the participants.

Participants

The research team worked with eight elementary teachers from Future State Primary School to incorporate knowledge building principles in the design of their elementary science and English lessons. The teachers have been teaching from 2 to 15 years. The teachers met once weekly for two hours to design lessons. These meetings were facilitated by Cindy, a former secondary school teacher, who has cumulated more than 10 years of experience implementing knowledge building pedagogy, as well as working with multiple schools on implementing knowledge building principles. As part of the field support, Cindy first provided training for teachers on the use of Knowledge Forum and its associated learning environment before they met weekly to craft their lesson deigns. Importantly, Cindy catalysed collaborative knowledge building for the teachers; and as teachers became more proficient with the pedagogy, her scaffolding faded to an observer role. As a result, the PLC meetings were participant driven as the teachers engaged in the tasks of teaching, assessment, and reflection. Their meetings

were collaborative and interactional in nature (Palinscar & Brown, 1984; Bereiter & Scardamalia, 1989) which further supported the work of the teachers as situated within a PLC.

Analysis

Video recorded data of teachers' weekly PLC meetings were transcribed verbatim. We first read and classified the content of transcripts according to procedural and conceptual discourse. Procedural talk includes discussion on logistics of lessons, venues, and distribution of work. Conceptual talk encompasses teachers' individual reflection, group discussion on how to teach particular a Science or English topic. The start and break of talk segments are marked by teachers announcing their intentions or listing their agenda for the meetings. Focusing on language in use, that is, how teachers used talk to thread lesson design for classroom implementation, we analysed the conceptual discourse that was available for making sense of teachers' knowledge building process.

Next, we created event summaries of the conceptual talk occurring during each PLC meeting to document the instructional topics discussed. This provided a macro view of how the teachers designed Science and English lessons using content topics drawn out from students' knowledge building posts. These event summaries documented teachers' design of knowledge building lessons for their students over time. Importantly, these event summaries identified episodes of interactions which positioned the function of talk against the instructional plans of the teachers (Edley, 2001). Following the principles of interaction analysis (Jordan & Henderson, 1995), we met repeatedly to discuss emergent meanings about the purpose of the teacher talks. We focused on how an idea from one teacher would influence the next teacher who speaks. We were motivated to understand how knowledge building principles may be present in the talk of the teachers. With such a focus, we read the weekly transcripts to familiarize ourselves with the many content topics that were covered. We also examined how a particular topic was developed and built up over the weeks. During the intensive group discussion of the data, we asked questions such as: What is the trajectory of learning across the topic of system? How did the teachers plan on starting the topic of "System"? How did the discussion on "Systems" change mid-way? Did they begin with definitions or questions or case examples to trigger questions from their students? What happened after each teacher shared their individual teaching idea? How did the English teacher respond to the other English teacher's teaching ideas? Did the teachers revisit the questions post by their students? Why are the English teachers focusing on stimulus based conversations as a start for the use of knowledge forum? What is the progression? Were more topics introduced along the way? Such questions were useful in focusing our attention on the discourse of teachers during repeated readings of the transcripts. As our comments and assertions evolved, so did our analytic approach. Ultimately, we applied Scardamalia's (2002) socio-cognitive determinants of knowledge building to identify how the teachers engage with knowledge building during their PLC meetings and all extracts were analyzed by the researchers until a common agreement about the interpretation was established. We then chose representative episodes of knowledge building where instructional topics were designed and subsequently implemented in the classroom to present teachers' work of knowledge building during their professional learning meetings.

Findings

We selected two vignettes of teachers' discourse that could illustrate progression in teacher's pedagogical approach across two subjects: Science and English.

Idea-centric rather than topical approach

This vignette illustrates how Cindy coached the teachers to focus on advancing students' ideas, a key principle of knowledge building, rather than sequential progression across topics to cover the official syllabus.

Relating students' posting about states of matter arising from the topics of life cycles, Patty highlighted the learning trajectory of her students and waited for reactions from other teachers.

> Patty: I have managed to complete the comparison between life cycle of frog and mosquito. But I notice the children are coming to a point where they are talking about matter, changes in state in KF such as water becoming water vapour.

However, Cindy had other concerns. She had wanted to understand the sequence of Patty's classroom events leading to the posts about water and water vapour.

> Cindy: Turn back a bit, with the cloud and water, what happens next?
>
> Patty: They had managed to see water droplets forming during the experiment. Some said it is gas, students said the hot air goes up and then the water vapour is formed inside. That was when I

told them to go on to KF to ask their questions and the students have done that. But I told them to also hold it there as I want to develop the other section of their postings which is related to life cycles rather than the cloud experiments that they have done.

Patty was referring to the "Cloud in the Bottle" experiment that aimed at simulating formation of cloud in a plastic bottle using warm water. Cindy highlighted her concern with students' understanding of clouds and waters under the bigger topic of system. This difference in knowledge problems persisted as Patty announced her intention to tap on students' posts about cloud and water for the bigger topic on States of Matter in future lessons. Countering Patty's ideas that developing students' understanding could wait, Cindy reminded Patty that the original purpose of the "Cloud in the Bottle" experiment was to help students understand the components of a system. Cindy feared missing the opportunity to develop students' understanding of a concept even though it was not required at such depth in the P4 science syllabus. She surfaced the problem more explicitly by asking if students had provided any conclusion about whether cloud was not a system.

Cindy: Did the students come to a conclusion? Is it important for them to have some sense of whether the cloud is a system after all the explanation?

Patty: They talked about life cycle and told them to move on about life cycles. They did not come to a conclusion about whether cloud is a system.

Cindy: But it is important for them to have some sense after their explanation.

Before Cindy could complete her sentence, Patty counteracted to explain that while students did not come to a conclusion, she was satisfied that her students were able to see the process of water cycle as being embedded in the cloud experiment. Not giving up on her idea, Cindy suggested to Patty that she could ask her students to write about whether cloud was a system so as to reveal students' understanding of system. The momentum of discussion continued towards improving of ideas when Patty acknowledged Cindy's concern and suggested a better way of actualising Cindy's suggestion:

Patty: But of course, on the other end, I want students to also know that system is made of many parts working together. Rather than asking students if cloud is a system, to me, I will ask them why do you say cloud is a cloud system inside the water cycle system. Because these students think that it is a system within another system.

Sensing Patty's receptive attitude toward her idea, Cindy quickly suggested that they could pull out a few notes on the Knowledge Forum and to get students to support their writing of their notes with more evidence. At this juncture, Emma, another teacher in the PLC group, revealed that her students had been posting their ideas about whether clouds belong to a system on the Knowledge Forum. Turning their focus on the students' posts in the forum, the three teachers read the notes of students together and noticed that while some students concluded that clouds do not belong to a system, many more students were still holding on to the misconception that cloud is a system. It is interesting to note that in this process, Emma and Patty noted that students would finally realise that cloud belongs to the water system once they proceed to the topic of State of Matter. This helped Patty to find her justification to move on the topic of State of Matter.

Emma: It (cloud) is part of the water system. So that is why we (students) have not got it. Because I think once they do the topic of change of state, then, they will realise that water is after all the same thing.

Patty: So that is why I want to move into matter using these notes. It is changing from one solid to a liquid or liquid to gas. And slowly students will see that it is the same water going up and coming back down and up and it is not many parts.

From resisting Cindy's idea to accepting and improving on Cindy's idea, Patty and Emma moved the conversation towards development of knowledge advancement. Aligning their diverse ideas over the problem of students being uncertain with the concept of system, the teachers made advancement in their lesson design by focusing on students' posts and offering concrete ways of helping students clarify the components of a system. The concerted conversation of these teachers thus became a collective knowledge which resulted in Patty asking students to write out their thoughts about whether cloud was a system in the following day's lesson. Following

knowledge building principles, the teachers offered diverse ideas to deal with the authentic problem of student's understanding and they collaboratively improved on the lesson design ideas.

Rising above current practices

During the 8th PLC meeting for English lessons design, three teachers first recalled verbally how they had in the previous week helped students on a continuous writing task on the topic of a snatch thief through the Knowledge Forum. Kenny took the lead to share how his students managed to conceive greater details supporting the building up of the story:

> Kenny: Students are supposed to come up with one idea first and the other groups are supposed to look at ideas and ask questions based on that particular idea. So we have some examples such as this robber was caught by the police in the end and some students would ask how the thieves were caught by the police. Students also came up with ideas about the type of punishment the robbers would get.

These ideations were concluded by Kenny as useful in helping students focus on their writing task. However, this initial knowledge building effort was negated when Kenny revealed that his students were given a sample writing subsequently so that they could submit an individual piece of writing. In short, the lesson reverted to the traditional mode of scaffolding with model essay.

Next, Priscilla shared a different model for teaching the writing task. She had first paired up with another teacher (Tim) to set up a thread in the Knowledge Forum to demonstrate to students how they can build on their peers' notes. For example, when Tim suggested on the Knowledge Form that the thieves were getting caught, Priscilla would ask how and where the thieves were captured and at the same time offer the suggestion that the police should be roped in for the plot. Guiding students through examples of how they can post their thoughts and questions on the forum, Priscilla modelled for students how they could develop their story plot. Unfortunately, after this modelling, it was back to the usual task of writing as Priscilla gave students sample stories to read after their discussion and students were instructed to submit their individual written work. Finally, Patty shared her method of teaching. She announced that her class was not expected to produce writing with different introductions. However, students were "expected to start with dialogue." Patty justified that within the framework of a dialogue, students could think and articulate in Knowledge Forum how their dialogue could be more exciting and fun. Patty also shared that within the constraint of working only with dialogues for story starters, students were able to generate more vocabulary and scenarios.

As these teachers replayed their instructional acts during the PLC meeting, they seemed to reveal a common trend that students all ended up with individual writing tasks. The messiness of students' posts was not refined and the diverse ideas were treated as alternative ideas. Students were in fact guided through deeply entrenched traditional ways of writing.

The opportunity to break away from current practices came about when these teachers attended a conference on Knowledge Building in Hong Kong. Upon their return, the teachers shared new insights into the ways of doing knowledge building in the classroom during the 10th PLC meeting. As revealed by Patty:

> Patty: We were too stuck in looking at mechanics of writing such as the types of words used. There is no in-depth exploration of the writing. The Hong Kong representatives commented the pictures we used for composition were so restrictive. They proposed we think about doing KB with a thematic slant. For example, we can do KB on a story hand out, so that they can build on their knowledge in the theme, and the subsequent writing piece can be on the theme. In this way, when students do the writing, they can reflect on the themes which they had ideas built upon.

With knowledge gained from the conference, these teachers worked towards higher-level formulation of the writing problem. This was visible as Kenny next announced that the English teachers were going to plan for a writing task on the abstract theme of *Friendship* as mandated by the lower primary curriculum. Critically, the lesson designs were planned to help students build on their own knowledge about friendship:

> Kenny: My initial lesson design requires students to make a stand regarding the story 'The Four Friends'. They will read and reason if the story is a good story about friendship and why. In this way, we will have all kinds of ideas form the students and after that we hope there can be one question where they can build on and then they can tie up with their postings. This would help them in their writing and build on their own knowledge of friendship in their writing.

While Kenny was hopeful that students may pose question such as "I want to know what friendship is all about", which has scope for other students to build on, he was also aware that such a scenario may not pan out. Hence, he suggested that after having students' questions up on the KB wall, they can revisit the theme with another reading about friendship and teachers can ask the same question "is this story a good story about friendship?' As students were expected to give their ideas, teachers subsequently can help them do comparison of ideas and await questions that can tie up with the theme of friendship.

Aligning her ideas with Kenny's, Patty added her own views of how the theme of friendship can be further developed:

> Patty: We intend to come up with the question, ask them an argumentative kind of question whereby they take a stand on a story, the wolf story that they had read last term. The story takes a different perspective of the actual story, so we want our children to take a stand, to decide is the wolf is as innocent as it seems or if the three little pigs are at fault. We hope to tap on the moral of the story which is to be truthful. After that students can go on to the composition about the taxi driver who had passengers leaving their wallets behind in his taxi after alighting. I mean students would have gained the knowledge of being truthful and use the vocabulary generated during posting of their views about the wolf story to write their stories.

Kenny immediately added that Patty could even give students different snippets of stories on truthfulness which will help give students even more ideas for discussion. This exchange captured how teachers rally around the improved idea of providing students with thematic writing tasks. As evident from Patty's comments above, she had extended the writing task to tackle more complex issues such as truthfulness. Subsequently, realising the challenge this new way of teaching may pose for her students, Patty voiced:

> Patty: I actually need suggestions because based on this argumentative task that we are thinking about, students may not come up with questions or examples. This is their first time and they are only at K3.

Not afraid of voicing her fear as a more experienced teacher, Patty felt safe in revealing her uncertainty about this new approach. Supporting Patty's emerging instructional goals, Kenny promptly suggested they could devise a template with scaffolding to help students along in writing down their stand about the stories read. In this way, students could also exchange their writings on the template as notes to help each other along. By offering such a solution that requires a change of the existing scaffolds in the Knowledge Forum, new syntheses was derived at the KF front. By moving to a higher plane of how writing can be taught, the teachers abandoned old methods of picture style writing tasks (the snatch thief) as they embraced a more complex way of teaching thematic writing that can potentially lead to different instructional outcome for different teachers. In the vernacular of knowledge building, the teachers achieve *rise above* from their initial ideas about writing, and display collective cognitive responsibility in contributing to the joint effort in lesson design.

Discussions

The results of our analysis locate knowledge building principles as embedded within conversations of teachers during their weekly PLC meetings. Moving from dealing with authentic problems to embracing idea diversity, Patty and Cindy were initially observed to be reacting to each other's ideas. However, by subsequently taking a collaborative mode to anchor their discussion on how students' posts about clouds and rain can be addressed, Patty improved on her initial idea. As a result, diversity of ideas surrounding students' posts enabled Patty as well as Emma to collaboratively construct an instructional plan for the topic of system different from the initial lesson design plan for the topic of matter. Similarly, over a span of two weeks, Kenny, Priscilla and Patty demonstrated attempts at rising above their initial conception of cookie-cutter type of writing lessons to embrace a thematic approach. This was especially salient when teachers improved on each other ideas on how the theme of friendship could be developed by their students on the Knowledge Forum. Ultimately, they engaged in knowledge building discourse that moved students from simplified writing lessons to a thematic one.

In terms of the addressing the research gap in knowledge building, the two examples in this study illustrate the principles of Knowledge Building (Scardamalia, 2002) in action leading to production of new knowledge for teaching during PLC meetings. These new knowledge include innovation as seen from the way thematic writing tasks were implemented as well as permanent advancement of ideas as evident from instructional designs for topic of *Systems*. Critically, these teachers engaged in the trajectory of knowledge building as they

attempted to design lessons for students to engage in knowledge building. Using the lens of socio-cognitive determinants of knowledge building (Scardamalia, 2002) to analyze the teachers' talks, we uncover a reciprocal layer of knowledge building in action (Table 1). The teachers were engaging in building knowledge on their professional practices while attempting to design for their students' learning using knowledge building pedagogy.

Table 1: Dual-layer of knowledge building

	1st Vignette	2nd Vignette
Teacher's reciprocal layer of knowledge building while designing for students' knowledge building	- Authentic problem of advancing student's knowledge of "Systems" - Diversity of ideas leading to better ideas on how to enact idea-centric pedagogy - Teachers showed epistemic agency in reasoning and rationalizing their actions	- Authentic problem of enhancing students' essay writing skills - Diversity of ideas on how to scaffold students in essay writing - Rise above from cookie-cutter framing of students' ideas to thematic brainstorming of ideas as resources for essay writing - Teachers showed epistemic agency in learning new approach and suggesting ideas to design lessons based on the new approach
Student's knowledge building	Authentic problem on whether cloud is a system	Ideation for essay writing

However, a critical question remains: Can teachers continue to distill their learning during PLCs and translate it into the classrooms and stay faithful to knowledge building principles? First, the teachers may not be aware of this tight coupling of their knowledge building on their professional knowledge while working on lesson design for their students. In short, they are not cognisant that they can apply the same knowledge building principles to enhance their own professional learning. For example, the teachers may not be aware that they can in fact use Knowledge Forum to augment their discussion. By creating their knowledge artefacts in the online forum, these artefacts can mediate their discussion and serve as record of their innovation. Thus, in further iteration of this research, participation of these teachers in the online Knowledge Forum platform will be considered. Examining the posts of these teachers will also allow for inquiry in the innovation challenges faced by the individual teachers as they reflect upon their teaching practices.

In terms of addressing the research gap in PLC, this study suggested a way of engendering teacher learning while making a real difference in student learning. Unlike the lesson study sessions reported in Lee's study (2015), the teachers in this study were deeply engaged in their weekly discussions; they were not rushing to complete the task of "meeting". Similar to lesson study sessions reported by Lee, the teachers in this study made significant progress in lesson design that can impact student learning. The collaborative knowledge building work among the teachers helps them focus on the needs of the learner and work relentlessly to improve pedagogy so those needs are effectively met (Harris & Jones, 2010). Indeed, the knowledge building PLC provides intellectual, social and materials resources for teacher learning and innovations in practice by anchoring collaborative reflective practice on students' real ideas and authentic problems. The students' posts in the Knowledge Forum provide the material resources as referents for teacher's discussion. The common goal in designing lessons to help students advance their ideas provides a natural collaborative task. This arrangement brings meaning to teacher's contribution during their meetings, thus extends taken-for-granted weekly meetings as a means to support their professional thinking instead of a simple requirement task of meeting to work out the logistics of following week's lessons.

Conclusion and implication

The knowledge building practices of teachers in this report highlights the continuity of the work practice and individual teacher's needs to realise their professional development goals. We propose that consideration of teacher learning in a professional learning community be conceptualised in terms of participatory practices as facilitated by knowledge building principles. A helpful approach is to encourage and facilitate teacher learning through work and provision of an environment where such learning and associated teacher professionalism can flourish. Foregrounding knowledge building as a self-organizing concept that engages teachers in continuous improvement of lesson plans for implementation, we concur with Barber and Mourshed's (2009) suggestion that this mode of localized teacher professional development is effective for being authentic, situative, contextualized

and practice-oriented. Moving forward, we suggest enhancing the awareness of teacher participants in terms of the reciprocal layer of knowledge building with more intentional leverage on creating knowledge artefacts to mediate their collective advancement in pedagogical knowledge.

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