

Teacher Noticing Associated With Responsive Support of Knowledge Building

Darlene Judson, University at Albany, djudson2@albany.edu

Abstract: Knowledge building is a student-centered, principle-based approach wherein students assume collective responsibility for collaboration and the co-regulation of activity in inquiry within a domain of study with the support of the teacher. Little is understood about the ways in which teachers support knowledge building in the classroom. This paper analyzes to what and how a teacher attends as noteworthy events in the classroom and investigates his associated enacted responses. The construct of teacher noticing was used to identify examples of teacher noticing attuned to students' ideas associated with responsive actions in the classroom in which the teacher supported knowledge building by empowering students to see and make connections to their own and one another's knowledge work and the ongoing trajectory of inquiry.

Keywords: knowledge building, teacher noticing, responsive teaching

Introduction

Knowledge building in the classroom is a principle-based approach in which students' ideas and emerging understandings are the objects of inquiry in a domain of study, commonly with a Knowledge Forum database. Individuals, groups, and the class as a whole define and refine problems of understanding, hypothesize, research, design experiments, share and build on findings, and monitor progress collaboratively with the support of the teacher. The approach is grounded in 12 principles such as community knowledge-collective responsibility, democratizing knowledge, and epistemic agency rather than predetermined curriculum (Scardamalia & Bereiter, 2006). Extant literature primarily focuses on student interactions, idea progression, and achievement often noting that teachers help, encourage, support, and facilitate. But little is known about *how* teachers support students in knowledge building. The construct of teacher noticing provides a framework for analyzing idea-centered responsive teaching. This paper represents first steps in understanding what a teacher attends to and associated enacted responses in a knowledge building classroom.

Knowledge building with Knowledge Forum

The Knowledge Forum (KF) database and companion software, Idea Thread Mapper (ITM), serve as both a record and tool of community progress. Students use customizable scaffolds to (co)author notes recording questions, theories, findings and results of their inquiry in pages in the KF database called views where they can read and build on one another's contributions. They monitor and co-regulate activity based on advances in KF together with face to face interaction, student created artifacts, and knowledge building discourse in the classroom. After initial cycles of inquiry, ITM can be used to display notes related to a specific thread of inquiry along a timeline to help students visualize and assess important knowledge advancement, and to identify potential areas for additional progress (Zhang, Lee, & Chen, 2014). The co-creation of knowledge is driven by students' ideas. The teacher must be aware of and attend to students' evolving thinking in order to make decisions responsive to it, supporting students' productive inquiry (Hammer & van Zee, 2006).

Responsive teaching and teacher noticing

The notion that effective teaching builds on students' own ideas promoting connections between students' understandings and to the domain, and recognizing potentialities is not new. Dewey was a proponent a century ago and episodes from classrooms such as Deborah Ball's are oft cited (Richards & Robertson, 2016). Recently, however, there has emerged a growing research interest in teacher noticing in the field of mathematics education, and in responsive teaching, especially in science education. Researchers from the two fields note concordance and have begun to explore broader questions and purpose (Elby et al., 2014).

Noticing is defined by Jacobs, Lamb, and Philipp (2010) as the interrelated skills of attending to children's strategies, interpreting children's understandings, and deciding how to respond on the basis of children's understandings (p. 172). Noticing expertise embodies the central components of responsive teaching. Importantly, studies with mathematics teachers find that these skills are not necessarily commensurate with teaching experience (Jacobs, Lamb, & Philipp, 2010). Teachers tend to focus on impressions or themselves, take an evaluative stance, and provide little evidence to support their observations (van Es, 2011). Responsive teaching

involves making sense of student thinking rather than evaluating or correcting, attending to the substance of students' ideas and recognizing disciplinary connections (Robertson, Atkins, Levin, & Richards, 2016). This investigation builds on the research on knowledge building by drawing on the foundation established in teacher noticing for identifying teacher attention to students' ideas. In particular, the following research questions explore how a teacher supports knowledge building when his attention is attuned to his students' thinking.

1. To *what* and *how* does a fifth grade teacher attend in a knowledge building inquiry on the human body?
2. What teacher actions in the classroom are associated with noticing attuned to students' ideas?

Methods

One teacher, Mr. C, was selected from three fifth grade teachers implementing knowledge building inquiry for the study of the human body in five science classes in a suburban public elementary school in New York's Capital Region. The data consisted of recordings of monthly teacher meetings and Mr. C's science class periods over the course of the second year of implementation in this setting. Mr. C's classroom recordings afforded the greatest detail in teacher-student interaction enabling the tracking of noted events.

Analyses included two stages. To address the first research question and the first two component skills, teacher meeting transcripts were divided into idea units separated by a shift in topic following van Es's (2011) framework for learning to notice student thinking. Statements made by Mr. C about his class were selected for analysis similar to the focus on individual teachers as is common in studies on noticing (e.g., Jacobs et al., 2010). Mr. C's statements were coded along two dimensions, *what* and *how* he noticed, using the descriptors of the framework (van Es, 2011). *What* encompasses to whom he is referring and the topic, for example behavior, pedagogical strategies, or thinking about the human body. *How* concerns the analytic stance of the remarks (evaluative or interpretive) and depth indicated by detail and evidence in support of his analysis. Segments were considered attuned to students' ideas when Mr. C attended to (what) students' thinking and the relationship to specific aspects of the ongoing trajectory of inquiry, and when his analysis (how) was interpretive and grounded in evidence from events and interactions.

To address the second question, instances in which Mr. C discussed his decision making in response to what he noticed in his class, the third component skill of noticing, were compared to his actions taken in class. In analyzing teachers' deciding how to respond, Jacobs et al. (2010) noted (a) whether the teacher referenced the student's thinking and (b) whether the suggested response left room for the student's future thinking as opposed to only the teacher's. Stated responses, or response options, were analyzed according to these criteria. However, in Mr. C's case, classroom video allowed for the inclusion of actions actually taken. Patterns emerged regarding the types of enacted responses associated with what and how the teacher noticed. Actions associated with noticing attuned to students' ideas are discussed in the next section.

Results

Mr. C attended to a range of issues from student motivation and participation, pace of progress, and pedagogical strategies related to inquiry, to students' ideas and how they connected to students' own and others' work. Statements that were evaluative, based on impressions without supporting evidence, and/or related to the pace of progress tended to be associated with assigned whole class activities or options discussed in the teacher meetings that were not enacted. Though some of these statements referenced student thinking in some way, comments were evaluative and the associated teacher decisions and actions did not leave room for students' future thinking or build on inquiry advances. These findings are similar to those in the literature on noticing.

Reports of math teachers' decision making in the extant literature rely on teachers selecting or creating a fictitious next task. In Mr. C's class recordings there is evidence of how he supports knowledge building. Instances of noticing attuned to students' ideas were associated with teacher decisions and enacted responses in the classroom that helped students make connections to ongoing knowledge building and left space for future advances. The following examples illustrate to what and how Mr. C attended in his statements in the teacher meetings and how he decided to respond, as evidenced by statements and classroom actions, in two such instances (Table 1).

In the first, Mr. C brings students' prior work to the group's attention to help them build on earlier advances and understand their new interest area more deeply through current understandings. He tries to "lead" them from researching disease as a brand new inquiry to thinking about how it connects to their expanding knowledge based on prior work. In the excerpt below he goes beyond suggestion to leading them through steps of connective reasoning. Knowledge building occurs along a trajectory. It is not a collection of isolated inquiries within a domain. Mr. C notices enthusiastic interest developing in a group but interprets the students' interactions as a possible disconnect from the ongoing knowledge building.

The second example shows how the teacher pulls students together from diverse areas of inquiry to help them see that their research and new questions are converging into a promising direction that is new to the class. He suggests a similarity in that their new interests are related to what is going on in the body while it sleeps while emphasizing the diversity of their questions. He allows students to share thoughts and experiences but then brings them back, twice, to the connections between their interests. He suggests that this could be an area of research that is new to the class, but leaves it to the students to decide if it fits within an existing topic or needs its own. He asks them to consider how they will word a question that encompasses the diversity of their interests and picks up with the formulation of that question in the next class. Mr. C notices the inquiry of several students in diverse groups heading in the direction of sleep which is not a big topic area for the whole class. He interprets this as an opportunity for new collaborations and advancements in understanding. He encourages collective responsibility for wording a single question that can encompass their diverse interests.

Table 1: Actions associated with noticing attuned to students' ideas

Statement from teacher meeting	Action taken in the classroom
Mr. C: If you've done this work, the knowledge that you have about white blood cells. Look into that and then diseases may pop up instead of the opposite way around. Try to lead them in that direction.	<p>Mr. C: A good way to get into the field that you find exciting is to use your information about blood that you know, circulatory system, things like that, to get to diseases. Because there is definitely a connection, literally and figuratively.</p> <p>S1: Oh, I know what you mean. You're talking about since we're blood, we won't have to start a new group. We can start moving toward the disease.</p> <p>Mr. C: Right. That's exactly right. But it's not even so much that. You can probably end having a new one, a new section. But it's that fact that you're kind of building off of the information that you already know. Instead of starting from scratch.</p> <p>S2: I don't think we should go off from what we already have.</p> <p>Mr. C: Well, how do I say this? This is what you've got to remember. Another name for circulatory system is the cardiovascular system. It delivers. What does the circulatory system deliver to the. .</p> <p>S3: Blood.</p> <p>Mr. C: Blood. What's in blood besides. .</p> <p>S1: Cells</p> <p>S3: Blood cells, white blood cells, oxygen, nutrients</p> <p>S2: Germs</p> <p>Mr. C: Germs. And the white blood cells fight them. That was one of our things.</p> <p>S3: Sometimes there may be too many germs.</p> <p>Mr. C So fatal diseases are infecting your blood. . . It sounds like you guys are interested in fatal diseases but you should use what you already know.</p>
Mr. C: The sleep people, they had different parts. One was interested in REM sleep. And one was interested in like sleepwalking. Another one was sleep disorders. They all kind of have like different areas. Dreams, that's another one. That they're interested in. We figured that there's enough subtopics of it for it to be its own thing.	<p>Mr. C: Could I throw this out to you? Now if you think about how does the brain do its job. So you're sleeping. Your whole body is, sleeping. Right? It's resting. Whatever it is. Your heart's still beating. You're still breathing. You still have those things, those parts of your body that you're not consciously thinking about, breathing, heart beating, digestion, things like that. So, all of a sudden, now you add into it, um, there's other things happening as well, right? Like you guys were talking about dreaming. Talking about if you were sleepwalking, like you're unconsciously using your motor skills.</p> <p>(student stories)</p> <p>Mr. C: I guess what I hear is you guys have a lot of questions about unconscious times when you're kind of, really sleep. What's happening during sleep.</p> <p>(student stories)</p> <p>Mr. C: This is like, what I'm hearing you guys say is a ton of different questions or observations that you have, that you've either experienced, heard about, you're wondering about. And, it seems like a very large area of research. It seems like a large place that you could all, so would you like to make it its own question? Or do you think it's part of brain and part of its jobs?</p> <p>S1: Its own question. (Others agree)</p> <p>[End of class. Mr. C asks group to think of wording for a big question.]</p> <p>(Next class) Mr. C: People who had some interest in having dreams being something about, or sleeping, or dreams, and it's something a lot of people were talking about so let's come up with a big, juicy question for it. And then people can go about what they're going to do. . . What do you guys think that could be a way of phrasing this big juicy question that could <i>include</i> kind of what everybody's interested in. What were people interested in?</p>

Conclusion

The implementation of knowledge building depends on responsiveness from the teacher as students' ideas are the objects of inquiry. Mr. C's above responses demonstrate instances of noticing attuned to students' thinking highlighting connections between students' ideas, to the domain of study, and to the trajectory of understanding advancement in support of knowledge building.

This paper represents an exploration of teacher noticing as a framework for beginning to understand the ways in which teachers can support students in knowledge building. There is no best response in teaching situations. There is always a range of reasonable responses (Hammer & van Zee, 2006). The construct of teacher noticing provides a way to identify when teachers' attention is attuned to students' ideas and a means to classify decisions as being responsive to the teacher's interpretations of that thinking. The examples demonstrate that a focus on the teacher's noticing may lead to a greater understanding of ways in which teachers can support students in knowledge building; they are not meant as exemplars. The above examples are but two from all that a single teacher chose to discuss in teacher meetings. They are not necessarily representative of his in-the-moment decision making in the classroom. The next phase of this work involves having teachers keep semi-structured reflection journals modeled on the dimensions of noticing throughout the current, full-year fifth grade inquiry on the human body.

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