Shifting Epistemologies: Examining Student Understanding of New Models of Knowledge and Learning

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Abstract: New models of teaching and learning designed to address the demands of 21st century education require shifts in classroom norms and practices. This paper examines a group of students and teachers who implemented the Knowledge Forum model (Scardamalia, 2004) over the course of two years. Interviews with the students are used to assess three epistemological changes identified as critical in the Knowledge Forum model: a shift from teacher-directed activities to student epistemic agency, a shift from right and wrong answers to the notion of improvable ideas, and a shift from individual to community knowledge and collective responsibility. There are indications that shifts are indeed taking place in students’ views toward their own agency in the learning process, the dynamic nature of knowledge, and the importance of community. The work also identifies challenges faced by teachers in implementing new models of learning that can inform teacher pedagogy.

The demands of the 21st century society require that students become active learners who are able to work with a wide variety of people and resources to accomplish their goals. Over the past few decades, new models of learning and teaching meant to address such demands have emerged in the field of the Learning Sciences. These include the models put forth by the BGuile project (Reiser, et.al., 2001); the Fostering Communities of Learners project (Brown and Campione, 1996); the Knowledge Forum project (Scardamalia, 2004), and the ThinkerTools project (White, 1995). However, one of the greatest challenges facing the implementation of such models is the change process that teachers and their students must move through (Bielaczyc & Collins, in press). That is, many of these new educational models require a shift in classroom norms and practices. This shift can take multiple forms, including (a) teachers who are new to a given model learning to shift their pedagogy and the type of culture they create within their classrooms, or (b) cases where teachers are more experienced with the model, yet still need to support each new student cohort in shifting from their prior enculturation to that of the model. We are interested in how teachers support such a progression from where their students are initially to the goal state set forth in a new educational model: How can teachers help students conceptualize knowledge and learning in new ways? What are the challenges? Are there particular trajectories carved out by such shifts?

Over the past few years, we have been studying one well-known model of collective learning with new computational media, the Knowledge Forum classrooms of Scardamalia and Bereiter (1991; 1994). Creating a Knowledge Forum classroom typically involves students in shifting from more traditional classrooms focused on individual learning to classrooms that function as knowledge building communities. Our earlier work focused on teachers’ strategies for implementing Knowledge Forum classrooms (e.g., Bielaczyc, 2001; Bielaczyc & Collins, 2005; Caswell & Bielaczyc, 2002). In Caswell and Bielaczyc (2002), Bev Caswell, a 5th/6th grade teacher, shares her personal experiences in creating a new culture of science learning in her classroom. Based on classroom observations, we also began to examine shifts in the ways students conceptualized the enterprise of science within a knowledge-building context. In the present paper we analyze interviews with students who have participated in a knowledge-building classroom over the course of two years. We examine changes in student understanding of knowledge and learning, what we call "shifting epistemologies." We specifically focus on the challenges that teachers face in helping students to make these transitions.

The Whitman Team

The student interview data for the present paper is drawn from a 6th-7th Grade Team who integrated Knowledge Forum into the daily rhythm of their classrooms. Knowledge Forum is a technology-based tool that allows learners to construct a communal multimedia database (Scardamalia, 2004). Typically, students investigate problems in different subject areas over a period of weeks or months and enter their work into the database. Contributions can take many forms, including (a) Notes, in which students share their ideas and research findings,
(b) *Views*, which allow graphical organizations of related notes, (c) *Build-Ons*, which allow connections to be made among notes, and (d) "*Rise Above*” *Notes*, which can be used to synthesize notes in the knowledge base. Any of these kinds of contributions can be jointly authored. The environment supports students in constructing their notes through features such as scaffolds (e.g., "My Theory," "I Need to Understand"). Students can read through the knowledge base adding text, graphics, questions, links to other notes, and comments on each other’s work.

Whitman Middle School is a suburban school in the Midwest United States serving approximately 600 students in grades 6th-8th. During the period of the research, the Whitman Team consisted of 4 teachers with classrooms of roughly 25 students each. The teachers and students stayed together for two school years, starting in 6th Grade when the students first came to the school and continuing through 7th Grade. Knowledge Forum was a part of the learning environment throughout the entire two years. Each teacher on the team specialized in one subject matter area: Math, Science, Social Studies, or Personal Development. However, the Knowledge Forum investigations were independent of these divisions. Over the course of a school year, all students worked on the same research unit, with three research units covered each year. The learning community that the Whitman Team worked to build spanned all four classes. Although students worked on their Knowledge Forum research on a class-by-class basis, the Knowledge Forum database contained the work of all students.

The first author conducted research at Whitman Middle School over the course of one and a half academic years. Beginning in the Spring of the 6th grade year and continuing until the end of the 7th grade, classroom visits were made roughly every 6 weeks for a period of 5 days. Data collection included classroom observations, student and teacher interviews, surveys and written data, along with online data from the Knowledge Forum databases. For the present analyses, we chose to examine student interviews collected at the end of the 7th grade school year. We felt that interviews taken at this point of time would provide interesting insights into student’s views on knowledge and learning, since they had been engaged in the new educational model for two years. The interview data collected for the project includes students who had been identified as low (L), medium (M), and high (H) performers on standardized tests prior to entering the 6th grade. Here we look at a selection of nine students across this spectrum.

**Examining Shifting Epistemologies**

When Whitman students were asked whether the way that they learned with Knowledge Forum in 6th and 7th grade was different from how they learned in 4th and 5th grade, all students described how a change had taken place. The overall nature of the change described is captured in the following quote:

> In 4th and 5th grade, we really didn’t do a lot, you know what I mean? It’s like we read it and then we tested over it and then that was, like we didn’t go over it again. Or we didn’t do anything with it. But this we have like, face to faces, so we know what else people, what other people are doing with this knowledge, how they’re like, keeping it, like, learning in their way. Also it’s like we interact with each other more. Like we share knowledge and then we help each other build theories and help each other, like, the way we’re doing the project all together, in the teams. That way it’s like, it’s more teamwork then. (Lissa)

To examine more deeply the nature of the shifts experienced by the Whitman students, we focus our analysis here on three specific areas. Scardamalia (2002) details the nature of the desired shift in Knowledge Forum classrooms through a set of “twelve ideas that in combination set a knowledge building classroom off as profoundly different from even the best of traditional and model classrooms” (p. 8). In the present paper, we chose to focus on three of these ideas that matched most closely with the type of shifts that the Whitman teachers describe as what they were trying to achieve in their own work (Bielaczyc, in preparation). These are (a) epistemic agency, (b) improvable ideas, and (c) collective knowledge and collective responsibility.

**Shifting from Teacher-Directed Activity to Epistemic Agency**

*Taylor:* Yeah. In fifth grade the teacher has almost all the control. They told you what to do, how to do it, when to do it and where to do it. But in sixth and seventh grade, I kind of liked this class, the Knowledge Forum, because we did get control, but we did get to decide when we read or when we responded, for the most part. And when we didn’t, just other stuff to do, you could go out to the library or interview people, but if you didn’t feel comfortable doing that you didn’t have to.
Interviewer: What difference does that make, being able to have your own control?

Taylor: I think it gives people a sense of responsibility in that they can do it. I think it’s nice because people then know that they are in charge of what’s going on and you don’t have somebody else doing everything. And it’s kind of, it’s like that’s how it’s going to be later on in life, so it’s kind of a good practice.

Scardamalia and Bereiter (1991, Scardamalia, 2002) discuss the importance of having students take on “higher levels of agency” in the learning process. The concern is that “students have little idea of the strategic activity involved in learning if all such strategic activity is carried out by their teachers and without their knowledge” (Scardamalia, 2002, pp. 3-4). The shift from teacher control to epistemic agency involves helping students to take over more of the executive functions of learning, such as setting learning goals and monitoring understanding. The Whitman teachers similarly felt that it was important to transfer control of the learning process to the students. For example, a key area of student control identified by the teachers was taking responsibility for question generation: “It is all based on them asking the questions, this is the strength of the whole thing.” Turning over responsibility to the students was not only about question generation. The teachers felt it needed to be all-pervasive: “The whole idea of the teacher being the person with all the knowledge and all the answers in the classroom is out the window, whether a person felt like that or not before they started using Knowledge Forum.”

Throughout the interviews, students described how they tend to get more involved with their Knowledge Forum investigations because it is their own work:

Well, see that’s the different thing about Knowledge Forum, from any other thing I've ever done before, is that it’s because, I think that the kids will do more stuff because they’re no longer restricted. There are no longer restrictions placed on them by their teachers. And like, most teachers would ask like why would you do extra work if you don’t have to. Or kids will even ask you that, why would you do extra work if you don’t have to. And they don’t do it on this database cause there really is no such thing as extra work or not enough work because you’re letting the kids do the learning by themselves. … Because you do as much as you can. (James)

I think it helps you to like, kind of interpret your own ideas into things you learn. I think it’s like, it makes, I think it’s like more creative, like when you make theories and everything. And I think that it kind of helps you get into something if you’re putting your own ideas into it. It helps you get into a subject more, if you’re putting your own ideas into it. (Lissa)

Students also gave descriptions of how they became experts in various topics and how this was important because others relied on them. Students did point out that some students took advantage of the freedom they had in Knowledge Forum to “goof off.” However, students also noted that many of these students “don’t participate in much of anything” (Jason). Another area of learning that students spoke of was acquiring skills in self-management of the learning process. One student described these skills as “good habits,” where you have to monitor your learning: “And you’ve kind of got to tell yourself when it’s time to stop and when it’s time to go on. I mean you can go on and on and on forever, but there’s kind of a point where you can stop and move onto the next topic” (David).

One of the challenges to a shift toward higher-level agency appears to be students’ uncertainty as to how to re-interpret the role of the teacher. Sometimes students confused teacher actions with still taking control over the learning process. For example, one area where teacher activity was often misconstrued was when teachers read the database. The teachers described how they read the student database entries in order to “listen” to where the students were and gain insight into their learning needs. However, some students interpreted teacher reading of the database as an act of evaluation. These students described how they adapted their work in order to be judged well: “I have written in my note every single day…that’s why I don’t get many messages from them” (Katie). One of the students took this to an extreme of going back over her note from time to time and inserting theories or other information after the fact in order to have a better-looking note because “I don’t like to look bad in front of the teachers” (Taylor). Other students talked about how they were not graded by teachers on their work in Knowledge Forum because the teachers knew this was new to them and didn’t want them to be “stressed.” This uncertainty in the role of the teacher seems very understandable in the context of school, particularly given that students spoke of the central control that teachers had in their school life prior to the use of Knowledge Forum. Helping students re-
conceive the role that teachers play seems a key consideration in making a successful shift to higher levels of student agency in the learning process.

The students in the Whitman classrooms were clearly taking more responsibility for their own learning, while noting that some students were still inclined to “goof off” in school. Most students appeared to be formulating their own questions and theories and carrying out extended investigations. They also appeared to be developing the metacognitive skills to manage their own learning process. However, many students described how it was sometimes difficult to sustain motivation over a 6-8 week period, “30 days is a long time” (Katie). Another challenge was that their choice of topics to study remained limited to those topics related to the 6th or 7th grade curriculum. Also many of the students still worried about looking good to their teachers. But despite these limitations there was a decided shift toward higher-level agency on the part of the students.

**Shifting from “Right and Wrong Answers” to Improvable Ideas**

*Interviewer* – When you're working on your notes, how do you know if you're successful?

*Jason* – If you find the exact answer. You're never going to find everything that you can know. But you're never, you're going to find steps to the answer. And to find one step to your answer is a big goal, should be a goal.

The fact-based learning that anchors traditional school models belies a view of knowledge as static information to be acquired. Knowledge Forum classrooms emphasize a more authentic view of knowledge as constantly evolving and usable in real life; it is "more than stuff sitting in textbooks to be used for answering quiz questions" (Bereiter, 2002, p.21). This epistemological shift requires moving away from a view of ideas as either right or wrong. Instead, ideas become complex, living entities open to further improvement, and students become participants in the process of building knowledge rather than simply information gatherers. The Whitman teachers characterize this shift in the following way: "your product is meant to be used as a brick in knowledge building, not an end product."

Knowledge building classrooms are designed to create "a system of interactions around ideas" that encourage students to problematize knowledge (Scardamalia, 2002, p.9). The Whitman students engaged in such interactions both online and offline --- running debates occurred within "discussion notes" in the Knowledge Forum database as well as in "face to face" group meetings. Students reflecting on the nature of these debates reveal an advanced view of the nature of ideas, recognizing that multiple perspectives are possible:

You start taking sides if someone makes a point and someone takes a side with you and someone doesn't. And then you, that's when a discussion gets into, they defend their point and you defend yours. And then in the end you'll probably end up learning more from that because you'll have two conflicting points. And it's not like it's a right point and a wrong point. It's debatable. (James)

Notably, James and his peers are not dogmatic in their positions. They view debate and argumentation as part of the learning process and feel comfortable changing their minds. Moreover, being convinced is an integral part of learning and requires a new depth of understanding about the subject under discussion. David describes this process as follows:

You want to have an argument or something going on that keeps the note alive, that changes your perspective on things, that makes you want to differentiate what they said or something. You don't want to just OK, I agree, I agree.

Part of the learning process at Whitman involved researching topics and presenting those findings in notes that are viewable to one's peers – the "bricks" of knowledge building. Objectifying knowledge in this way led some students to develop a view that facts alone are insufficient for understanding. Asked what constitutes a "good note," James responds, “Instead of just listing facts and information like a book does, it’ll make you think harder about what’s going on”. Understanding the role of presentation in improving the coherence of ideas represents a key element in the shift to improvable ideas.
Although many of the Whitman students succeeded in problematizing knowledge to some degree, not all advanced beyond the traditional right-wrong answer paradigm. One of the more persistent elements of the traditional model is the idea that answers are endpoints. Katie, for example, believes that debates over research topics would end if the group could find the "real truth." In the quote at the beginning of this section, Jason expresses this goal as finding "the exact answer," but then restates the goal as finding "steps to the answer." The answer as end-state idea remains for both students, but Jason is beginning to conceive of knowledge as a process of improvement. Supporting this shift presents a problem for teachers who may need to help students to distinguish accepted facts from debatable positions in order to push the group's understanding forward.

Shifting from Individual to Community Knowledge and Collective Responsibility

James: And after you've recorded that, you can go to the other people’s notes and views that are related to yours and read about what they've been learning and maybe they have something you didn't know. Or maybe they have some information that you can use. And it kind of helps you to understand more about your topic than just if you were doing an individual research report.

Interviewer: Why?

James: Because now it’s not just you as an individual going through books and looking for facts and information and things you can use. It’s you and a bunch of other people who can help you, and you can ask other people questions now. And other people that may be on a similar topic or even the same topic as yourself, and then you can look back at what you’ve already written and what you thought you knew, and change your thinking...

Scardamalia and Bereiter (1994) propose: “Can a classroom function as a knowledge building community similar to the knowledge building communities that make up the learned disciplines?” (p. 270). The concept of community knowledge and collective responsibility emphasizes that students “produce ideas of value to others and share responsibility for the overall advancement of knowledge in the community” (Scardamalia, 2002, p. 10). The Whitman teachers described their desire to cultivate the classroom as a “learning club” where students take responsibility for improving their ideas and the ideas of other members. This includes the perspective that “…this person sitting next to me is an important part of my learning... They have to see each other as researchers, and they have to respect what each of them has to say and what each of them has to contribute to whatever the learning happens to be.”

In the student interviews, students consistently spoke positively of the shift toward helping each other to learn, pointing out that helping others can help one’s own learning: “…you can push ahead knowledge that you have. And that other people have. And so you can learn more that you haven’t learned before” (Sabina). Even one student who described herself as a “do-it-yourself person” thought that learning how to work as a community was an important skill to learn: “I think it would just be that I would like, kind of, grow into doing that more and thinking more on the idea of community instead of just me” (Lissa). Many students also indicated that working as a community gave learning a more important purpose than producing something for the teacher.

Some of the challenges to working as a community identified by students included feeling squeezed for time to read around the database and contribute to the investigations of others. Some students also talked about sometimes having difficulty critiquing the work of others. Another challenge to shifting to a more comprehensive conceptualization of community building and collective knowledge by the Whitman students comes from limitations in the conceptions held by the Whitman teachers. In interviews with Whitman teachers, the four teachers agreed that the concept of “communal knowledge” was difficult to fully grasp, even after eight years: “But this whole understanding of the communal database is so nebulous and so large that I think it’s what I feel is a big challenge still in seeing how that happens and how we can make attempts to facilitate that. It’s a biggie.” This is not to say that the teachers offered no support for shifting from views of individual learning to communal knowledge building, but rather that because the concept posed a challenge, it may have been difficult to facilitate the shift for their students. It should also be pointed out that the difficulty experienced by the Whitman students and teachers in developing a good feel for the meaning of “communal knowledge” or “collective understanding” is not surprising, according to the literature on collective work in schools and workplaces (e.g., Brooks, 1994; Senge, et. al., 2000; Webb & Palincsar, 1996).

Conclusion
The Whitman interviews begin to illuminate the nature of student conceptualizations in relation to three central ideas of Scardamalia and Bereiter’s knowledge building community model. There are indications that shifts are indeed taking place in students’ views toward their own agency in the learning process, the dynamic nature of knowledge, and the importance of community. However, the nature of these shifts does not appear to be uniform across students. Further, certain conceptions appear to have almost a fragility to them: Do I really have control or does the teacher? Is knowledge always debatable or are there “real truths”? The instability of particular conceptions within the context of shifting epistemologies seem consistent with similar findings within the conceptual change literature (e.g., diSessa, in press). There is also some indication in the data that the differences among student changes may be related to performance levels (e.g., L, M, and H as measured by pre-Knowledge Forum standardized test scores). For example, L, M, and H students appear to differ in their views on how the Knowledge Forum scaffolds guide the learning process. The L and M students tend to view scaffolds as organizational tools that direct them in the steps they need to take --- offering a welcome entry-point into a previously opaque process of carrying out their own investigations. The H students tend to describe the scaffolds as a way to reflect on the learning process, a sort of jumping-off place for modifications and developing their own approaches to carrying out investigations.

In the present paper our analyses have uncovered a variety of challenges in moving from more traditional views of knowledge and learning to the types of views specified in a new educational model. We believe that understanding such challenges can help inform teacher pedagogy and research on classroom epistemology. In our future analyses we plan to investigate more deeply whether certain epistemological shifts are more difficult to achieve than others, and what the trajectory of such shifts may entail. We also plan to examine more closely the differences among students of varying levels of academic performance.

References


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