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Learning to Participate in Communities of Scientific Practice

Vexation

I often think about an observation my colleagues and I made while conducting research in a third grade classroom using force and motion curriculum materials. In the particular observation I am thinking of the students compared the speed of 2 cars. The activity involved students in explaining how they knew if one toy car was moving faster than another. Almost as if suggesting it was a silly question, one boy said, "You just look at it." His response initially confused the adults in the room. But the teacher asked him to explain what he meant and we figured out that by looking at the 2 toy cars simultaneously the boy could determine comparatively which one moved faster. What was more confusing for the adults was that he, one of the more scientifically motivated students, was satisfied with this method of collecting data about the speed of the car. He was not concerned with having rigorous approaches to collect data about the speed of the car, consider alternate variables that affect the speed, nor was determining the exact speed of the car even important to the student. He was satisfied to be able to make an anecdotal observation that one car was faster than the other. And he didn't need more elaborate ways to make that observation, defend his conclusion, or offer any explanation. In short, this wasn't really a meaningful or useful problem for him.

This anecdote relates to a central issue that concerns me involving people learning to reason and think scientifically. Such reasoning and thinking involves identifying problems or confusing issues that have meaningful impact on explaining phenomena, collecting and organizing particular kinds of information about those problems, and then reasoning about that information in particular ways. Learning to reason and think scientifically is often difficult to accomplish in schools for several reasons. One challenge is that it can become tempting to move toward objectification of the knowledge building practices as skills isolated from the purpose of learning those skills. Alternatively stated, this problem is that the epistemic commitments of science are transformed into a list of process skills. Another challenge is that focus on reasoning leads to logical reasoning that neglects the human element that connects science learning and knowing with a passion for exploring and explaining phenomena in the natural and social world. Finally (though this is only a brief list), focus on the scientific reasoning can inadvertently neglect the notion that science is about solving problems or explaining confusing and/or confounding issues.

An alternative perspective considers the epistemic practices of science. From this perspective learning science, beyond learning facts, principles, and concepts of science, involves learning the skills and abilities needed to participate in scientific communities as well as the knowledge construction assumptions, values, and beliefs shared by the scientific community. Thus in a sense, the notion of epistemic practices attempts to bridge canonical science with everyday science in ways that assist students in transitioning between those cultures. However, the epistemic practices of science are unfamiliar and potentially irrelevant to the needs and desires of children. Furthermore, these epistemic practices are equally unfamiliar for educators and future educators. In particular one problem has to do with understanding that science inquiries are based on things that are confusing, troubling, or just don't make sense to the inquirer. Yet, school science often fails to situate science learning in problems or confusions. Rather, inquiries are about what is neat, cool, or fun. This contributes to students and eventually the public having inaccurate perceptions of science and scientists.

Venture

I am beginning a venture that involves creation of learning communities to support and engage students in using epistemic practices of science. This focuses on activating technologies to support development of epistemic practices *and* structuring the experiences to avoid typical power asymmetries (teacher-student) in using those practices. My idea is that by engaging students in contexts and with purposes for using epistemic practices with peers, they will develop a greater understanding of the nature of science and scientific reasoning.

The learning communities will be situated around a sequence of small-scale (small groups of 3-4 students in Middle School classrooms – each class having multiple concurrent conferences with other classrooms) video-conference sessions in which students learn to use the technology and then use the technology to communicate about on-going scientific investigations of factors affecting environmental quality across the state. The sequence of experiences in video-conference sessions would occur during regular class times (to the greatest extent possible) and be organized sequentially to allow students to develop knowledge, skills, and abilities to

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communicate their ideas as well as use the technology. The sequence of sessions would look something like the following.

1. Session One: Discussing a common article that includes information about relevant environmental quality issues. This session would:
 - a. introduce students to the web-based video conferencing.
 - b. offer students practice communicating using a shared common experience.
 - c. introduce students to related technology resources that are embedded in the project.
2. Session Two: Describing to one another how to conduct testing procedures and sharing initial research problems and questions. In this session students would:
 - a. describe relevant and common environmental problems to one another and raise researchable questions about those problems.
 - b. teach one another about testing procedures they have used.
 - c. explain the kinds of data that the procedure will collect and the ways this will answer their questions.
3. Session Three: Defending a research proposal. Students will design a research proposal relevant to the on-going investigation that peers will review. In this session students will:
 - a. have read their peers' proposals and be prepared to discuss the strengths and limitations of the proposal.
 - b. clarify the variables in one another's proposals and brainstorm possible mediating factors, alternate hypotheses, etc.
 - c. discuss the potential for generalizability and consider data sharing.
4. Session Four: Reporting findings. In this session peers will present their findings to one another. This will involve:
 - a. presentations of data and claims.
 - b. discussing the implications of their findings.
 - c. discussing potential approaches to communicating their findings.

This structure intends to place students as the central figures in communicating ideas, explanations, understandings and questions, thus shifting positions of teacher authority. At the same time it situates a need for students to communicate about their ideas and understandings, thus legitimizing a need to clearly describe procedures, have ways to communicate about understandings, and use patterns of dialogue that have meaning and purpose in science.

In this venture I am struggling with practical and methodological issues. The practical issue is that I am struggling to find financial support. This is a complex problem because my position limits the nature of grants that I can seek. In the methodological issue, I am struggling to develop a research design and instruments to adequately observe events in the project to yield understandings of the effect it has on students. The critical issue is identifying which of many variables to focus attention on.

Epilogue

Now, as I reflect on this essay describing my vexation and venture, I wonder if one will impact the other. In the end does the venture I describe have the potential to respond to the vexation that I have? More important to me, I wonder if such venture help people understand that science is about identifying, exploring, and understanding phenomena of the natural world, not just knowing that speed is the distance traveled in a unit of time?