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Classrooms Where Children Do Science Rather than Do Testing

My Vexation

In the current movement toward accountability in American education, standards are now tied closely to a system of quantitative measures for assessing the performances of students, teachers, and schools. Called a techno-liberal accountability system by some, it uses standardized tests as its primary instrument of evaluation. If the scores on the assessments show improvement, then learning has taken place. The laudable goal of leaving no child behind becomes equated with a test score. The system leads inevitably to 'test taking' and 'teaching to the test' pedagogies in which standardized content takes center stage and is delivered to students.

As the 'gaze' of standardization and accountability turns towards science education, the system perplexes me for a number of reasons. It is being invoked into a context of increasing difference and diversity in our country. Consider these places: a conservative, rural, Mormon town in Utah; a mostly Latina/Latino and Chicana/Chicano border town in the desert Southwest; an African American neighborhood in the post-industrial northeast; and a mostly Muslim town in Michigan. In such diverse contexts characterized by people with vastly different cultural histories, how could we possibly think that standardization and normalization could work? In a country best described as a 'carnival of difference,' how can homogenization possibly be a panacea?

The current context of difference and diversity in our country should be reason enough *not* to standardize. But other reasons exist, perhaps ones just as compelling. Sociological views of science as a social practice have critiqued notions of science as a purely inductive process guided by a single method. If science is not a standard process that involves uniform types of reasoning, then what forms the basis for a standardized curriculum? Second, the provisional nature of scientific knowledge questions notions of science as content. Science knowledge grows and changes, and the vast body of knowledge of science is simply too big to fit into a curriculum. If science is not content, and content is constantly changing, then what content serves as the basis for standards? More importantly, who gets to choose what content is included and what is not? Given the nature of scientific process and knowledge, is it possible to create anything that resembles it?

One thing that I am certain of is that there exists no 'it' to copy, standardize, concretize, or solidify. Science is an active and dynamic social practice that occurs in a myriad of different ways across contexts. Attempts to standardize the practices or content of science are bound to end up as simulacra, copies for which no originals exist. The implications of science education as simulacra are profound. Standardization threatens to further render school science as a thing unto itself with little relevance to students' lives or cultural selves, a thing that ironically may resemble many active science classrooms that continue to serve certain kinds of students while ignoring, marginalizing or demeaning others. Standardization in its current form can only further the critiques of school-based science. I recently heard such critiques from the students (and their parents) who attended a one-week science camp at our university. The students engaged in an open-ended, authentic, inquiry project grounded in a community-based problem. According to the students, the camp was like a breath of fresh air compared to the boredom and drudgery that they face in their standardized school science classes.

It is not standardization *per se* that I am arguing against, but the kind of standards that are tied to the current accountability system. As we reduce science down to measurable content and low-level reasoning skills, the science becomes lost. Further, what I am arguing against is a positivistic science turned back on science education, a science that has crossed its bounds from the natural into the social world. Science education is a social practice, and like all social practices, the learning that takes place through it defies quantification and measurement. Without the bounds of the current accountability system, might we be able to envision a future for science education that values both science as a social practice as well as the cultural histories and personal identities of our students?

My Venture:

Given my vexation, I would support a brand of secondary science education in which educators pay close attention to the following: 1) the social, cultural, historical and political contexts in which they work and their students inhabit, 2) the nature of science as a social practice, 3) the individual interests and identities of students, 4) relevant community based problems and issues, and 5) the nature of the interpersonal relationships being forged and fostered in their classrooms. In order to envision science education to meet these guidelines, a

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'reconceptualization' of science education may need to take place, one similar to what occurred in the field of curriculum studies in the 1970s. The institution of schooling is far too constraining for such thinking, so we need to remove ourselves, at least for a while, from the constraints of the system in order to envision a different future for science education. But a word of caution is needed here. Going too far adrift for too long can leave us lost at sea and out of the conversation. So as I (we) think through alternative futures for science education, I am asking my colleagues to help navigate a return journey. To keep the conversation grounded, I attempt to conceptualize a vision of science education within a single classroom.

A brand of science education that pays attention to student cultural lives and to alternative views of science is inspired here by two particular works. In the 1960s, Herbert Kohl and his class of New York City elementary school kids published a class newsletter. Through this yearlong project, the students engaged in rich multidisciplinary learning grounded in their interests and practices. Similarly, Eliot Wigginton and his students in Southern Appalachia created the Foxfire Magazine. They drew upon the local historical practices of the community to produce a series of informative books that aimed to preserve a way of life being lost in the modern world. Both Kohl and Wigginton drew upon the social and cultural practices as well as the local knowledges of the community in order to create projects and works that deeply connected to student lives and selves.

For science education, we need only add disciplined inquiry to the project-based learning of Kohl and Wigginton to create a basis for our classroom pedagogy. The science teacher would build a laundry list of possible community-based issues or problems for students to investigate. Some strategies might include scouring local media sources, conducting Internet searches, and speaking with a variety of political leaders or community-based groups. The overall goal here is to not only build a list of issues, but to build partnerships with key actors and organizations in the community that could later be used as resources. Through these partnerships, the community and the classroom become linked. The teacher could present the list to the students at the beginning of the year, as well as draw additional ideas from the students.

The design of the classroom is an important facilitator and mediator of science practices. The goal here is to design a space that encourages student participation in the multiple practices of science. Through these varied modes of participation, the resources that students bring to a classroom become valued contributions. As students engage in inquiry projects of their own design grounded in issues of community importance, they use the areas of the room that best facilitate meeting the specific tasks that need to be accomplished. Students and parent volunteers could even play an active role in the design, decoration, and set up of the room. Such a project would be a way for teachers and students to begin building strong relationships based upon respect and mutual trust. An ideal classroom might include the following: a table for group meetings; a research area equipped with books and computers with internet access; an area with comfortable seating for reading, relaxing, socializing, and enjoying a refreshment; a telephone for making contacts and scheduling, lab space for conducting experiments; and a chalkboard with several desks to facilitate direct instruction or group discussion. The science classroom would be transformed from an institutional setting into something akin to a gathering place or an Internet café.

In this classroom, the teacher interacts with students in a way that shows respect for their interests, hobbies, talents, language use, interaction patterns, dress, and knowledge. However, at critical times throughout the inquiry process, the teacher uses their knowledge of science and of the subject matter in order to help move students in productive directions. The style of communication is far from that of initiate-respond-evaluate and instead takes on a form in which all party's voices are heard and respected equally. Through these interactions, accepted scientific practices become part of the students' projects and knowledge.

With this brief sketch laid out for our classroom, many questions remain, but one seems to rise to the top: How might this venture begin? As a first year professor (eventually), I could negotiate it as part of my workload, partner with a local school, and facilitate the initial endeavor. The classroom could work as a living laboratory for a new kind of school science. Both inservice and preservice science teachers, as well as educational researchers, would be encouraged to observe, facilitate activity and conduct research in the classroom. The evolving community of practitioners would be invaluable in providing support and feedback for the project.