L*ittle Brother Jumping on MY Bed: Engaging Children in Science through "Personal Science"*

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I will begin this proposal with a story from my own work with minority and immigrant students in an informal setting. The story that I will share is the experience of an African American fifth grade school girl, Tanya, in the Bakken Museum of Electricity and Magnetism (the Bakken) and her invention of an "alarm blanket" that connects her life to science. The invention of the alarm blanket is Tanya's "personal science."

VEXATION

Alarm Blanket: Tanya's Personal Science

This story of Tanya takes place in the Bakken. Tanya attends a very poor urban school in Minneapolis. She is one of the students who comes to the Bakken to experience, explore, and participate in how electricity and magnetism is connected to her own life. Tanya participates in the 'invention program' where students create an object that is personal to them. In order to attain this goal students are encouraged to conceptualize, design, and produce an object that solves a problem for *them* and is about *them*. For Tanya this was a life-time opportunity to make something that is her own in a science context. She wanted to make an electrical blanket that she could tuck under her bed cover and it would trigger an alarm whenever her "younger brother jumped on her bed." The reason for her to design this blanket was to catch her brother when he "messed-up" her bed and discourage him from doing that again. At the Bakken she spent four weeks from design to completion of her "alarm blanket." A week later Tanya came to the museum and told us that she successfully deterred her brother from messing up her bed. Her enthusiasm was visible on her face and vivid in her tone as she described the success of her invention. We later found out from her teachers that she has been sharing her story about the blanket and how cool science can be. We didn't expect the surprise that was to follow after three months. Tanya returned to the Bakken and asked if she could design another blanket because her brother discovered how to disconnect the alarm system. This time Tanya wanted to make a blanket that would utilize a "laser beam" [Tanya's own words] to trigger an alarm. Her view was that with this new blanket her brother could not "even enter [her] room and mess-up [her] bed." With the help from volunteers and me in the Bakken invention room, Tanya was able to design and produce a laser-alarmed room to discourage her brother from going into her room.

I believe stories like these are very personal in nature but equally powerful and transforming to the children who go through these experiences. Stories not only tell us who these youths are, where they come from, what they can do, and how intelligent they are but the stories also tell us what matters to them and what it means to know, do and learn science. The story tells us that science, like any other learning, has to be personal where the subject matter is intricately intertwined with who the learner is. I use the phrase 'personal science' to indicate that there is more than a simple connection between science and the learner. In 'personal science' the person (student) is the most important actor who defines, pursues, and internalizes science learning. Therefore learning is meaningful to the person to further participate in the learning process.

Social capital is inherent in the structure of relationships that allow individuals to share and act for the common good. Individuals utilize their social relationships as resource, power, and influence to gain access to materials or other resources that benefits them. Therefore as our students engage in science activities, they gain new skills and knowledge that will help them interact in new ways and also empower them to connect to other people in science (Coleman, 1988; Dika & Singh, 2002, Field, 2003). I also believe that this kind of action and interaction through science activities builds human capital that these students can then use for their betterment.

Informal science settings such as the Bakken provide opportunities to bring students from minority groups into a science context where they experience the feeling of creating something that is useful to them. Additionally, the Bakken is all about electricity and magnetism, the two science content areas that most students find very difficult to understand. The NAEP consistently shows that students in all grades do very poorly on the electricity and magnetism questions. Thus, this informal setting and engagement in 'personal science' inventions may promote increased willingness to study these content areas. I am wondering if work in such a narrow band of science content area would be of interest to elementary and middle school science teachers. Electricity and magnetism are left to be covered in high school therefore, what issues might arise by carrying out this project with elementary

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and middle school students. Do these activities have to be in informal settings? How do we convince funders and teachers that stories like Tanya's are valuable teaching and learning tools? How do we document the long-term contributions of these 'personal science' moments in learning science? How do we parse-out the contributions of 'personal science' moments (informal setting) from other kinds of activities in a formal classroom? In what ways might 'personal science' stories and 'standard based science' work together for transformative science learning experiences for minority youths?

VENTURE

In the last two years I have been working in afterschool programs at three different poor schools in North Minneapolis. Most of the students come from recently immigrated or non-immigrant minority families. Their schools are desperate to increase science achievement. The school principals of three North Minneapolis schools, where I work with inner city urban students and teachers, told me that only three percent of their fifth grade students passed the Minnesota Comprehensive Assessment II (MCA-II) test in science. Yet, the Minnesota Department of Education touts that the fifth grade science test score in the fifth grade MCA-II test rose by six percent (MDE, 2009). Such claims mask the realities that many students, teachers, parents, and administrators face in poor urban schools. An attempt has been made by these schools and their teachers to bringing the community into the process. What I have seen is that both students and teachers are very eager to teach and learn science. The students know that they need to excel in science but they fell that science is too difficult and unimportant for solving their immediate problems. To make science as a part of students' everyday lives, we (colleagues from Public Health, Agriculture, City Master Gardener, and I) are working with these schools on community gardens where students will design, chose, plant, harvest, and sell the produce. The goal of the gardening project is developing a partnership among schools, students, community, and the university to help students learn and understand science. One of the outcomes being that these students will be more active in learning science in formal classroom settings. We also believe that this kind of engagement will create 'personal science' moments for students. Furthermore, the informal setting offers a relaxed environment where these students, who are already labeled as cognitively low, can venture into what they want to do and learn from creating their own 'personal science' moments.

We wonder what and how much the students will have learned once they are done participating in the afterschool program. We also wonder in what ways students will transfer the knowledge gained through this experience in science classrooms. Many studies have looked at students' attitude changes after these activities — but isn't there more to learn than just the change in attitude towards science? I am not discounting the important role of attitude in learning, but I believe attitude change or for that matter any of the changes that we (science educators) seek to measure should be measured over time. In what ways do students bring and utilize their social and cultural capitals to these settings and how could these capitals create or facilitate tensions for teachers and also for students. As knowledge created from various social and cultural activities differ from each other, how would science knowledge fit within those realities?

At this juncture, I seek to gain valuable suggestions and comments on the following three questions:

1. What would be some appropriate means and methods of documenting 'personal science' stories or moments?
2. What are some appropriate science related measures (surveys) that would facilitate documenting growth over time (attitude, interest, etc.)? How would I account for the influence of other factors over time?
3. What outlets in science education would be appropriate for presenting the results of the study and the contributions of those stories in teaching and learning science?