

Cultural Toolkits in the Urban Physics Learning Community

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Abstract. Chicago State University has been involved in curriculum development, teacher preparation, and education research that targets urban physics learners on the south-side of Chicago. Through this work we have begun to recognize specific cultural norms that our students bring to the classroom. These cultural norms appear to help our students establish strong communities in classes. Because of the homogeneity of our population, with most students coming from within a five-mile radius of our campus, there are a set of shared experiences that help establish a level of trust and sense of community that manifests itself in the science learning environment. Aspects of community play a major role in the preparation of teachers. In this paper we discuss our understanding of CSU student culture, its importance in the development of community, and its role in the preparation of future physics teachers. [1]

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INTRODUCTION

The physics education research program at Chicago State University (CSU) initially focused its studies on students' physics conceptual understanding. However, to better understand how students constructed concepts it was necessary to examine not only their prior ideas but the resources they bring to the classroom. These resources include receptiveness to the inquiry style of instruction and a willingness to be part of a scientific community [2].

We believe that the presence of some of these classroom resources likely stems from the culture of the students we work with on the south-side of Chicago as many of these resources have been reported by others who work with African American communities [3]. In this paper we focus on our work with CSU physics majors who are engaged in early teaching experiences and provide specific examples from the CSU PhysTEC and Noyce Programs. See Ref. [1].

CSU is a public, comprehensive, urban institution located on the far south-side of Chicago. Demographically, about 80% of the undergraduate students self identify as Black, 6% Hispanic, 7% White, and 7% other.¹ The population at CSU is representative of the community in which the university is located, drawing most of its students from a roughly 5 mile radius around the campus. The demographics of the pre-service physics teaching option are similar to that of the university, and most graduates choose to teach in the local community. We

have broadened our examination of the cultural resources our students bring to the college physics classroom to extend to resources our students take with them to the high school classroom.

This work has implications for both the students we serve in our introductory physics classes and more importantly the students who will be teaching future generations of scientists. It is the shared responsibility of those in the science community to make the culture of science more welcoming to all students. In this paper we present some initial work on our efforts to better understand and value the culture of our students and provide an example of how the culture of our students might manifest itself in an early teaching experience.

CULTURE IN THE PHYSICS CLASS

Researchers have found that often students in physics classes have not yet acquired certain values that we believe we promote in the introductory physics course. These values might include a belief that physics concepts are connected to one another, or that the physics ideas we study are related to real contexts. Evidence for this comes from nationwide results on attitude and expectations surveys like the Maryland Physics Expectations Survey (MPEX) and Colorado Learning Attitudes about Science Survey (CLASS) [4, 5]. In both these studies researchers found that student attitudes and expectations typically veer away from experts after completing the introductory coursework.

There are two ways to look at these results. If we view culture as a set of values that our students have, we might say that our students don't value the same

¹ <http://www.ibhe.org/InstitutionProfiles/>

things we do as experts in science. If we view culture as a toolkit of symbols, stories, rituals, and world-views, rather than a set of values, we might say that it is difficult for our students to pursue these values when the “accepted skills, style, and informal know how are unfamiliar [6].” Swidler posits a view of culture where individuals will pursue values for which they already have the cultural equipment. These two views are in stark contrast to each other. If as instructors we embrace the latter interpretation, it suggests that it is very important for us to pay attention to the culture of our students and align aspects of student culture with the culture of science. It is also important for us to recognize the important role culture has played in the lives of our students and the important role that their culture can play in the science classroom.

All of the students we work with have lives, sometimes quite complicated lives, and have developed a rich cultural toolkit that has allowed them to survive and succeed. If we look at the culture of our physics classrooms, we need to decide if we want to capitalize on the culture that exists beyond the classroom and therefore pay more attention to the whole student [7].

As instructors we can choose to either ignore student culture, stifle student culture, or align with student culture. One viewpoint that we have heard among faculty is that we should help our students acquire the culture of the scientific community so that they can function within the community. Another viewpoint, which we believe is less prevalent, is that in addition to helping students succeed within the culture of science as it is now, we need to understand student culture and see how the culture of science could change to become more welcoming to many of our students. The culture of science might benefit by importing some of the cultural norms of our students [8]. These viewpoints are quite different and may play an important role in whether our students see the physics (or science) community as a welcoming place. This has strong implications for the attrition rates for women and underrepresented minorities as they go from high school to university and the undergraduate program to the graduate program. While about 50% of the students who take high school physics are women and 25 % are students of color, this number decreases as students move into undergraduate programs and then decreases further as students move to PhD programs [9].

IMPLICATIONS FOR SECONDARY EDUCATION STUDENTS

As most of the students at CSU live in the urban, south-side community surrounding campus, our student population is remarkably homogeneous. Many of our students share similar values and share experiences, and this seems to foster ready communication and collaboration in the classroom. See reference [2]. We believe that there is a level of trust that exists in our students that promotes community and support in the classroom. This homogeneity also means that culture plays a strong role in the classroom – a much more visibly stronger role than it might play at other universities with greater diversity. This strong presence of culture in the homogeneous community can be utilized in developing an effective college science classroom.

Similarly, the Cultural Toolkit plays a strong role in how our preservice teachers are prepared for the K-12 classroom. CSU is in a unique position because the students it works with in the secondary education option are likely to become teachers in the communities in which they were raised. Because of this, the preservice secondary education students often have experiences and understand the culture of the local community in a more intimate and complete manner than the university science education faculty. In addition, because many teachers in Chicago come from outside the community where they teach, there are specific experiences that the CSU students have that even very experienced inservice teachers simply do not have. For this reason it is important that we recognize and embrace the cultural understandings that our CSU students possess. We have found that if we provide space for our students to be creative in the K-12 classroom and utilize their knowledge from sources outside of their physics and education courses they often develop novel strategies of engaging their audience which resonate with K-12 students.

We describe two examples of how our students have brought elements of culture into the classroom. Both students, Cheryl and Joe, are pursuing their physics degrees at CSU, are African American, and reside on the south-side of Chicago.² These examples come from early teaching experiences that are part of our NSF-Noyce Program and our American Physical Society PhysTEC Program.

Cheryl is a physics secondary education major who developed an activity on density with her fellow Noyce Scholars. This early teaching experience, which is part of the course, Readings in Science Education (Phys 4710), brings a classroom of middle

² All student names are pseudonyms.

school students from the south-side to CSU to engage in a lesson developed by our Noyce Scholars and provide an early college campus experience. Noyce scholars in biology, chemistry, and physics participate in this activity every spring semester.

Joe is a physics major who is considering high school physics teaching and is funded by the PhysTEC Program as a PhysTEC Fellow. At CSU all PhysTEC Fellows are involved in our Teaching Immersion Institute (Phys 3500). In this course, taught by two Chicago Area Teachers and two CSU faculty in science education, potential preservice teachers engage in a semester long action research project. They begin by brainstorming about a specific topic that they would like to implement in the high school class; read relevant science education research on that topic; develop a pretest, an activity, and a post test; implement the activity in the classroom, and then reflect on the activity, the implementation, and the pre and post test results.

The planning, implementation, and assessments of Joe and Cheryl were analyzed. Both students were also interviewed after implementing their lessons in one-on-one interviews that investigated their decision-making processes in the lessons. A case-study methodology was utilized.

These two students brought techniques and ideas to their activities that were based on their own experiences and cultural norms. Both instances involve a call and response type of engagement, which can be described as a “type of interaction between speaker and listener(s) in which the statements (“calls”) are emphasized by expressions (“responses”) from the listener(s), in which responses can be solicited or spontaneous, and in which either the calls or responses can be expressed linguistically, musically, verbally, non-verbally, or through dance [10].”

During the middle school lesson, Cheryl, our Noyce scholar began to feel as though she was losing the attention of her students and decided that she needed to re-engage the class. “... I did that right there on the spot ... Yeah. I just, I just up and prayed it worked ... Um, well they were getting noisy. And I wasn't getting their attention. So I, I feel like a clap you can hear that. But if you're doing a loud clap and if you're, um. It's almost like a call and response type thing. ... So, if I feel like I don't have your attention, you know, I'm gonna clap. And, you're gonna clap, saying, 'Ok, I got you.' ... And then I say, "Ok, let's stop." Then we all stop together. Then I know you're, we're together. ... So, this is my call [claps] ... I mean, I guess it comes from church. I don't know where it comes from. I didn't look for the origin. I just - that's just what...I can think of it as. ... I need your attention. And then they're gonna go clap, you know,

'Okay, oh, she needs our attention.'” Cheryl notes that the spontaneous classroom management technique arose from a feeling of what would work with the students and may have stemmed from interactions in her church community. The middle school students readily responded to the technique and joined in the clapping exercise.

The second student, Joe, utilized an ice-breaker activity in his class. He felt this was important because he didn't know the emotional state of the individual students before they would be engaging in his lesson. He mentioned that he did not know what happened to them the night before or whether they had a bad class earlier in the day. He wanted to make sure there was positive energy as he implemented his activity.

In the interview, Joe described his ice-breaker activity. “The ice-breaker game actually came from me watching my boss in theater. I work with sounds, switchboards, for musicals ... and ... he try to get all the actors' and casts' energy up. And they play a game where you point at someone and you make a noise, like, "Zip." And that person was ... point to someone else and make another noise like, "Zap." And what that does is go around in a circle; and then you speed it up. And then whoever mess up - they have to step out ... get your energy going. ... There's no interacting fun. There's no, I might have had a bad class period before I came in this class. I need to change that energy to make it positive.... So that was a good way for students to interact with each other...” Joe believed positive energy was a necessity for the individuals within the class to effectively, collaboratively engage in learning physics. Later in the lesson he used a variation of the game as students were asking and answering questions about conservation of energy. Joe decided that a student could “zip” a question to a peer for them to answer. This is an excellent example of taking a technique that is designed to promote positive energy and connecting it to the content in the lesson. It was also a piece that Joe was especially proud of when he described his lesson.



FIGURE 1. Joe engages the group of high school students in an ice breaker activity.

There are a number of themes that emerged from these two episodes. We saw that students used a call and response mode of discussion. Cheryl states "I'm gonna clap. And, you're gonna clap, saying, 'Ok, I got you.'" Joe uses the icebreaker where students need to respond to each other through sounds or noises. Additionally, there is a focus on community rather than just the individual and on the importance of the individual in the support of the group. As she describes the clapping technique Cheryl states "we're together." Joe uses his exercise to allow the students to engage with each other. He believed the icebreaker was "a good way for students to interact with each."

Both students also alluded to building a positive energy in the classroom. While in Joe's activity he was explicit about the importance of the activity to "get your energy going" Cheryl cited the importance of "a loud clap" to garner attention and inclusion.

SUMMARY

In both cases our preservice students brought in experiences and culture from their own lives, rather than from coursework or university resources, into their teaching lessons. Both techniques show a respect for the high school students with whom they were working and both instructional implementations appear to acknowledge the resources of community in these high school classrooms. There was rarely an instance where Cheryl or Joe transmitted knowledge, procedures, or disciplinary rules. Instead, it was more of a collaboration. There seemed to be a trust established between the Cheryl and Joe and the students in that when the instructor says "I need you" the students will respond "Ok, I got you." These activities also align with classroom management techniques that build on mutual respect for the roles that the high school students and the preservice teachers play in the classroom.

This work highlights the need for faculty members to recognize the importance of valuing the experiences and cultures of the students we work with as learners in the science classroom and as future teachers. At least one of the instructors that worked with Joe on his early teaching experience was concerned that his ice breaker activity would take away from the physics content in the lesson and would not be well received by the high school students and the other instructors supervising the early teaching experience. But we agreed to let him proceed and found that the activity that many might consider "off task" was important to the content portion of the lesson because of the positive, welcoming instructional environment he had created.

Often we find that when we give students creative space and allow them to emphasize certain elements of their cultural toolkit they are then able to develop a sense of loyalty and solidarity among the participants and create resonances in the classroom.

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