

Culturally Relevant Mathematics: Students' Cultural Engagement with Statistics

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Abstract: This poster reports on the results of a culturally relevant mathematics unit, the Community Mapping Project (CMP), where urban students learned statistics by producing and analyzing maps of their own community using Geographic Information Systems (GIS). In this poster we show how three aspects of culturally relevant pedagogy, familiarity of context and authentic purpose, and informal linguistic competencies succeeded in engaging youth at a crucial point of their statistics research project, choosing a research question.

Background

The mathematics education community has begun to place an increased emphasis on the ways in which we can improve the achievement of students who have been underserved by our educational system due to class- and race-based geospatial polarization. One proposal has been to teach with a more *culturally relevant pedagogy*, which aims at fostering students' sense of community membership and pride, engaging students to use their academic skills to critique social inequities, and providing ways to succeed academically that preserve students' cultural integrity (Ladson-Billings, 1995). To this end we designed a mathematical intervention intended to engage students in statistical analysis of data layered onto maps of their local geographical community. Following Cobb and Moses (2001), familiarity with the mathematized spaces was expected to both engage them in research projects and provide resources for the construction of meaning by allowing students to draw on their cultural experiences and knowledge to interpret the statistics and displays their classmates produced. In designing the unit, we theorized that three aspects of culturally relevant pedagogy would facilitate students' engagement with the statistical research projects in which they engaged: 1) the *familiarity of the context* of the mathematical problem, which was borrowed from the students' own communities, 2) the emotional charge and *authentic purpose* from attempting to solve real social justice problems facing their own community, and 3) building on *informal, linguistic competencies* that these students already possess. The main questions of this poster concern what aspects of culturally relevant pedagogy embodied in the CMP unit succeeded in engaging students in mathematical analysis of data.

Study Design and Methods

The Community Mapping Project (CMP) was a curricular intervention where two seventh-grade mathematics classrooms of urban students learned statistics by producing and analyzing maps of their own community using Geographic Information Systems (GIS) and Tinker Plots, to examine social justice issues. After an introduction to the GIS software (MyWorld), students worked in small groups of 2-3 students to create a research question, choose and analyze relevant data, and present their findings to their peers in class. The study was carried out in a Los Angeles middle school with a diverse student body (46% Hispanic, 35% Caucasian, 12% African American, and 5% Asian and/or Pacific Islander), and 41% of the students received free or reduced price lunches. Two seventh grade classrooms, with a total of 47 students engaged in the CMP unit for six weeks. For the larger project we collected interview, pre-/post-test, and video data, the latter of which is the focus of this poster. All whole class activities and four small groups selected by the teacher to be case studies were videotaped during their work on the project. All videos were logged and from these logs we looked for moments when students were engaged with the data and making meaning from the project. These 'moments of engagement' were transcribed and analyzed using grounded theory video analysis methods described by Erickson and Shultz, 1997.

Findings

While the findings presented in the full poster will encompass all four case study groups, here we illustrate our findings with a description of one small group at a crucial stage of their research project, choosing a research question, and illustrate how familiarity of context, authentic purpose, and informal linguistic competencies each played a role in engaging the students in meaning-making with statistics. The group of African-American and Latina ethnicities, included Mark, Jasmine, and Lorena (pseudonyms are used for all names). They had two class periods to construct a research question that was answerable with the data available to them. They began with a question about "why are there so many whites in Santa Monica" (one of their local communities that is a relatively wealthy suburb of Los Angeles) and over the course of two days transitioned to

whether there are more ‘rapes where there are more females’. While at first this dramatic transition between questions surprised us, analysis of the video shows the students’ struggle to find a question that was relevant to their lives and positioned them in a non-threatening way.

On the first day the group began with their question about “why are there so many whites in Santa Monica” and talked with several adults in the class (researchers and their teacher) who tried to help them create an answerable question and choose relevant data. In particular the teacher suggested high API scores (a relative measure of school quality) and distance to the beach as data relevant to their question. After this the group began to voice and finally articulate a discomfort with the question because of the way it privileged white people. As Mark said, “I don’t want to make it about why do white people blah blah blah [sic].” On the second day, the group left the question about white people behind and explored questions about parks and violence around Los Angeles County. They took turns clicking on different areas of the GIS map based on their ideas about which areas had more violence. Finally, they decided that studying the number of rapes in different areas would be interesting, and when a researcher said they needed to compare the number of rapes to something else, the group decided that number of females was a variable that might be related to the number of rapes.

Throughout the two-day long search for a research question familiarity of context, authentic purpose, and informal linguistic competencies all played a role in the group’s engagement. Familiarity of context came up frequently as students used their cultural and local knowledge to explore the data and suggest questions. First, the students drew on their own knowledge of a racial divide – that there are more whites in Santa Monica as opposed to other areas of Los Angeles – to suggest a ‘why’ question for why this could be. Perhaps because they already thought that there *was* a divide, the why question was more relevant than asking whether there *were* more whites in Santa Monica. Second, the students used local knowledge about which areas of the county might have more violence to explore the GIS map, trying to figure out where various cities they knew of were on the map and whether there was indeed more violence there.

Authentic purpose and emotional charge also played a role in the questions they generated and in the transition from their initial question of race to their final question about rapes and females. The group’s initial question regarded a racial and economic divide in the local community that privileged white people. Once they decided not to pursue that question, they considered a range of questions that had personal implications for their lives. Mark suggested “what races go to parks” would be good because “you know some of my people don’t want to go to the hood park because they’re gonna get shot up.” Not long after, Jasmine, the quietest member of the group interjected a rare suggestion, gangs, saying, “I’m a little gangbanger.” Concern about violence was of daily relevance because of where parents would allow them to go and because of family members involved with gangs. Their final research question about rapes and females seems to have come about in part due to a concern about violence and as a way to produce shock value in the classroom, “We need something that’s really good.”

Finally, the process of building a research question built on students’ informal, linguistic competencies, allowing them to use everyday language in phrasing their questions. One linguistic area of struggle was figuring out how to make a question that could be answered with the data available. Informal patterns of argumentation do not necessarily limit one to considering only ‘provable’ claims or questions. However, this is an important aspect of mathematical arguments. In this case, we argue that the negotiation and interplay between short, informal arguments that students brought to the table and the more formal, research questions introduced by the teacher and the researchers, both shaped the students final choice and contributed to the students’ engagement with the project. Notably, after one researcher queried the group regarding this (“Is that a question you think you can answer with the data? Cause it’s a why question.”) the group took up this challenge and when evaluating various questions started asking each other and other adults, “But how can we prove it on the computer?”

References

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