

RUNNING HEAD: Student involvement in WideNet

Bringin' It to the Table:
Student Involvement in the WideNet Research Project

Dawn Evans *

Nancy Ares

Warner Graduate School of Education and Human Development

University of Rochester

*Corresponding author: P.O. Box 270425, Rochester, NY 14627; 585-273-4916;

devans@Warner.rochester.edu

Introduction

The WideNet Research Project incorporates a new generation of networked classroom technologies focused on shared construction of mathematics learning (cf., Participatory Simulations and HubNet, Wilensky & Stroup, 1999; SimCalc, Hegedus & Kaput, 2002) in secondary mathematics classrooms in a northwestern urban region in the U.S. Networked technologies are quickly making their way into classrooms, and are seen by organizations such as the National Research Council as “one of the most promising technology-based education innovations” (Roschelle, Penuel, & Abrahamson, 2004, p. 51). Our work extends efforts that implement these technologies in demographically diverse classrooms by attending to the fact that students bring varied cultural practices and resources to the task of learning and to how these practices contribute to learning. We respond to Lee’s (2003) caution that, “where such tools may be used with students of color¹ or students living in poverty, little attention is given to the impact of culture on how these tools are appropriated” (p. 42). Fundamental questions remain as to whether some uses of these technologies may simply reinforce current inequities in opportunities to learn, unintentionally widening achievement gaps, or how their use may invite teachers and students to tap into cultural practices and resources to promote and accelerate learning. There is little hope of addressing differential achievement across groups and transforming classroom teaching and learning if research and development efforts ignore issues of culture. Instead, it is possible that implementation of these promising tools may have only superficial effects rather than supporting substantive change, due to a lack of understanding of the powerful influence of culture on learning.

¹ I use varying adjectives throughout the paper to refer to youth and communities that have and continue to be subject to societal inequities as a way to problematize what Lee (2003) points to as “‘current terminologies (e.g., inner city, at risk) [that] carry with them similar sets of assumptions that continue to place groups in hegemonic opposition’ to use any of the current terms inadvertently communicates the assumptions of privilege against which we argue” (p. 3).

The WideNet project has been designed to examine whether Participatory Simulations and HubNet (Wilensky & Stroup, 1999) invite both teachers and urban youth of colour to draw upon youths' cultural resources to advance rigorous mathematical learning. The core research question of this project is: *How can networked classroom technologies be designed and used to help teachers draw explicitly on the cultural practices of urban youth of colour as resources for rigorous mathematics learning?* One subsidiary question arising from this primary one and relevant to this paper is: *What youth peer community cultural practices are important in scaffolding rigorous, network-supported mathematics learning?*

To address these questions, the WideNet Project involves studies of youths' classroom and out-of-classroom activity and has two related foci:

- *Classroom research* examining network- and non-network supported activity to extend understanding of network-mediated classroom processes, especially interactional and motivational processes that leverage the funds of knowledge of urban students of colour and of the unique mediating influence of the networked technologies, and;
- *Youth peer community research* identifying cultural practices in which students engage in their peer communities at school that may be important in culturally relevant network-mediated mathematics activities.

This paper addresses the youth peer community research focus, through which we aim to build understanding of cultural practices in which non-dominant students engage in various areas of their school, and to identify those that may be important in the design and use of culturally responsive network-mediated activities. To do this, we argue that that a critical part of addressing issues of culture is incorporating the students themselves into the research project as co- (or participant) researchers. As co-researchers, students help answer the following questions: What

youth peer community cultural practices are important in scaffolding rigorous, network-supported mathematics learning? What are processes and outcomes of using identified youth peer community cultural resources to enhance the cultural relevance in networked activities?

We present our approach to and experiences of involving student co-researchers from the first two years of youth peer community research. Secondary school student involvement in both data gathering and data analysis demonstrates that mathematical funds of knowledge we have jointly identified involve both modes of participation and mathematical content that are potentially important resources to draw upon in network-supported classroom learning. Further, issues of social justice, embodied in the sociopolitical dimensions of identifying and drawing on cultural practices of non-dominant communities, are made clear, both in terms of the ways those practices are brought into school learning and the increased sociopolitical awareness our co-researchers exhibit as we work together.

As we describe below, analysis of our work with student co-researchers over the past two years reveals that their work with us is informing the WideNet Project along three trains of thought. First, we find that as we are challenging their notions of traditional mathematics, they in turn are locating such challenges in the work we do in their classrooms as we analyze classroom data together. Second, understanding of some of the mathematically rich, culturally valued practices they engage in (for example, card playing, sports, dance) has become much more tangible. They have situated Spades, Step, and Football historically within their communities and helped make explicit the cultural value and mathematics involved in these practices. Finally, they have explicated their experiences of being urban youth of colour in a world that devalues and further oppresses them.

We start by providing an overview of research literature addressing educational reform, particularly with regard to the incorporation of urban youth cultural practice in the classroom, as well as that attending to urban youth as co- or participant researchers. Subsequently we discuss our recruitment and preparation of student co-researchers, as well as their work over the past two years. Finally, we conclude with a discussion of how their work has informed the larger WideNet Project following the three threads outlined above, and the implications of engaging students as co-researchers in educational research.

Literature Review

Students' cultural practices as resources for classroom learning

Cultural practices – social and cultural knowledge or “funds of knowledge” (Moll & Greenberg, 1990) – are “historically accumulated and culturally developed bodies of knowledge and skills essential for household or individual functioning and well being” (p. 323). There is a considerable body of research showing that incorporating the funds of knowledge children bring with them into the curriculum has tended to increase the self-esteem and academic achievement of minority and lower socioeconomic class children by bridging gaps between school and home knowledge (Gay, 2000; Ladson-Billings, 1994; Lee, 1998; Lipka & McCarty, 1994; Olmedo, 1997; Rosebery, MacIntyre, & González, 2001). However, as Wilcox (1998) notes, it is often the case that “many popular educational reforms are likely simply to rearrange the appearance of classroom interaction, leaving the substance of what takes place in the classroom largely untouched. This is because the reforms are conceptualized and introduced with little understanding of the powerful cultural influences at work in the classroom” (p. 303; cited in Panofsky, 2003, p. 422). Lee (2003) cautions that the substantial funding being invested in educational technologies may, instead of supporting every student’s learning, unintentionally

increase the gaps in achievement among cultural groups because of the lack of attention to sociocultural influences on students' engagement with schooling and learning. Additionally, Lee (2003) notes, "With the new opportunities for forms of representation and communication afforded by new computer-based technologies, it may well be quite useful for designers to consider the implications of this work for communication opportunities within computer-based environments" (p. 44).

School contexts outside the classroom offer important opportunities to explore diversity in communication styles that may be valuable for supporting students' mathematics learning through network-mediated activity. Seminal work in this vein is found in research by Au and colleagues (1980a) and Dick, Estell, and McCarty (1994) on communication and interaction patterns among native Hawaiian and Navajo children, respectively, showing how using students' home/community social and cultural practices can provide important avenues for scaffolding development of literacy skills. Additionally, Rosebery, Warren and colleagues (1992, 2001) identified important connections between Haitian Creole students' skills in argumentation and storytelling and inquiry in science, using those connections to support their learning of both the content and the practices of science. Finally, Lee's (2001, 2003) Cultural Modeling Project draws on linguistic features of African American Vernacular English, including "use of metaphor and ... satire, irony, and shifts in point of view" (Lee, 2001, p. 100) to scaffold students' literary analysis of canonical texts.

The studies mentioned above are designed to identify and utilize students' home/community social and cultural practices in the classroom both as a means of bridging a cultural disjuncture, where school and home cultural practices are very different from each other and as a medium for engaging students in rigorous scholarly learning. The sociocultural

practices identified and used range from those involving science to social studies to literacy. However, they all involve adults as researchers and co-researchers without tapping into the ‘insider’ perspective of the students themselves. The next section of this literature review addresses research efforts that seek to gain that emic viewpoint.

Students as co-researchers

Benefits to students and the field. Mitra (2003) notes that in their attempt to improve school climate and address student performance and retention rates, few schools “have decided to go straight to the source and ask students” (p. 289), despite the fact that students are uniquely positioned to discuss classroom and school experience from a far more personal standpoint than are the adults in the school. Similarly, to gain a perspective on issues such as dropout rates among urban high school students, many researchers (Farrell, Peguero, Lindsey, & White, 1988; Kelly, 1993) advocate use of the subject population (students identified as being in danger of dropping out) to act as co-researchers. Both these studies echo the value of the unique positioning of students as researchers of educational reform as set forth by Atweh and Burton (1995) who selected students as researchers because “young people were well situated to identify and express their educational needs. Further, conducting the research themselves provided an educational experience for the students that might be seen as worthwhile and valuable to their future employability” (p. 562). Here the authors point to the importance of the emic perspective gained by involving students as researchers of educational reform, those who are *most* intimately connected to the research problem, as well as the educational gains those students receive as a result of their training. Finally, in addition to emic perspectives and educational gains, student research on bullying in the U.K. confirms that students and adults see the same things very differently (Gunter & Thomson, 2006). Decisions to ignore name-calling, for instance, are seen

by students as extremely unfair while teachers feel they are choosing a ‘path of least resistance’ in steering the class back to the task at hand. These differences in perspectives are important to identify and understand in efforts to foster substantive reform. Taken together, this body of work highlights some of the benefits of involving youth as co-researchers – insider perspectives that yield important insights, multiple perspectives that add dimensionality to our understanding, and important support for students’ development of research skills, practices and understanding.

Student engagement and socio-political awareness. Having students serve as co-researchers in both the classroom and peer youth community studies strengthens our access to students’ peer communities, as well as trustworthiness of the data and analyses of the WideNet Project as a whole. Similar work with students-as-ethnographers projects in literacy is numerous (cf., Bloome & Egan-Robertson, 1998; Wigginton, 1985). For example, Curry and Bloome (1998) engaged students in ethnographies to help build understanding of literacy-related knowledge and practices of their families and communities. Students in Yeager, Floriani, and Green’s work (1998) used ethnographic methods to examine the ways in which their own processes of learning, for example, science or history were different from and like those of scientists and historians. As with the studies reviewed above, these projects also point to this approach as a way to achieve an “insider’s” perspective available only through collaboration with students. Similar efforts have also been undertaken in science education (Hammond, 2001; Barton, 2001), where critical ethnography with students as co-researchers “involves generating new ways of understanding, valuing, and genuinely incorporating into school-based practices the culture, language, beliefs, and experiences that these children bring to school” (Barton, 2001, p. 899). Employing students as co-researchers serves to facilitate students’ abilities to draw on embodied practices such as rhythm, fluency, and energy (Elmesky, 2005), select artifacts and

resources for interpretation, provide a unique insider perspective (Elmesky & Tobin, 2005), and provide a “mechanism for collaborating with the community and for helping it build future capacity” (Rao, Arcury, & Quandt, 2004, p. 3). Such works stress the transformative potential of student ethnography, as students and families come to understand social and political influences on their communities, including those that shape relationships to the disciplines and to schools.

The studies alluded to above illustrate the depth of insight into the social and cultural worlds of youth of colour that academe stands to gain through wedding the work of student co-researchers with that of educational researchers. Such work however, must be grounded in an appropriate theoretical framework and it is that topic we address next.

Theoretical Framework

The pivotal theoretical framework upon which this paper is based is the Vygotskian sociocultural-historical framework comprised of four core assertions from which a multitude of research has originated. Essentially, these assertions are that learning is mediated first between a learner and more experienced others and cultural artifacts. Once this first mediation occurs, the learner then appropriates the experience internally (Lee & Smagorinsky, 2000). Moll and Greenberg (1990) describe this mediation as a “‘harnessing’ of social resources” (p. 344), thus facilitating teaching and learning. As their study shows, Mexican-American households harness their resources (or funds of knowledge) and transmit them among their family members. They claim that development of social networks beyond, but connected to, the classroom creates connections between the social and academic lives of students. Such connections “help teachers and students to develop their awareness of how they can use the everyday to understand classroom content and use classroom activities to understand social activity” (p. 346).

Vygotsky's second assertion states that interpersonal learning involves an interaction between more experienced individuals and less experienced individuals, a type of mentoring interaction that is not to be misconstrued as transmission. Rather it is more of a mutually constructed activity. It is this activity that constitutes the social co-construction of knowledge (Wertsch, 1991) and is of particular interest to psychological and educational researchers (Nasir & Hand, 2006).

Thirdly, all psychological tools, mediational means, or signs that are drawn on while constructing meaning are culturally and historically constructed, thus tying together people, psychological tools and the cultural construction of tool use. Bahktin (1981, as cited in Lee & Smagorinsky, 2000) calls language the "tool of tools" and it is through language use that learning, the construction of meaning and the transmission and transformation of cultural signs and artifacts, takes place.

Vygotsky's fourth and final core assertion relates to the learner's capacity to learn. A learner's capacity for knowledge construction is intertwined with the learning context (what the learner already knows, the nature of the learning to be done, the activity in which learning takes place, the quality of the learner's interactions with others). Vygotsky used the phrase "zone of proximal development" to explain the learner's potential to learn (Lee & Smagorinsky, 2000). Teaching in the "zone" should always extend the learner beyond her/his present capability, but not without the support of an adult or more capable peers.

In conclusion, Vygotsky argued that cognitive development was more than merely passive responses to the environment. It was due to a person's social interactions within the environment or socially meaningful activity mediated by language and other mediating artifacts (Dixon-Krauss, 1996, p. 9).

However, while all children come to school with cultural and social knowledge, for those of Latina/o, African American, and Native American descent, this knowledge is often unrecognized and devalued in schools, including urban schools where the concentrations of students of colour can be found (Barton, 2001; Gay, 2000). Rosebery, McIntyre, and González (2001) suggest that middle-class white students come to school somewhat more prepared than their lower-class minority counterparts because of the greater alignment between home and school knowledge. In other words, the ‘cultural capital’ or the cultural knowledge of white students is valued in schooling as opposed to the cultural capital (knowledge) of urban students of colour (Bourdieu, 1992).

Literature that addresses students as researchers of cultural and linguistic artifacts strongly suggests that through inviting students to engage in authentic (i.e. beyond the school walls) research, students are developing deeper, more relevant relationships with academic knowledge. They are simultaneously engaging with, creating, and preserving cultural knowledge (Bloome & Egan Robertson, 1998). For instance, Curry and Bloome (1998) attempted to move urban 7th graders away from the reproduction of ‘doing school’ in which the students constructed themselves as non-knowers. To unpack what is meant by ‘doing school’, think of a theatrical performance in which actors are acting out a scene. Without researching the setting, characters, and context of the scene, actors can only perform the scene, they make neither the audience nor themselves feel or get involved with the performance.

In sum, this research reflects a number of the core assumptions of sociocultural theory. In all cases mentioned above, interaction occurs between more experienced individuals (adult researchers who are sharing their research skills) and less experienced ones (student researchers who are ‘mining’ the knowledge contained within their cultures/communities) in a mutual co-

construction of knowledge (Lee & Smagorinsky, 2000). Across the studies, student researchers made deliberate choices to study aspects of their culture and communities. These choices resulted in the recognition, acknowledgement, and, in some cases, celebration (through publication) of the funds of knowledge to be found within their cultures and communities. It also resulted in a growing understanding on the part of the student researchers of the oppressive practices of society as a whole and school more specifically in valourizing particular ways of knowing and doing. While society and the 'doing' of schooling has constructed urban students of colour as being unknowledgeable, the examples of student researchers above aptly illustrate the Vygotskian notion that there is no boundary on a person's capacity to learn, given what the person already knows, the nature of the learning to be done, the activity within which learning takes place and the quality of the learners' interactions with others (Lee & Smagorinsky, 2000). Furthermore, the relationships between student researchers, adult researchers and teachers provide a collaborative environment, where shared goals of understanding one's community and place in it are the norm. Student researchers are engaged in purposeful research that holds real meaning for them and creates a desire to work together to understand and solve the problem at hand (Wells, 2000). Such real and challenging work serves not only to enhance the learning of student researchers, but also serves a social justice purpose in that it makes apparent the various inequities experienced by urban communities and the people within, including urban students of colour, enabling them to utilize their cultural capital to reconstruct themselves and their communities as knowledgeable.

Recruiting and Preparing Co-Researchers

In the WideNet Project, student co-researchers are recruited from the classes in which the networked technology is being used and studied. They are brought to the University of

Rochester campus for two consecutive, all-day Saturday sessions focused on introducing them to the central constructs and activities of the WideNet project, and to ethnographic approaches to studying cultural practices of youth. Following Booth, Colomb and Williams (1995) and Bloome and Egan-Robertson (1998), the student co-researchers engage in on-campus activities involving observation and field noting and examine notions of cultural practices. As well, they are introduced to basic interviewing skills and given the opportunity to practice them. Once they are introduced to some of the rudimentary research skills, they work with graduate students to develop a research project they can conduct at school during the school year – one that is both of interest to them and that will contribute to the WideNet classroom study described above. Throughout the course of the school year, the student co-researchers return to the University for meetings with the WideNet team, both to continue to collaborate with us on their personal research (concomitantly drawing upon the expertise of the University team for assistance), and to lend their expertise in the analysis of video data gathered by the University team in the high school classrooms, thus helping the University researchers gain that ‘insider’ or emic perspective mentioned above into both youth peer community practices and the impact of the networked activities on mathematics learning and classroom practice. Students are eligible to receive official credit from their high school for completing the year’s work with us.

Context (Setting the Table)

With the WideNet project in its third year of study, two groups of student co-researchers have participated and collaborated in data analysis and research. In the 2004-05 school year, seven students participated (2 Black girls, 1 Latina, 1 White girl, 1 Latino, and 1 Black boy), while in the 2005-06 school year, five students participated (4 Black girls, 1 Black boy). In this,

the third year of the study, six students are involved, all of whom are Black, with 2 being boys while four are girls. Our co-researchers have been and are 10th – 12th grade students.

Preliminary evidence based on the two years of study thus far has been fruitful for the larger project and for the students themselves. In the first year, the student co-researchers focused our attention on the mathematics involved in team and role-playing card games (e.g., Hearts, Spades, Tunk, Pokémon, Magic, Yugio), role-playing and other video games (Star Wars, Guild Force, Sim City, Mortal Combat), and dieting as regular peer community activities involving mathematics. Specific content includes ratio and probability, relative values (among video game characters: life points in relation to power levels, time to swing in relation to number of hits needed to win), averages, as well as relationships among velocity, distance, and time to finish.

In our second year of work, student-led research has also made us aware of the mathematics involved in Stepping (a form of dance important in African American communities that involves groups' precisely coordinated, intricate arm and leg movements, loud stomping/marching, chants, and music. Its beginnings have been traced to the South during slavery, where it served as a link to African tribal dance and a means of retaining cultural practices in the face of oppression (Malone, 1996)), football, and Spades play (a 4-person, 2 team trick-taking card game, similar to Bridge and Whist), as well as the youth cultural practices involved in these activities, for example, modifying traditional Step routines to incorporate Hip Hop and other popular music, changing rules in Spades to increase the chances of winning by large margins, and the value of performance in both activities.

With the aid of our student co-researchers, we have ascertained that the mathematical content embedded in all three activities includes pattern formation, counting, timing, angles and

precision coordination in Stepping; probabilistic reasoning, prediction, strategizing, risk assessment, and collaboration in Spades; and statistical analysis, probabilistic reasoning, and strategizing in football. Additionally, our student colleagues have enriched our understanding of those cultural practices in which they engage. Specifically in this essay, we report in more depth on their work with us to identify the above activities as culturally valued, mathematically rich activities; how the student co-researchers designed mini-case studies to examine those activities and engaged in data collection and analysis. We next describe the ways in which we worked together with youth, the formation of roles and relationships, and the ways in which they informed the larger project.

Process of Working with Youth as Co-Researchers

Recruiting and Relationship-Building

As mentioned previously, students from the classes participating in the WideNet Project are invited to work with us; hence the student co-researchers aspect of this Project is purely voluntary. Through negotiation with the Social Studies Department at the school involved, senior students who work with the WideNet Project are able to obtain the necessary Participation-In-Government credit, which requires that all seniors perform 20 hours of community service as part of their Social Studies work. Depending on the individual needs of the student co-researchers, we've also been able to negotiate additional single credits in other courses for them. As well, all student participants learn about social science research. It should be noted here that the student co-researchers in 2004-05 assisted the Project in a more informative, advisory capacity (particularly with the classroom data), thus reflecting Fielding's

(2004) definition of student co-researchers². In the second year, with the help of graduate students, some student co-researchers, in addition to assisting with analysis of classroom data, designed and conducted their own research projects on the mathematics inherent in cultural practices in which they engaged (e.g. Step and Football), the culmination of which was a public presentation of their work. In this case, the work of these students reflects that of what Fielding (2004) considers student researchers; that is, having been trained in the craft of research by either teachers or formal researchers, they have identified and shaped a research problem, formulated a question, and established a methodology whereby they collect and analyze data in an effort to respond to their question. They have greater autonomy in crafting and presenting their response. Despite this distinction, we refer to our student colleagues as co-researchers because they were asked specifically to develop their own project in a way that informed the larger WideNet Project.

Student co-researcher recruitment typically takes the form of two graduate students making a very brief presentation to the classes involved in the project and giving the students further textual information and a permission slip to be read, signed, and returned by both the interested student and her/his caregiver(s). The University team hosts training meetings on Saturdays at the University for two or three consecutive weeks (if possible). During this time, student co-researchers are taught, through participating in activities, what cultural practices are, what social science research is, and are given the opportunity to develop skills in observing, taking field notes, and interviewing. By the end of training in the first year, student co-researchers began assisting in analysis of classroom data, while in the second year they were establishing research questions to examine. At least once per month following the training

² Student co-researchers are fellow researchers who have not necessarily constructed a research question and methodology (though they may have contributed to the process), but who assist with data gathering, analysis, and may (or may not) collaborate in the dissemination of findings.

sessions, the student co-researchers met with their University counterparts to either analyze classroom data or establish goals for a research project of their own. While all the sessions, whether training or otherwise, were opportunities to learn for the entire team, they were also opportunities for our high school colleagues and ourselves to exchange stories, worldviews and generally develop a rapport that, for some has continued into a subsequent year.

Now that the table is set, we describe what the student co-researchers have contributed to the WideNet Project since its inception two years ago.

Bringin' it to the table

An important role of our student co-researchers has been the way in which they have helped us make sense of what is happening in the classroom when the networked technology has been in place. Additionally, they have helped us see some of the everyday mathematical practices they engage in among themselves. They have provided suggestions for activities that, once coded into the computer language of PartSims, could become networked, mathematically rich and culturally relevant activities. And finally, they have been able to express their sociopolitical concerns. The following provides a sense of what our student co-researchers are contributing to our understanding.

What happens in the classroom: challenging traditional notions of mathematics

With WideNet, we hope to challenge students' (and teachers') notions of what mathematics is. Rather than being a static body of knowledge to be mastered in school we, with Lave (1997), argue that schooling, although purportedly the site for powerful learning that can be abstracted and generalized across many contexts constitutes a mere fraction of the mathematics involved in students' lives. Associated with this critique is the recognition that people in many cases question whether everyday math constitutes 'real' math, underscoring the pervasiveness of

the belief that formalized, decontextualized mathematics taught in schools is real math while the mathematical problem-solving of the ordinary, everyday kind is not.

A networked activity we conducted in our first year of the project, called ‘Phases of the Moon’, guided students to consider graphic representations of natural phenomena having a cyclical nature. During one of our conversations with student co-researchers, one of them expressed a sense of wonder or disbelief:

SR: I was surprised that by changing just one number of the equation the whole graph would change. I didn’t think math would be like that. I didn’t expect squiggly lines.

SR is referring here to a graph transformation activity related to curve matching to represent the cyclical nature of many phenomena in the world, such as the phases of the moon or, as SR pointed out, the predator-prey relationship. This example points to an instance where we attempted to contextualize seemingly decontextualized mathematics by relating it to the natural world. Co-researchers’ perspectives on how what we were doing in their classes broadened or did not challenge their notions of the nature of mathematics have been crucial in both our modification of curriculum and our theorizing about how the mediating function of the networked activities.

In the next year we continued to challenge those traditional notions of mathematics.

With a different group of student co-researchers, we examined video footage of some WideNet classrooms engaging in a CBR or computer-based ranger activity³. This particular activity requires that students work in groups. As our two co-researchers observed a group of girls attempting to work with the CBR activity, they were initially struck by the fact that the girls were

³ In this activity, a group of students are given a CBR attached to a graphing calculator. The CBR acts as a motion detector and records distance and speed up to 15 feet away from it in the form of a graph that is displayed on the calculator screen. Students are given a series of graphs to reproduce physically (by walking the graph), verbally (by giving oral instructions to the walker), graphically (by reproducing a graph on the calculator), and in written form (by writing out what actions the walker took to reproduce each graph).

easily distracted, “talkin’ about other stuff”, like phones, watches, and hair. They noted that the girls were getting their work done, despite some technical difficulties and the distraction. Later, BT pointed out that, “you won’t see this [the group work] in the regular math class”, although she qualified herself by adding that you will see students distracted and talking to each other in mathematics class. It seems that, as it is traditionally presented in school, mathematics is seen by these co-researchers as an individual activity, not a social one as the WideNet Project is attempting to present.

On another occasion, we met with our younger colleagues to examine a segment of video data from a Gridlock⁴ session that was of particular interest to us because one of the students in the class literally took over the class to explain his strategy for maintaining traffic flow. In this class, there is a notable shift in the attention level of the class on two occasions: First, when the traffic simulation is running and the students are manipulating their intersections, there is a high level of interest and chatter among the students. Following gridlock, the class’s attention is focused on the graphs produced and the teacher leads discussion about what the graphs are telling them. At this point, interest begins to wane, until during a strategy discussion, one of the students in the class comes forward to describe a strategy. Our student co-researchers focused on what was happening at that point.

BB: I seen two things. Compared to when the kids are using the calculator, now kids are starting to get a bit bored when AI⁵ explains how the graphs come to work. So we got kids putting their heads down or looking around. The only people who understand math

⁴ Gridlock is a PartSims activity in which each student controls, by means of a graphing calculator, an intersection on a traffic grid projected at the front of the classroom. The objective of Gridlock is for the class as a whole to work together to optimize traffic flow through the grid. As a result of the students’ interaction with this dynamic system, three graphs (Average Wait Time, Number of Stopped Cars, and Average Speed) are produced and discussed. Whole class strategizing becomes a key element of this activity.

⁵ During the first two years of the WideNet Project, graduate research assistants taught the classes, not the regular math teacher.

are John and the other guy. You can tell like John spoke and how the class boosted up and had more feedback to John.

JJ: John made the connection, like, to real driving, so kids paid attention to him.

BB: And kids can relate to John.

When asked whose knowledge was important, our student colleagues instantly recognized John as being the locus of both knowledge and control in the segment they'd watched, but one student (BT) hypothesized that earlier in the class, "people are tryin' to say something, but they didn't want to say it 'cause they think they might be wrong". Despite the degeneration of class discussion from multiple interactions (during the simulation) to a dialogue between John and Al where it appears that only one student is making sense of the Gridlock simulation, another student (CM) points out that other students are agreeing with John as he's talking, "so they probably understand".

Ideally, it would be great to have students in the math classes we visit take it upon themselves to lead more of the class discussion instead of it relapsing into a teacher-led question and answer session. We proposed that to the student co-researchers and they agreed, with BB adding that he'd like to be a teacher. However, due to the risky nature of getting up and leading a class, it takes a special kind of student to do that, as we discovered much to our chagrin, when John refused to participate in the same manner in the subsequent Gridlock class.

The above examples of work with our student colleagues speak to the necessity of continuing to challenge traditional notions of mathematics in order to destabilize deeply held convictions regarding the nature of mathematics, particularly school mathematics. First, mathematics is not confined to the solving of problems or rote memorization of theorems - it can be playful, even aesthetic in nature. Second, mathematics is individual (not multiplex) in nature. And finally, while our co-researchers understand very well that the world around them is rife

with examples of mathematics, it is not the case that they believe they can draw upon their own knowledge of the world to demystify school mathematics. As our co-researchers make clear, this broadening of what mathematics is assumed to involve is the type of work to be done if utilization of student mathematical funds of knowledge is to impact at the classroom level.

Mathematics in everyday cultural practices

We are also beginning to analyze mathematics discourse and practice in everyday activities of youth peer communities with particular attention to interaction and language-use patterns, as well as to multimodality in mathematical practice and discourse, i.e., the use of gesture, everyday language, coordination of efforts and co-construction of mathematically rich objects and repertoires of practice. For instance, the importance of the performative aspect of Spades play and Step dance, explored in depth below, is confirmed in our analysis with co-researchers. Our collaborating researchers made clear that this aspect is important in providing a venue for displaying prowess, prowess built in part on a strong grasp of the deeply embedded mathematics, i.e., conditional probabilities, combination, remembering and recognizing patterns, prediction, precision, strategizing. Further, the history of the cultural practices our co-researchers have turned our attention to has also been made clear to us, highlighting the importance of the value placed on cultural practices as a significant element for us to attend to as we seek to transform mathematics teaching and learning in school.

Our student co-researchers are helping us see rigorous mathematical reasoning in some of the activities which youth find engaging. For instance, CS described a video game she plays as follows:

CS: You have several different swords...and you have to, um, ...you have five seconds to hit or kill a zombie before it kills you and the bigger, um, sword, the different probabilities of hitting it because it's [the sword] is really long and powerful. So it takes him, the

main..., the little thing you're moving around the RPG, um, like three seconds to swing it and get it out. With the master's sword, that's the basic sword, like it take five hits to kill the zombie with that. And it takes two for the bigger sword.

From this description it is possible to see that, in order to be successful at it, one must be able to calculate probabilities and speeds almost instantaneously. A more familiar game, Pokémon, is similarly complex. As CS described it, each character in the game has a certain number of 'hit' points. It is possible to "make a character faint" by eliminating its hit points. In order to do so, one must know the differing attacks by both their probability of hitting and the power behind each attack.

CS: Different attacks have a greater probability of hitting, like their accuracy is 85% and the power behind an attack ranges from 5 to 170 hit points taken.

One's character, opponent, and location are also variables that must be accounted for in order to successfully play Pokémon. The complexity of the tacit mathematical reasoning that must take place in order to play these games is extreme, yet the activity is highly engaging for youth. Gee (2003) reports that the combination of high challenge, active engagement, and complexity are critical to youths' avid playing of video games. He identifies learning principles that inform game design as crucial to their success, including active, critical learning, metalevel thinking, committed and ongoing learning, and multiple routes to solutions.

Our student co-researchers from the first year also pointed out the mathematics inherent in card games such as Tunk (one has to keep the lowest cards in one's hand)⁶ and Bullshit (one has to know who picks up what). Music, an important aspect of youth culture, was also hallmarked as containing mathematics. Knowledge of beats and rhythms in playing an instrument contains an arithmetic element as does Stepping, described above.

⁶ Tunk also contains an element of gambling, hence it would be necessary to keep track of cards played and probabilities.

The student co-researchers recruited in the second year of WideNet chose to research rather specific practices of their own. JJ and BT combined forces to study the mathematics found in Stepping; CM, a high school football player, chose to examine the mathematics specific to football; and BB worked with one of the university researchers to expose the mathematics inherent in Spades, a popular card game played during lunch by secondary school boys at the WideNet research site. As work unfolded in these smaller projects, a much richer understanding of peer group practices emerged, as is witnessed by the following examples.

Culturally valued, mathematically rich practices

The co-researchers were critically important in helping us identify not only mathematically rich practices, but also those that are highly valued in their communities. Three examples are particularly salient. Across all of them, their rich history in the local African American community is important to their value. For two of them, the performance of the activity is key (Step, Spades), while for the third the notion of community and team membership is central (Football).

Understanding Step. As JJ interviewed former and current Step dancers and coaches, drew upon her own reservoir of knowledge of Stepping (she is captain of the girls' Step team), and read about Step, her analysis highlighted the following points:

- The importance of sequencing (“if you forget an egg, the cake will fall”, interview, 03.25.06), coordination, timing, precision, and attitude in Stepping⁷
- Sequencing, coordination, timing, symmetry, and geometry were the mathematical elements of step that could be incorporated into elementary school mathematics via the activity of Stepping.

⁷ Quotes come from JJ’s interview data analyzed by both she and BB.

Above and beyond the mathematics, though, we were able to gain insight into the collaborative and performative nature of stepping as Steppers collectively select their music and choreograph their routines, thus involving a great deal of group negotiation skills. Attitude is important in that it reflects the courage required to go on stage and it is fueled by the interaction between the steppers and their audience (“Black children want to shake what they got,” interview, 03.25.06). Although the criteria for judging a Step performance in a competitive situation are not always evident, JJ pointed out that organizing a Step team according to height if all are doing the same Step pattern, or coordinating a more random organization of Stepping bodies on the stage if different Step patterns are being used, adds symmetry and aesthetics, as well as having a crowd- and (presumably) judge-pleasing effect. Audience appreciation is an important criterion for judging, as well. JJ noted, “[t]he main reason [for Stepping] is to give the crowd a show” (interview, 03.25.06). The audience shows their appreciation through cheering and clapping and this, in turn motivates the team further.

Further, one can’t look ‘bougie’ (pronounced ‘boo-zhee’) on stage, one interviewee revealed.

This term was unfamiliar to us and the co-researchers helped clarify it:

CM: It means beautiful and ghetto.

JJ: No, not that.

BB: Bougie, I don’t know.

CM: Well, that’s what it first meant.

JJ: No, it means, when you, um, when you’re really poor, but you act like you’re rich.

BB: Yeah, you’re fronting.

JJ: Yeah, a front, yeah.

Not ‘fronting’ speaks to the value put on authenticity, and on representing oneself and one’s community in a genuine way. Additionally, Stepping is an embodiment of power - the Steppers literally perform their power with their dance routine, the music and chants they’ve selected,

their appearance, and their ability to elicit audience reaction. Together, the focus on authenticity and performance reveals how important attitude (e.g. pride, power) is to the performance of Step.

Understanding Spades. Through data analysis with a Spades-playing student co-researcher, both the deeply embedded mathematics and the performative aspect of Spades became much more evident to us. In a discussion of the type of tacit mathematical thinking that takes place during a Spades game, BB also showed how dominance is displayed by enacting a hand where he knows he has the highest card left. He pretended to smack it down onto the table (giving a performative display of power). According to him, this type of display occurs “when the possibility of you takin’ the hand is really great – not necessarily one hundred percent, but slightly high” (interview, 03.25.06). As we attempted to draw out the mathematical reasoning employed by skilled players of the game, BB tried to explain:

BB: If you’re a good Spades player, you’re going to use strategy. Math comes into play, but I don’t think people, really crossing everything, that they’re usin’ math. They’re doin’ ...playin’ Spades is math anyways.

Al: Right.

BB: They usin’ math, but I don’t think they know they *are* using math.

This is interesting to watch as the university researcher leaned forward, eager to learn. BB, on the other hand, was leaning back easily in his chair, swinging from side to side, gesticulating with his hands as he explained his point. Positionality was telling, with our junior colleague as the expert, and the university researcher as the novice.

The performance of laying strong cards (or “laying the mac down”, as BB explained) is a demonstration of style and flair, enabling a player to show his expertise in Spades. It can also be used to intimidate, especially in highly competitive situations, as a way of “getting inside” your opponent’s head. Some of this posturing comes from watching one’s elders play also - so it is part tradition, part display of intimidation.

When asked about the performative nature in Spades carrying over into other sports, BB points out that, “we gotta be the best...you’re not going to beat me in my territory.” He believes this competitive performativity may have originated “back in the day”, a reference to slavery, and adds, “it’s been around awhile. I guess it was a way to identify us...we play differently than you. This is how we do it – this is how y’all do it...so that we different” (interview 03.25.06). The explicit reference to ‘we’ (African Americans) as separate from ‘you’ (White researchers) highlights the cultural origins and value placed on the game.

Spades, as noted previously, is a four-person, two-team game. Our observations show that there is an element of cross-board communication taking place during the course of the game. BB spoke of giving or getting “the look” or “vibes” to and from his partners as they play. Additionally rules of the game have been modified to enable wins by large margins. Such cooperation (whether it be the subtle communication between team members or the rule modifications) simultaneously blended with the competitive nature of the game of Spades adds up to an effort on the part of the young Spades players at our research site to “reach for the top”. Our co-researchers’ work with us has illuminated many aspects of Spades play, particularly that it is a highly valued cultural activity that involves rich, deeply embedded mathematical reasoning.

Understanding Football. CM, the high school varsity football player, chose to research the mathematics football players use to measure individual and team performance as well as the mathematics specifically involved in the playing and winning of a football game. Through his efforts, we came to understand that, as with Spades, mathematics is an integral part of football. For example, statistics are used before and after the game. CM tells us,

We don’t go online like they do in the pros. We go on, like, what we see in games. How many times they scored. What’s their win/loss record. Who’s doin’ the most receivin’

on their team? We try to stop them, people like that. Who's runnin' the ball?
(presentation, 05.06.06)

He explains that arithmetic such as addition and subtraction is important in determining downs and yardage calculations. Again, as with Spades, probabilities come into play, but in a somewhat different fashion:

Odds of a particular play, like you don't know...probability would be like does this play work in a ... okay it's fourth down, there's only like four minutes on the clock. They're up by seven points and like you, you're trying to figure out what play is going to work and will it work at this certain time. You think about the time and like, will this person on the team fumble or not. Will he catch the ball? So you look at that and that's when you look at the individuals and not the team. (presentation, 05.06.06)

As CM makes clear, calculating odds, as well as assessing strengths and weaknesses of individuals on your and your opponent's team, are rich mathematical practices integral to play calling.

Up to this point, CM had been emphasizing the cooperative, team effort of a football squad. His interviews with fellow players revealed that most of them measure their individual performance by their contributions to the team and what they do on the field and measure team performance by their cooperation with each other and positive attitude. It is in those key situations as CM describes above, when probabilities of making a key play are critical, that each individual's performance is scrutinized.

In the case of high school football, CM taught us that mathematics and mathematical reasoning are employed in various aspects of the game, from simple calculations of yardage needed to probabilistic consideration of individual players' abilities to deliver a key play. As well, the mutual effort of the football team reflects elements of the collaborative effort of Stepping.

CM also conducted a library/Internet analysis of the history of Football generally and in Rochester in particular. He began by talking about his own history with football, then described two former high school players from his school who ‘did it big’, one winning two SuperBowl rings and the other now engaged in community recreation work after playing with two professional teams. Finally, he pointed out that the city of Rochester had a historical connection with football, having once fielded a National Football League team from 1920 to 1925. The team, “a ragtag group of Rochester area teenagers ... became known as the Jeffersons in reference to the locale of their playing field which was on Jefferson Road” (presentation, 05.06.07). CM described how the Jeffersons, in search of other teams to play, were able to secure a match against the Kansas Bulldogs, at that time the greatest team in the country. Significantly, Jim Thorpe, a famously successful athlete, played for Kansas at the time. Although Kansas crushed the Rochester team, their audacity caught the attention of those persons starting the NFL and the Jeffersons were invited into the nascent league.

Through his research, CM apprised us of the rich historical legacy football holds for himself, his school and his community, illustrating for us the depth of the cultural value placed upon the football tradition.

Burgeoning sociopolitical awareness

As we worked with our high school colleagues, issues of social justice, embodied in the sociopolitical dimensions of identifying and drawing on cultural practices of non-dominant communities, arose. They became evident in terms of the increased sociopolitical awareness our co-researchers exhibited as we worked together.

On several occasions, they expressed a keen awareness of the social order in which they find themselves. They are acutely aware of the double standard that exists in America regarding

Black people. Despite the fact that in their school, white people are the minority, these urban students of colour know more about that minority culture (and are expected to conform to its standards) than they do of their own. As one of them exclaimed, "...they, they makin' our culture a routine. You hear the same darn Martin Luther King from 5th grade all to 12th grade" (interview, 03.25.06). They recognize the 'heroes and holidays' (Banks, 1993) type of education where they learn about the contributions of a few Black people, while many are omitted or not given the credit they deserve.

BB illustrated a poignant point as he related what he recalled of a poem read to him by a teacher. The poem described some of the difficulties Americans would face if Black people weren't brought to America:

- BB: The poem was about a kid who was wakin' up and he was trying to find different stuff but it was like the Black people never came to America. He was like, uh, he went outside...
- N: Oh.
- BB: Well, first he started to dry his clothes, but there wasn't no washing machine. Why was that? Because it was created by this such, such, such and such...
- N: Umhm.
- BB: And he tried to find the iron. He was trying to iron his clothes 'cause they was wrinkled. He couldn't find the iron 'cause it was created by a Black man. Then he went outside to start the car but couldn't start it 'cause the key ignition, that wasn't invented.
- N: Umhm.
- BB: 'Cause, you know, it was crazy. I know a lot of things that we contributed to America but we gets no credit for it.

The poignancy here lies in the glimpses these students get of possibilities, of contributions to be justifiably proud of, but which get no recognition from society at large.

They are also acutely aware of stereotypes they are held to. Hair weaves are brought up as a culturally Black practice:

- BT: Yeah, you know how they talk about us wearing weave all the time.
- BB: That's our style!

BT: White people wear weaves but you never hear them talk about that. They never talk about that.

JJ: They sure do wear a weave.

There was some further conversation about celebrities who wear weaves, as further examples of the double standard, and then BT mentioned having to continually assert both her and her family's Blackness because of their long straight hair. She and her family had immigrated to America from Nigeria. She spoke of getting into fights over being pigeon-holed as being mixed with Indian. "Why you gotta be mixed if you got long hair, right?" she asked.

Our co-researchers recognized the social injustice that has been perpetrated against their race (and them). BB imagined a special tax on every Black invention with the revenues earmarked for the Black people, "then we could start buildin' up, makin' up for those 400 years." In this glimpse into their world, we witness their recognition of the inadequacies of the education they receive; the stereotyping that permeates their lives, and the need for racial uplift (Woodson, 1998). For us, it reinforces the need to try to make a difference with them and their classmates.

Conclusion

Mathematical funds of knowledge we identified involve both performance and mathematical content that are potentially important resources to draw upon in network-supported classroom learning. It is becoming clear that the mathematics involved *and* the performance of mathematically rich activities is important. The student co-researchers were critically important in helping us identify not only mathematically rich practices (video games and dieting), but also those that are highly valued in their communities (Step, Spades, and football). Across the latter three, their rich history in the local African American community is important to their value. For Step and Spades, the performance of the activity is key, while for football the notion of community and team membership is central.

Our student co-researchers have illustrated how they see a similarity in the atmosphere created in networked classroom activity such as Gridlock and their peer community activities' focus on collaborative effort and active engagement in authentic, yet tacit mathematical activity. These findings point to important relationships among culture, motivation and learning (Ares, 2005; Ares, Evans, & Schademan, 2006), and to co-researching with urban youth of colour as an important aspect of culturally relevant research aimed at increasing critical awareness and supporting youth's development of critical research skills and attitudes that they can use in future potentially transformative activities.

Draft

References

- Ares, N. (2005, April). *Culturally relevant design and analyses of network supported learning*. Paper presented at the meeting of the American Educational Research Association, Montreal.
- Ares, N., Evans, D. & Schademan, A. (2006, April). *Mathematics and numeracy as social and spatial practice*. Paper presented at the meeting of the American Educational Research Association, San Francisco.
- Atweh, B. & Burton, L. (1995). Students as researchers: Rationale and critique. *British Educational Research Journal*, 21(5), 561-575.
- Au, K.H. (1980a). Participation structures in a reading lesson with Hawaiian children: Analysis of a culturally appropriate instructional event. *Anthropology and Education quarterly*, 11(2), 91-115.
- Banks, J.A. (1993). Approaches to multicultural curriculum reform. In Banks, J. & McGee Banks, C.A. (Eds.), *Multicultural education: Issues and perspectives* (195-214). Boston: Allyn & Bacon.
- Barton, A.C. (2001). Science education in urban settings: Seeking new ways of praxis through critical ethnography. *Journal of Research in Science Teaching*, 38(8), 899-917.
- Bloome, D. & Egan-Robertson, A. (1998). Introduction. In Bloome, D. & Egan-Robertson, A. (Eds.), *Students as researchers of culture and language in their own communities* (xi-xxii). Cresskill, NJ: Hampton Press, Inc.
- Booth, Colomb, & Williams. (1995). *The craft of research*. Chicago, IL: The University of Chicago Press Ltd.
- Bourdieu, P. (1992). The practice of reflexive sociology (The Paris workshop). In Bourdieu, P. & Wacquant, L.J.D. (Eds.), *An invitation to reflexive sociology* (216-260). Chicago: University of Chicago Press.
- Curry, T. & Bloome, D. (1998). Learning to write by writing ethnography. In Bloome, D. & Egan-Robertson, A. (Eds.), *Students as researchers of culture and language in their own communities* (37-58). Cresskill, NJ: Hampton Press, Inc.
- Dick, G.S., Estell, d.W., & McCarty, T.L. (1994). Saad naakih bee'enoiltitji na'aikaa' Restructuring the teaching of language and literacy in a Navajo community school. *Journal of American Indian Education*, 33(3), 31-46.
- Dixon-Krauss, L. (1996). Vygotsky's sociohistorical perspective on learning and its application to western literacy instruction. In L. Dixon-Krauss (Ed.), *Vygotsky in the classroom: Mediated literacy instruction and assessment* (pp. 7-24). White Plains, NY: Longman Publishers.

Elmesky, R. (2005). "I am science and the world is mine": Embodied practices as resources for empowerment. *School Science and Mathematics, 105*(7), 335-342.

Elmesky, R. & Tobin, K. (2005). Expanding our understanding of urban science education by expanding the roles of students as researchers. *Journal of Research in Science Teaching, 42*(7), 807-828.

Farrell, E., Peguero, G., Lindsey, R., & White, R. (1988). Giving voice to high school students: Pressure and boredom, ya know what I'm sayin'? *American Educational Research Journal, 25*(4), 489-502.

Fielding, M. (2004). Transformative approaches to student voice: Theoretical underpinnings, recalcitrant realities. *British Educational Research Journal, 30*(2), 295-311.

Gay, G. (2000). *Culturally responsive teaching: Theory, research, & practice*. New York: Teachers College Press.

Gee, J.P. (2003). *What video games have to teach us about learning and literacy*. New York: Palgrave.

Gunter, H. & Thomson, P. (2006, April). *Bullying? You get the picture...Student researchers using still photography and dramatic scenarios*. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Hammond, L. (2001). Notes from California: An anthropological approach to urban science education for language minority families. *Journal for Research in Science Teaching, 38*(9), 983-999.

Hegedus, S. & Kaput, J. (2002). Exploring the phenomena of classroom connectivity. In D. Mewborn, et al (Eds.), *Proceedings of the 24th Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 422-432). Columbus, OH: ERIC Clearinghouse.

Kelly, D.M. (1993, April). *Secondary power source: High school students as participatory researchers*. Paper presented at the annual meeting of the American Educational Research Association, Atlanta, GA.

Ladson-Billings, G. (1994). *The dreamkeepers*. San Francisco, CA: Jossey-Bass Publishers.

Lave, J. (1997). The culture of acquisition and the practice of understanding. In D. Kirshner & J. Whitson (Eds.), *Situated cognition: Social, semiotic, and psychological perspectives* (pp. 17-35). Mahwah, NJ: Lawrence Erlbaum Associates.

Lee, C.D. (1998). Culturally responsive pedagogy and performance-based assessment. *Journal of Negro Education, 67*(3), 268-279.

Lee, C.D. (2001). Is October Brown Chinese? *American Educational Research Journal*, 38(1), 97-141.

Lee, C.D. (2003). Why we need to re-think race and ethnicity in educational research. *Educational Researcher*, 32(5), 3-5.

Lee, C.D. & Smagorinsky, P. (2000). Constructing meaning through collaborative inquiry. In C.D. Lee and P. Smagorinsky (Eds.), *Vygotskian perspectives on literary research: Constructing meaning through collaborative inquiry* (pp. 1-15). New York, NY: Cambridge University Press.

Lipka, J., & McCarty, T.L. (1994). Changing the culture of schooling: Navajo and Yup'ik cases. *Anthropology & Education Quarterly*, 25(3), 266-284.

Malone, J. (1996). *Steppin' on the Blues: The visible rhythms of African American dance*. Urbana-Champaign, IL: University of Illinois Press.

Mitra, D.L. (2003). Student voice in school reform: Reframing student-teacher relationships. *McGill Journal of Education*, 38(2), 289-304.

Moll, L.C., & Greenberg, J.B. (1990). Creating zones of possibilities: Combining social contexts for instruction. In Moll, L.C. (Ed.), *Vygotsky and education: Instructional implications of sociohistorical psychology* (319-348). New York: Cambridge University Press.

Nasir, N.S. & Hand, V.M. (2006). Exploring sociocultural perspectives on race, culture, and learning. *Review of Educational Research*, 76(4), 449-475.

Olmedo, I. (1997). Voices of our past: Using oral history to explore funds of knowledge within a Puerto Rican family. *Anthropology & Education Quarterly*, 28(4), 550-573.

Panofsky, C.P. (2003). The relations of learning and student social class: Toward re-"socializing" sociocultural learning theory. In A. Kozulin, B. Gindis, V.S. Agueyev, & S.M. Miller (Eds.), *Vygotsky's educational theory in cultural context* (pp. 411-432). New York: Cambridge University Press.

Rao, P., Arcury, T.A., Quandt, S.A. (2004). Student participation in community-based participatory research to improve migrant and seasonal farmworker environmental health: Issues for success. *The Journal of Environmental Education*, 35(2), 3-15.

Rosebery, A., McIntyre, E., & González, N. (2001). Connecting students' cultures to instruction. In McIntyre E., Rosebery A., & González, N. (Eds.), *Classroom diversity: Connecting curriculum to students' lives* (1-13). Portsmouth, NH: Heinemann.

Roschelle, J., Penuel, W., & Abrahamson, L. (2004). The networked classroom. *Educational Leadership*, 61(5), 50-54.

Rosebery, A.S., Warren, B., & Conant, F. (1992). Appropriating scientific discourse: Findings from language minority classrooms. *Journal of the Learning Sciences*, 2, 61-94.

Wells, G. (2000). Dialogic inquiry in education: Building on the legacy of Vygotsky. In Lee, C.D. & Smagorinsky, P. (Eds.), *Vygotskian perspectives on literary research: Constructing meaning through collaborative inquiry* (51-85). New York: Cambridge University Press.

Wertsch, J. (1991) *Voices of the mind: A sociocultural approach to mediated action*. Cambridge: Harvard University Press.

Wigginton, E. (1985). *Sometimes a shining moment: The Foxfire experience*. New York: Anchor Press/Doubleday.

Wilcox, K. (1988). Differential socialization in the classroom: Implications for equal opportunity. In G. Spindler (Ed.), *Doing the ethnography of schooling* (pp. 268-309). Prospect Heights, IL: Waveland Press.

Wilensky, U., & Stroup, W. (1999). Participatory simulations: Network-based design for systems learning in classrooms. *Proceedings of the Conference on Computer-Supported Collaborative Learning, CSCL '99*, Stanford University.

Woodson, C.G. (1998). *The mis-education of the Negro*. Trenton, NJ: Africa World Press, Inc.

Yeager, B., Floriani, A., & Green, J. (1998). Learning to see learning in the classroom: Developing an ethnographic perspective. In A. Egan-Robertson, & D. Bloome (Eds.), *Students as researchers of culture and language in their own communities* (pp. 115-142). Cresskil, NJ: Hampton Press.