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## Parents as Resources for Mathematical Instruction<sup>1</sup>

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This paper addresses one component of a research project that aims at the development of mathematics instructional innovations in classrooms composed of predominantly minority working-class students. Our goal is to develop teaching innovations in mathematics that capitalize on students' (and their families') knowledge and experiences from everyday life. In this paper, I focus on the work with parents in this project. This work takes three different avenues: a) ethnographic household visits to some of their students' homes. Our premise is that the students' households and community can provide strategic resources for classroom practice; b) regular mathematical workshops with a core group of working class, immigrant, Spanish speaking mothers. Through these workshops, we explore these women's ideas about and understanding of mathematics, while maintaining a two-way dialogue to better inform our work with their children; c) interviews to uncover the uses of mathematics in some typical occupations in this community (e.g., construction worker, carpenter, seamstress). Analysis of these interviews should provide us with insight into curricular connections between in-school and out-of-school mathematics, as well as into our work with parents as adult learners of mathematics.

### **Background**

Our current research project BRIDGE (Linking home and school: A bridge to the many faces of mathematics) builds on a prior project, the Funds of Knowledge for Teaching (Moll, Amanti, Neff, & González, 1992). One of the main components of that project are teachers' ethnographic household visits. Teachers visit the home of some of their students to learn about the funds of knowledge in these households. Funds of Knowledge are "the essential bodies of knowledge and information that households use to survive, to get ahead, or to thrive" (Moll, Vélez-Ibáñez, & Greenberg, et al., 1990: 2). Questionnaires on the family structure, parental attitudes towards child-rearing, labor history, household activities are used to provide some structure to these home visits.

By going into the households we try to learn about the particular circumstances of the families and students with whom we work. Thus, rather than guiding ourselves by general cultural definitions of, for example, Mexican-Americans, we take a dynamic approach to culture as meaning the lived experiences of our students and their families. There are wide differences between, for example, recent Mexican immigrants whose children were born in Mexico and may have been here for two or three years, maybe less, and families who have been here for one generation or more. The home visits allow us to go beyond the often simplistic and stereotyping characterization of a certain group (in this case "Mexican-Americans") that looks

at what can easily be seen, such as type of food, folklore, way to dress, and ignores more hidden aspects. Martha Floyd-Tenery, a teacher/researcher who participated in the Funds of Knowledge for Teaching Project writes:

The ethnographic research process causes teachers to become more aware of the multidimensionality of students' lives. A student may be a caretaker, friend, musician, champion Nintendo player, and family interpreter. Such information acquired through home visits can prevent teachers from jumping to erroneous conclusions regarding their students (Floyd-Tenery 1995:11).

This qualitative study of households has consistently documented a wealth of resources and knowledge in these working-class, minority families. For example, this household knowledge ranges over themes such as farming, construction, use of herbs for medicinal purposes, mining, repair, budgeting, cooking, sewing, etc. Furthermore, another aspect that the project was interested in documenting is how is this knowledge used by the families. How do families develop social networks and how does this networking help these households get ahead? Of interest to us, from a teaching point of view, is the children's level of participation in the household activities.

In school, we seldom build on the knowledge and experiences that working-class, minority students have. Building on that knowledge (and the families' knowledge) was one of the premises behind The Funds of Knowledge for Teaching project. For example, a teacher finding out about her students' families knowledge about construction led her to developing a comprehensive learning module around this theme, in which she not only integrated the different school subjects, but actively involved some parents and community members who eagerly came to share their expertise (Civil, 1993).

### **Bringing in the Mathematics**

The current project, BRIDGE, has as a main focus the teaching and learning of mathematics. It builds on the prior project, but also on research on the social construction of mathematics in the classroom (Ernest, 1998; Lampert, 1990) and on studies on everyday mathematics and on the gap between in-school and out-of-school learning (Abreu, 1995; Lave, 1988; Nunes, Schliemann, & Carraher, 1993). Furthermore, for our work with the parents we have found research on adult education, particularly that grounded on critical pedagogy, particularly useful (Benn, 1997; Frankenstein, 1989; Frankenstein & Powell, 1994; Harris, 1991; Knijnik, 1996)

Over the years of my working with prospective elementary teachers, I became intrigued by the fact that the "more successful" were less likely to make use of "informal" methods, everyday

type reasoning, and would rather use a formula, algebra, school-like methods. The "less successful" were often trying to make sense of the problems, making connections to everyday life. Abreu's (1995) study on the relationship between home mathematics (sugarcane farming) and school mathematics among children in the North East of Brazil, resonates with my own experience with prospective teachers. I was particularly struck by her observation that the students who were more engaged with home mathematics often were more unsuccessful at school mathematics; and among those more successful at school mathematics often were students less engaged in home mathematics. How are students perceiving these two forms of mathematics? Are these different forms of mathematics given different value?

These questions are grounded on our primary interest in the project--children's learning of mathematics. However, as we tried to gain a better understanding of the effect of household knowledge and experiences on the mathematical learning of these children, we realized that household visits were only one aspect, almost like a beginning. We decided to add two components to our work with parents:

- Regular mathematics workshops with a core group of parents. So far these workshops have been mostly with a group of working class, immigrant, Spanish speaking women.

- More focused interviews trying to uncover the uses of mathematics and the mathematical potential in the occupations of some of the students' parents. This is what we have called occupational interviews.

I will describe these two components next.

### Workshops

Our aim through these workshops is the development of a core group of parents to engage in a two-way dialogue about the teaching and learning of mathematics. This concept of a two-way dialogue is crucial to our work: on one hand, these workshops are aimed at enhancing the participants' understanding of mathematics. On the other hand, we want to learn about their ideas about mathematics, its teaching and its learning, as well as about their everyday uses of mathematics. This group of women is very diverse in terms of years of formal education, ranging from two or three years at the elementary level, to high school. Our workshops have engaged them in geometric explorations (including some work on Logo), strategy and topological games, and fractions. Our approach in these workshops is very similar to what we do in professional development sessions for teachers. Thus, we select reform-based activities and have them work in small groups, constantly encouraging them to come up with their own approaches. This provides a very rich environment for us to learn about their thinking about mathematics.

The discussions have shown a mixture of wanting to do things the way they were taught (although sometimes they only remember part of the procedure) and a common sense, practical

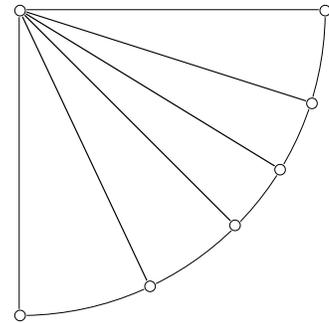
approach (as in the case of trying to go from a recipe for eight people to one for four people, where one of the proposals was to bake the one for eight and either freeze the leftovers or give them away). All throughout, these discussions have shown an eagerness to investigate, to learn. For many of them, the approach is different from what they experienced in their own schooling--a traditional approach in which they were shown (told) how to do things. Thus, a question that we have is how do these women appreciate an open-ended approach in which closure (in a traditional sense) is not necessarily reached at the end of each individual workshop? Another question we have is should we be looking at fractions from the school mathematics point of view in these parents' workshops? We want to do this because one of our goals (and one of the reasons why these women expressed an interest in participating) is for them to be able to help their children at home with school mathematics. However, we wonder about how to bring in school mathematics in ways that make it relevant to these adults, not "only" as mothers, but as learners themselves.

We want for these parents to be seen as intellectual resources in that not only they participate in the discussions but then they go to classrooms to teach what they are learning in these workshops. This is a different kind of parental involvement from what many minority, working-class parents usually experience (e.g., monitoring of cafeteria, organizing papers for a teacher, cutting things for an arts activity, ...).

Not only are we learning about these women's ideas about mathematics, but about their uses in their everyday life. For example, in one session we had the opportunity to listen to a woman describe a step by step procedure of how to make a dress. She used the teacher as her model and walked us through the whole process. Throughout, the other women in the group shared their knowledge of sewing, exchanging "tricks" and asking each other how to do certain things. In a very collegial atmosphere, comments about the mathematics they saw in sewing, as well as comments about their own experiences as learners of mathematics were naturally shared. From my point of view, there was a richness in mathematical content in the whole process of making the dress (e.g., her technique to draw a quarter of a circle; her use of symmetry all throughout; a possible arena for exploration of theorem of Pythagoras). At this point, this was mostly an exercise for me as I attempted to uncover the mathematics in the making of the pattern for a dress. And this is not an easy exercise. My lack of familiarity with sewing and my formal training in mathematics did not seem to mesh together well for me. It reminded me of Fasheh's (1991) account of his relationship to mathematics versus his mother's relationship to mathematics, "In 1976 it struck me that the math she was using was beyond my comprehension. (...) Mathematics was integrated into her world as it never was into mine" (Fasheh 1991: 59).

A question that these workshops raise for me is what should we do as these parents tell us about their everyday practices and their uses of mathematics? This relates to the issue of

sensitivity that Benn (1997) points out when using contexts from these adults everyday practices. Do we want to use these contexts as starting points on which to ground our discussion of academic mathematics? For example, what are the implications of noticing that a seamstress makes a quarter of a circle by holding her measuring tape fixed at one corner of her rectangle (the center) and marking points 25 cm from that point, then joining them to get her quarter circle?



Drawing an quarter of a circle

It certainly shows the circle as the geometric locus of points equidistant from a given point. But how can we use her knowledge to inform us for school mathematics?

I did not really discuss the embedded mathematics (from my point of view) with the seamstress (Vithal & Skovsmose, 1997). Yet, this seems like it could be a next step. Or do I first need to get a better understanding of what are these mathematics? In a sense, this was one of the motivations behind the occupational interviews

### Occupational Interviews

We have only recently began work in this area. To this date we have interviewed a seamstress (different from the one I referred to earlier), a mechanic, a tile layer, a designer, and a construction worker. The analysis of these interviews is still ongoing. For the seamstress we analyzed her practice in terms of mathematical content (e.g., angles; from 2D to 3D and viceversa; area; estimation) and dispositions (e.g., persistence; enjoyment of challenge) (see González, Civil, Andrade, & Fonseca, 1997 for a description). For the mechanic, we highlighted issues of measurement, use of the two systems (metric and “English”), number theory situations (in terms of multiples in the context of revolutions, gears, ...). We are also working on characterizing his problem solving approach. We came up with a list of mathematical questions that we would like to ask him. For example, in his talk sometimes he used units, sometimes he didn't; he seemed to be very comfortable with all kinds of numbers; at one point he said "point six", at another "zero point six zero." We would like to probe into some of this. However, we need to find a way to do it in context and in a non threatening manner.

Through these interviews we are also learning about these parents' values about their "own" mathematics and about their expectations for their children. Generally speaking, these parents appear to be very confident about their knowledge of their practice, but they seem to dismiss this knowledge as if there was nothing to it.

### Conclusion

The three avenues we are using to interact with parents (household visits; workshops; occupational interviews) give us information on their everyday practices and experiences. This information is crucial to our efforts to bridge in-school and out-of-school mathematics. In the pedagogical transformation of this household and everyday knowledge, we are forced to re-examine what we count as mathematics. In this process, we are faced with Millroy's (1992) paradox of whether we can see mathematics that may look very different from the kind of mathematics that we learned in classrooms.

At this point in our work, the workshops and the occupational interviews raise several questions for us. How can we develop a truthful collaboration in which all parties come both as learners and as resources? What should the mathematical content of the workshops be? How can we assess the impact (affective, cognitive) of these workshops? What should we do to follow up the occupational interviews? Of course, for some of these questions, we have partial answers. But this is an evolving process. We are constantly revising and rethinking our approach.

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