Traversing Two Worlds: Participating in Adult Math Classes and Helping with Children’s Homework

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Many parents return to study mathematics, in part, because they want to help their children with schoolwork and to communicate to them the importance of education. As they study math themselves, the parents are engaging with their children on math that may or may not be familiar to them from earlier days or from current study. Data include interviews with parents, classroom observations by the adult educators, and videotapes of parents and children working together on homework-like activities. Through three case studies of mothers in one adult math class, we explore the ways the women interact with peers during problem-solving activities in the classroom and the roles they take on as they interact with their children during collaborative mathematics problem-solving.

Introduction

Among the reasons given by adult learners when asked about the impetus that spurred their return to education is their desire to be better able to help their children with schoolwork. This seems to be particularly salient for helping with children’s mathematics homework (Jackson & Ginsburg, 2008). Indeed, one mother and her daughter said to each other while working on a problem together,

Mother: “I don’t know how to do this.”

Daughter: “You don’t?”

Mother: “No, I don’t. That’s why I’m in school.”

The parents expect, and adult educators assume, that enhanced mathematics content knowledge and parents’ increased confidence in their own mathematical abilities will have a direct, positive impact on their work with their children. We can examine parents’ work with their children from a number of perspectives, including evidence of changes in parents’ familiarity with particular mathematical content, their willingness to engage with the mathematical content, their apparent comfort displayed during mathematics homework sessions, or the nature of the interactions between parents and children during collaborative work. This paper will look at examples of parent-child interactions and view them against observations of the parents’ experiences and interactions with teachers and other students within their adult mathematics classroom. We are seeking to know if parents engage in similar ways with their children as they do with their adult classmates when solving mathematical problems.
Conceptual Framework

This work is informed by two bodies of work. The first is Cai’s (Cai, Moyer & Wang, 1999; Cai, 2003) typology of the roles parents play in their children’s mathematics learning. These roles include: motivator, resource provider, monitor, mathematics content advisor, and mathematics learning counselor. For these studies, parents completed questionnaires describing their involvement in each of these types of activities, however, their self-reported activities were not confirmed through observation.

Cobb and colleagues (Yackel & Cobb, 1996; Cobb, Stephan, McClain & Gravemeijer, 2001) looked at the interactions among the students and teacher within elementary school classrooms. They identified general classroom social norms exemplified within the communal practices of a mathematics classroom, and developed the notion of sociomathematical norms to describe ways of knowing and ways of behaving that are specific to the study of mathematics in an inquiry-oriented classroom. Cobb et al used the concept of sociomathematical norms to describe the development and use of communal understandings of mathematical solution processes or acceptable mathematical reasoning. We apply the notion of sociomathematical norms to the particular ways adults are encouraged to and actually do behave within their adult education mathematics classes.

Data Sources

For this paper, we are drawing on data from a pilot study in which parents with children in primary school were recruited from two adult basic education mathematics classes in different urban programs. Twelve adult learners/parents (all women, including one grandmother raising grandchildren) were interviewed using semi-structured interviews about their prior and current mathematics learning histories (audiotaped). At a time and place of the adults’ choosing, each parent and her target child participated in an hour-long, videotaped task-based interview, with adult learner/child dyads working together on a series of mathematics tasks. Tasks were drawn from the children’s school curriculum materials (all were using reform-based materials), from traditional school-like tasks that would have looked familiar to parents from their own school days, and included an open-ended problem solving task typical of work encountered in their adult education classroom. For this paper, we will focus on three parents who were all in the same adult class, co-taught by one of the authors.

Adult mathematics class

The adults were participating in an adult mathematics class that was part of a family literacy program meeting in a public school in a large city in northeastern United States. The adult learners were pre-GED and GED students, all hoping to obtain their high school equivalency diploma. They included students who had chosen to drop out of school or had been encouraged to leave school to improve the school’s test score profile, students who were studying English as a Second Language, and mothers of children at this local school. The adult learners reported that their previous schooling experiences with mathematics focused on memorization of rules and procedures with little concern for developing understanding of what was being done.

In contrast, the pedagogical approach of the adult education class was, according to the teachers, to teach through problem solving and to create an engaging problem solving culture that emphasizes mathematical meaning. Learners were typically arranged in groups to work together on mathematical problems that were solved over multiple class sessions. There was a focus on providing ample opportunities for student problem solvers to present and explain their solution methods and argue for the reasonableness of the solutions. Teachers sought to orchestrate
discourse to highlight mathematical thinking, generalizing, and the most efficient solution methods. They reported that their model for adult mathematics was greatly influenced by and adapted from Lester’s *Teaching Mathematics Through Problem Solving* (2003).

**Research questions**

This paper examines parent-child interactions in light of the parents’ own experiences in their adult math class. We ask: How are the roles that parents enact with their children the same or different from the roles they enact in their adult mathematics class? Do learners’ classroom behaviors transfer to their home environment?

We recognize that the questions we are exploring and the evidence we are examining are deeply complex and we have only begun to look at surface manifestations. Clearly, there may be many factors involved in parents’ interactions with their children around mathematics homework that may influence what we see before us. These include, most prominently, a history of established patterns of interaction between the parties that have nothing to do with homework or mathematics. In addition, parents and children were being videotaped in an artificial setting and were completing tasks that were provided by the researchers and not classroom teachers. However, parents and children all reported that “this was pretty much like what usually happens at home.”

**Findings**

The three mothers worked with their children, who all happened to be girls, on the mathematics tasks. For this analysis, we are focusing on one task that presented a problem for each of the mother/daughter dyads in that neither person was able to find a solution quickly. Each mother/daughter pair had to work together to come to a mutually satisfactory solution and we focus on the dynamics of their interactions.

Denise

Denise had been attending the adult education classes regularly for 4–5 months. Her recent Test of Adult Basic Education (TABE) score was 6.2 (putting her in the pre-GED range). She says of herself:

“Years ago in school, I always was afraid, I think. I always shied away from it (math). I had test anxiety. Before I took a test my hands would start sweating. … I had a teacher explain to me that a test is just a test, and it’s really the way you feel about it, and as long as you don’t let it give you fear, then you can conquer it. And so I learned as I got older, helping my children do math that it wasn’t that bad, as long as you know the skills of math, the rules of math, math can be done, so it got a little easier for me. Now, today, I can sit in a classroom and I don’t have that fear. I don’t have a fear of math at all. I’m looking forward to learning more about math than I was years ago.”

Denise’s adult education teacher reports that Denise seems comfortable asking questions of teachers, but also asks group members how they got an answer and why they believe that is the answer. She is characterized as being interested in understanding concepts, not just procedures and is able to apply existing knowledge to new situations. She often plays a leadership role in her work group and sees herself as a role model for younger students and wants to inspire them.

Denise and her 7th grade daughter sat together working on a problem in which they had to determine the perimeter of an irregularly shaped figure. The mathematics content was similar to
an activity Denise had recently completed in her adult math class, but she did not seem to see the relationship between the activities. Still, she is supportive of her daughter, takes on a monitoring role, and gives learning advice such as,

“If you was taking a test, what would you do? You would eliminate this [a particular multiple choice answer].”

Denise seems to display little confidence that they will be able to come to a solution. She suggests giving up when the solution is not found quickly, “So, what do you want to do, do you want to go on [to another problem]? ”

When her daughter refuses to give up, Denise continues working with her and they each explain and discuss their reasoning to the other while trying to determine the lengths of the individual segments.

Daughter: “Hold on. This side and this side is the same thing. I think this is 5 yards, no, yeah, 5 yards. And I think this is 4 yards, because this side and this side, no…”

Denise: “But you’re missing a whole piece here. That I know.”

Daughter: “This, Mom? You talking about that? That is 5 yards. This gives you the 4, and this gives you the 2 and 2.”

Denise: “OK.”

Daughter: “So, if I do 5 and 4 is 9.”

Denise: “This side here would have to be bigger than 4, wouldn’t it? Because, this is 4, from here to here.”

So, while Denise is very confident in class, she is more intimidated, tentative and self deprecating when working with her daughter. Still, from the conversation, it is apparent that Denise is approaching the problem using the socionorms of her adult mathematics classroom—she expects that the work will be done collaboratively, with each party explaining and justifying her thinking as the negotiations to the solution unfold.

Elena

Elena has dropped in and out of the adult education program for several years, with continued inconsistent attendance. Her recent TABE math score was 6.1, similar to Denise’s score. She reports that she is motivated to return to school because she wants to be a good role model for her children. She describes her own school experience with math as frustrating.

“I had a hard time with percentages and the decimals and all that. I had such a hard time with it. But I remember the multiplication and the division and doing the fractions. That was easy, I did it. I guess because I didn’t understand where the decimal exactly goes, so it was like… I asked, do I still have to move it two spaces forward or backwards and everybody’s like, come on, we’ve been here for five weeks already…”

She sees similar frustration with math in her daughter, and links it to her own motivation to return to study.
“My eleven year old, my daughter, cannot. I don’t know, she gets so frustrated, and I feel so sorry for her because I try to explain it to her, but she can’t, because she is so frustrated. She don’t want to do it. I’m like, ‘You can’t get discouraged because I’m in school and by me seeing you guys, doing what you have to do, is motivating me to continue in school. You get discouraged, I get discouraged.’ So, I keep pushing her. And she’s like, she’ll get frustrated but she tries, she tries.”

Elena’s adult education math teacher describes her participation in class as a listener, willing to have others do the work and explain to her. She is inconsistent in applying previous knowledge to new problem situations, does not seem to transfer mathematics content or procedures accurately and effectively, and has a limited repertoire of problem solving strategies. In class, when she does not understand a problem, she readily admits she is ‘lost’ and gives up or shuts down.

Elena and her daughter worked together on a patterning problem, in a format that is familiar from the children’s curriculum materials. The task required reasoning about the addition pattern printed on a worksheet: ___, ___, ___, 61, ___, 75, ___.

The two struggle to grasp the problem situation and make a plan of what to do. They agree that there is a difference of 14 between 61 and 75, and Elena quickly grasps the idea that this difference has to be divided by 2 and then the 7 will be added to 61 to provide the number, 68, that should be entered on the line. But Elena is unsure of herself and continues to question and revisit her solution. Her daughter is confused about what should be done with the “14.”

Daughter: “61 plus what equals 75?” [daughter is counting up from 61 on her fingers while Elena is quickly subtracting 61 from 75 on paper multiple times] … “Yeah, it’s 14.” [leans over to the paper and says and writes] “Look, 14. 61 plus 14 [adds] is 75.”

Elena: “No we can’t. Cause we got to find the next number. You’re jumping. You’re jumping to here [pointing to the 75]. We have to figure out what’s here [pointing at the space between the 61 and 75]”

Daughter: “Yeah, that’s four…[trails off]”

Elena: “See?”

Daughter: “Then we do the 14 [writing 14 in the space between 61 and 75].”

Elena: “How is it 14? Then what number goes here? [pause] 61 and 14 is 75, right? So, we got to figure out what’s the number that’s here in the middle. What’s here? What is it? 7?

Daughter: “75 take away 61.”

Elena: [mumbling] “7, 68 [writing on her scrap paper, counting on her fingers] It’s tricky.” … [Elena and daughter continue to work separately, Elena writes on her scrap paper while her daughter mumbles, stares at the paper worksheet and counts on her fingers.] …
Elena: “When you subtract these two numbers. So, if we break down 14 divided into 2 is what? Or 2 divided into 14 is 7. So, 7, right? Here we go again, 68. 68. 7. Yep. So, we gotta add 7.”

Here Elena is a persistent and effective problem solver, unlike in class. Yet, she seems focused on arriving at the answer and is not actively interacting with her child to help her understand the process. While in class, she is passive and asks others to explain the reasoning to her. However, with her daughter, she is the active participant who works independently to solve the problem. She does not seem to recognize that her daughter needs to hear the explanation and to be involved in the reasoning process. When asked, Elena can and does explain her reasoning. She also tries to be supportive of her daughter and provides advice to her daughter: “There’s nothing wrong with using your fingers [to count], ‘cause I still use them. They help you out.”

Lydia

Lydia has been in class about 9 months. She has excellent attendance and always participates in mathematics activities. Her recent TABE math score is 7.7. English is not her first language. She compares learning in her adult math class with her earlier mathematics learning experience:

“I never understood that one (algebra), how to get the answer. …There were a lot of students for one teacher, that could be. They didn’t have enough time to explain. Now, I can understand better than before, maybe the way the teachers explain it. He goes step by step. We review and work as a team, like if we don’t understand, then one of your partners at the table can explain to you, how you find out the answer.”

Lydia’s teacher confirms that Lydia is supportive and helpful within a group situation, and values and contributes to collaborative work. She is willing to model a solution for the group and for the class. She is persistent and will keep working, even when struggling with a problem. She is able to apply existing knowledge to new situations and is interested in understanding concepts, not just in learning to perform procedures.

Lydia and her 3rd grade daughter worked on the banquet problem, in which the goal is to develop a generalizable rule that describes the number of people who can sit around a growing banquet table of any size. As Lydia and her daughter begin to work together to represent the problem, the daughter misapplies work she had done in school on arrays, and arranges the banquet table in an array inappropriately. Lydia interestingly then misapplies a strategy that was developed in class for a problem about the number of tiles that comprise the border of a 10 × 10 grid. So, while her daughter recognizes that the number of people that could sit around a banquet table is related to the perimeter or edges of the tables, Lydia focuses on the tables themselves and the number of tables making up the “border.” Focusing on their interactions,

Daughter: [making a 10 × 10 square of 100 tables] “100 tables.”

Lydia: “You sure it’s 100 tables?”

Daughter: “Wow! [counts down one side] 1,2,3,…10. There we go. And I check, [counting across the top] 1,2,3,…10. There we go. You can tell….10, 10, 10, 10. 40.

Lydia: “You sure?”

Daughter: “It’s perimeter, Mommy.”
Lydia: “Double check.”

Daughter: “I can tell.”

Lydia: “Ok, Double check.”

Daughter: “Look, ‘cause 10 is here, and 10 is here, and 10 is here, and 10 is here.” Count them. And what’s 10 plus 10 plus 10 plus 10, also known as 20 plus 20, [writing] is 40.

Lydia: “You sure, count again, let’s count together.”

Daughter: “1,2,3,… 37. Hmm?”


Daughter: “1,2, … 36. Thirty-six?”

Lydia: “That’s a different answer now. Count again, double check. You should start putting numbers on the tables.”

Daughter: “[starts putting numbers on top row of tables] 1,2,3 …10. [then begins to put numbers on second row of tables] 11,12,13,”

Lydia: “You going to sit there in the middle?”

Daughter: “True, true, true. [then continues to put numbers on all remaining perimeter tables]” …

Lydia: “Why it’s not 40, and it’s 36?”

Daughter: [quiet with a puzzled look] “I’ll just put 36.”

Lydia: “That’s kind of tricky, right! Why you think it came out to 36 and not 40?”

Daughter: “Hmm.”

Lydia: “You know why you get 36 here?”

Daughter: “Mmm, No.”

Lydia: “OK, you see this thing. The corner. Can you sit two people in one corner?”

Daughter: “Yes.”

Lydia: “You can sit two people in one corner? Somebody sitting here in the chair. You can sit another person in that same chair?”

Daughter: “No.”

Lydia: “OK, that’s why it is. All four corners.”
So, while the actual solution to the problem was wrong, Lydia’s interactions with her daughter were very similar to those modeled by the teachers in her adult mathematics class. She asked questions and made comments such as “Are you sure?” “Double check,” “Why?” She was concerned that her daughter would develop and understand a solution process. Lydia was actively involved in encouraging her daughter to explain her thinking and seemed to value the problem solving process over just arriving at a solution in an efficient way. Lydia thought she knew how the problem could be solved, and could have just explained her solution early on, but instead spent the time encouraging her daughter to get to the solution herself.

Implications for Instruction

When working with their children, these three mothers seemed to implement and be comfortable with aspects of the sociomathematical norms promoted in their adult education mathematics classroom. Whether these patterns of interaction were influenced by their experiences in a particular math class that promoted and modeled such interactions is unknown, nor do we know if their patterns of interactions have changed over time. These questions remain for further research.

Still, we believe that such parent/child interactions are well aligned with the goals of the children’s school mathematics curriculum and promote a home mathematics learning environment that supports the development of mathematical understanding and meaning, for children and for parents. Since parents come to adult education with a desire to better help their children with mathematics homework and learning, adult educators should be sensitive to helping parents consciously prepare for this work.

Towards this end, adult education teachers might incorporate reflection, debriefing and discussion to develop learners’ awareness of metacognitive processes in their own mathematics learning and help them use this awareness to better understand and support their children’s learning. In addition, drawing attention to and making mathematics teaching strategies explicit, including questioning techniques, value of multiple representations and multiple solution methods, use of manipulatives, strategic reasoning and justification, problem solving strategies, collaborative learning, and persistence in the face of frustration and struggle.

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References


