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Parents' interactions with their children when doing mathematics

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Abstract

In this paper we discuss a study with Latino parents doing mathematics with their children. Some of our findings reveal that parents react to their children's mathematics education looking back to their own experience as students. They try to make sense of their children's homework. They struggle with pedagogical strategies unfamiliar to them. Some parents report that they are not able to solve the problems in the way the teacher expects, so they send their children back to the teacher in order to get help. Other parents try to explain their own strategies to their children: Parents present their ways to do mathematics, while children refuse them because what they are doing is not what the teacher wants. Other parents turn to the community for help, such as taking their children to the community center, or asking other family members or neighbors for help with homework. There are also parents who express some concern about the level of the mathematics that their children are studying. Some parents deliberately engage with their children in activities that promote and require explicit display of mathematical reasoning and knowledge. All these scenarios illustrate different manners in which community, family and school are connected.

Introduction

This paper contributes to the research on parents' engagement in mathematics teaching and learning (Civil & Andrade, 2002; Civil & Bernier, 2006; Epstein & Sheldon, 2005; Lehrer & Shumow, 1997; Remillard & Jackson, 2006) Research with low-income, "minority" and immigrant families reveals that there is often a cultural and social gap between their expectations for their children's education and their experiences with the actual schooling their children are receiving (Abreu, Cline, & Shamsi, 2002; Calabrese Barton, Drake, Perez, St. Louis, & George, 2004; Civil & Bernier, 2006; Civil, Bernier, & Quintos, 2003; Horvat, Weininger, & Lareau, 2003). Research also points to the difficulties

framework (a reference) that mediates the learning process. Moll and colleagues (González, Moll, & Amanti, 2005; González, Andrade, Civil, & Moll, 2001) propose the term “funds-of-knowledge” (FoK) to analyze this process including cultural practices historically determined.

From a pedagogical approach we draw on ideas from Freire (1970, 1998), Flecha (2000), and others, who define learning as a process in which individuals are able to transform critically their (our) world using dialogue (and dialogical action) as means to acquire that “learning.” In this presentation we will not elaborate on concrete aspects related to how does this approach work in terms of learning. This theory is useful to us since it points out the importance of interaction and context (which impacts on interactions) in terms of learning.

In this paper we focus on three research questions:

1. What kind of practices do parents use to help their children with their mathematics?
2. How do parents’ different learning experiences affect their perceptions of their children’s mathematics teaching and learning?
3. What are the most prominent cultural elements that mediate parents’ perceptions of and reaction to practices related to their children’s mathematics education?

We understand these three questions in terms of our assumption that learning is a social process and hence it is mediated by interactions among individuals. Prior research in mathematics education and parents suggests that there is some sort of connection between how parents help their children doing mathematics and their cultural and social *milieu*. Within a CHAT framework, we know that interactions are an important factor to explain how learning works. For this reason we would like to explore how socio-cultural elements impact Latino children’s educational experiences, as expressed by our research questions.

Method

As Flecha and Gómez (2004) claim, phenomena in social sciences are social constructions, that is, the subject of study is a social construction made by people’s interactions. If we want to get answers for our research questions, we need to include the participants’ voices in the research. Critical communicative methodology –CCM– (Gómez, Latorre, Sánchez, & Flecha, 2006) is a way to achieve that goal. This methodological approach draws on an intersubjective epistemology; that is, social phenomena are produced by individuals through interactions. Our society is a social construction, as claimed by Berger and Luckmann (1988). For this reason a methodology that includes everybody’s voices is needed to analyze social processes, such as education. CCM uses discourse analysis as an analytical tool, drawing on Habermas’ *The Theory of Communicative Action* (1987). Therefore, we look at arguments provided by the participants in the research through dialogues (collected using qualitative techniques).

Our study took place in a borderland city of the Southwestern United States. Twenty-five Latino families were recruited for the study. Most of these families are originally from the northern part of Mexico. Many of the parents had attended school in that county and thus had schooling experiences different from those of their children. We want to point out that the schooling experiences of this group of parents were not homogeneous. Several of them went to primary school in rural areas and “ejidos” (common lands), where sometimes one teacher taught students from first to sixth grade all in one classroom at once. Attending

secondary school for these parents usually meant having to walk long distances, or moving to live with relatives in a larger town. For some others, those options were not there (i.e., not possible to move to a larger town, or being a girl and considering that it was unnecessary to pursue more education or being the older brother who had to help out the parents to provide for the younger siblings). On the other hand, in our group of parents we also had some who have a college degree or at least a few years of college education.

We carried out interviews, focus groups, workshops, classrooms observations, and debriefing with parents. Data collected was analyzed using the CCM approach, as well as grounded theory (Glaser & Strauss, 1967). CCM points out our attention to dialogues and how every participant in the research constructs their understanding, and thus their argumentation, to justify their interactions in terms of “learning mathematics.” Grounded theory provides us with a method to get an inductive approach to the data in terms of categories. All of them emerged from the data collected, which validates our analysis since those categories correspond to participants’ insights, rather than researchers’ interpretations. Furthermore, we discussed some of our interpretations with some participants in order to validate them, as CCM recommends. To include participants’ voices as co-responsible of the research process becomes a critical way to research with Latino parents (and children), rather than “on Latino parents,” which makes more reliable the conclusions achieved (Flecha & Gómez, 2004).

Discussion

We start this section by providing some “vignettes” from one family to illustrate our first question, “what kinds of practices do parents use to help their children with mathematics?” Then, we use data from parents’ interviews to address the second question, “how do parents’ different learning experiences affect their perceptions of their children’s mathematics teaching and learning? Our third question (what are the most prominent cultural elements that mediate parents’ perceptions of and reaction to practices related to their children’s mathematics education?) somehow encompasses the first two and is addressed last. There are examples to illustrate how parents’ prior experiences, as well as cultural identities, impact how they interact with their children doing/solving mathematics. Items such as “country of origin,” “cultural identity,” and “age/generation” are important variables to understand how parents and children interact around mathematics.

Analysis of interactions between parents and children

Margarita, an immigrant mother from Mexico, started attending the Math For Parents course in Spring 2005, when we first offered one at her child’s school. At that time the course took place in the morning and was geared to parents only; the topic was “exploring fractions, decimals, and percents.” The following year, we switched to an evening format in which parents came with their children. Margarita then attended with her husband Sergio and their daughter Berta, a third grader. In this paper we focus on the interactions between the parents and the child during these workshops. We also draw on an interview in their home during that same time (Spring 2006) in which the daughter sought her parents’ help with homework, as the interview took place.

Vignette 1: Berta and her mother (Margarita) on the paper clip task

In this particular activity, parents were working with their children on subtraction by grabbing a handful of paperclips from a box of 100 clips, counting how many they took and then they had to figure out how many were left. Berta picked up 25 and figured out that there

were 75 left by using the 100-number chart and counting from 25 to 100. Her mother had also figured out that there were 75 left, but she had done that independently. The facilitator wanted to engage mother and daughter in a dialogue about how the mother had done it.

1. **Bety:** Pero ella supo que era setenta y cinco, ¿cómo supo tu mamá que era setenta y cinco?
[But she knew it was seventy five, how did your mom know that it was seventy five?]
2. **Berta:** We counted by tens
3. **Bety:** Tu mamá, pregúntale a tu mamá cómo supo que eran setenta y cinco.
[Your mom, ask your mom how she knew it's seventy-five.]
4. **Berta:** (to her mother) ¿Cómo supiste que eran setenta y cinco?
[How did you know it was seventy-five?]
5. **Bety-** ¿Cómo le hiciste en tu cabeza Margarita?
[How did you figure it out in your head, Margarita?]
6. **Margarita-** Yo lo hice en mi cabeza.
[I figured it out in my head.]
7. **Bety-** Pero ¿cómo?
[But how?]
8. **Margarita-** ¿Cómo? que tenemos cien en la caja y el resto veinte y cinco queda setenta y cinco.
[How? well we have one-hundred in the box I take away twenty-five, seventy-five remain.]
9. **Bety-** Pero ¿cómo supiste que era setenta y cinco?
[But how did you know it was seventy-five?]
10. **Margarita-** Por lógica...
[Through logic.]
11. **Berta-** (raising her hand) setenta y cinco. Bety, (hitting her paper with her pencil and counting) ten, twenty, thirty, forty, fifty, sixty, seventy, eighty, eighty one, eighty two, eighty three, eighty four, eighty five, eighty six.
[seventy five]
12. **Margarita:** Porque es de 100 menos 25.
[Because it's 100 minus 25]
13. **Bety:** Pero ¿cómo lo hiciste, lo sabes automático?
[But how did you do it, do you know it automatic?]
14. **Margarita:** Me lo sé automáticamente.
[I know it automatically.]
15. **Bety-** Sí, ya sabes que...
[Yes, you already know that...]
16. **Bety-** ¿Cómo le hizo tu mamá?
[How did your mom do it?]

In this excerpt we notice the efforts of the facilitator to involve the daughter in talking to her mother about how she had approached this task (lines 1, 3, 16). The daughter seems more interested in talking about how she did it (line 2, 11). The facilitator, Bety, turns to the mother to try to get her to explain how she did it. This dynamic was quite common between Margarita and her daughter. Margarita seemed to enjoy coming to these workshops as a learner herself. Her behavior is different from that of some other parents, including her husband, in that they come to help their children in a very direct way. Margarita, on the other hand, seemed to enjoy solving the activities for her own enjoyment. This may have been due to her original participation in the course that was for parents only, in which parents were basically adult learners. This is not to say that Margarita did not scaffold her child's learning, as we will see in a later vignette.

Bety continues to probe Margarita on how she did it and Margarita shares that she thought of money:

1. **Bety-**Ella pensó en el dinero.
[She thought about money.]
2. **Berta-** Ella no hizo, yo lo conté.

[She didn't do it: I counted.]

3. Bety- Ella también le hizo en su cabeza más rápido.

[She also did it in her head faster.]

4. Berta- (looking at her mother) A ver, hazlo... (returning to her paper) no pero yo lo hice mas rápido porque yo ya sé

[Let me see, do it, ... no but I did it faster because I already know]

5. Bety- Diferent[e]

[Different]

6. Berta- que allí están los números y es twenty five.

[that the numbers are right there and it's twenty five]

7. Bety- Eso es lo más importante que hay formas diferentes.

[That's the most important thing, that there are different ways]

8. Margarita- (looking at her daughter) *hay formas diferentes*

[there are different forms]

9. Berta- (asking her mother) A ver, ¿cómo lo hiciste?

[Let me see, how did you do it?]

In this excerpt we see that Berta challenges that her mother did it (line 2 “she didn’t do it, I counted”). Berta followed what in her view was an approved method to solve the problem, while she did not see how her mother did it. Her mother did it in her head, “using logic.” We see from other interactions with Berta that she has a concern for the approach, for making sure that she using the expected approach. The facilitator, while teasing her about her mother’s method being faster, introduces the idea to there being different approaches (lines 5, 7), to which the mother agrees (line 8). After that Berta, somewhat reluctantly asks her mother to share her method.

Vignette 2: Berta and her father on addition and subtraction

On that evening workshop, parents and children were supposed to practice strategies for addition and subtraction that are different from the “standard” ones. For example, the worksheet showed “ $23 + 46 + 7 =$ ”; the idea was for the families to solve this addition sentence horizontally by breaking apart and combining numbers. The parents had a sheet showing different approaches and teachers and facilitators were going around the room explaining those approaches. During this scene, one of the teachers is explaining the worksheet with the different approaches to Margarita. Sergio, Berta’s father, did not seem to pay attention to that and right away took the pencil and set it up vertically for his daughter to solve, using the traditional addition algorithm (“put it here, look”). The daughter was trying to solve it horizontally, but the father insists (“do it like this, look”), and Berta switches to her father’s paper and does the vertical addition. Their interaction is very procedural with the father telling her what to do. After Berta finishes that first sum, she proceeds to the next one, which she immediately re-writes vertically and goes through the same procedure than in the previous one. She does the same thing with the third sum ($23 + 26 + 27 =$). Berta makes a mistake and the father intervenes:

1. Sergio (father)- dieciséis, está mal ahí. *[Sixteen, it's wrong here.]*

2. Berta – ¿Cómo?, a ver, a ver, a ver *[How? Let's see, let's see, let's see.]*

3. Sergio- Mira, siete y tres son... *[Look, seven and three is...]*

4. Berta- Yo, yo lo quiero hacer. *[I, I want to do it!]*

(Berta is counting on her fingers)

5. Berta- [laughs] sí está bien la tuya Pa. No me tienes que decir porque yo quiero aprender. *[Yeah dad you were right. You don't have to tell me because I want to learn.]*

6. Sergio- Siete. Está mal ahí. Y la una que llevabas, mira pon el uno aquí arriba.

[Seven. It's wrong there. And the one that you were carrying, look put the one here on top]

7. Berta- ohhhhhhh con razón! *[Ooooh, no wonder...]*

8. Sergio- Mira está bien fácil. *[Look, it's really easy]*

(Berta does one more on that sheet -which happens to be a subtraction problem but she does it as an addition- and then goes back to her own worksheet to work again on the first one, $23 + 46 + 7$, which her father had originally set up for her; she does her own setup vertically.)

9. Berta- más cuarenta y seis más siete

[plus forty-six plus seven]

10. Sergio- Ponle cero para que no te confundas.

[Put the zero so that you won't get confused]

(The father is referring to the 7, when setting it up vertically he had written it as 07 and he wants his daughter to do the same thing; Berta does that and proceeds to solve the addition problem.)

In this interaction the father is watching everything his daughter does and intervenes as soon as she makes a mistake. His style is direct and somewhat authoritarian, but the daughter does not just follow what her father tells her. She does not want to be told, she wants to do it herself and learn (lines 4 and 5). This may explain why on line 9 she goes back to the first problem (the father does not ask her to do that; she just goes back to it). Her father had set it up for her and she wants to do it all by herself.

After that, they switch to subtraction. The idea for this workshop was to look at subtraction as adding too; for example, to do $51 - 22$, one could do from 22 to 30 (8), then 30 to 40 (10), 40 to 50 (10) and then one more to 51, so the answer is 29. The worksheet the father and daughter were working on shows some indication that they (Berta?) had attempted this method (but incorrectly as there was 2 from 22 to 30 and a 1 from 50 to 60). The father proceeds to explain to her the standard algorithm for subtraction. Once again, it is very procedural (“this one -pointing to the 5- gives 1 so this becomes 11”). What is interesting to point out, however, is that although the father did not seem very interested in other approaches to subtraction, a few days later during an interaction in the home around a homework task, he actually brings up this other approach to do subtraction when he is trying to help his daughter. We move now to this third and last vignette.

Vignette 3: Margarita, Sergio and Berta on a subtraction problem

This interaction took place in their house, while one of the researchers was conducting an interview. Berta requested help on a task that basically said “Jack has 73 pennies; how many more pennies does he need to be able to change them for \$1?” The mother right away made a connection to the paper clip task (see Vignette 1):

Margarita: Setenta y tres; setenta y tres; es lo que hicimos con los clips. Pero estos son pennies.

¿Sí? M'hijita? Y sacamos cuántos pennies nos quedaron adentro.

[Seventy-three; seventy-three; it's what we did with the clips. But these are pennies, right, "m'hijita"? And we found how many pennies were left?]

But Berta does not seem to see (or hear) the connection to that activity. After a few seconds she turns to her father for help:

1. **Berta:** Papá, necesito ayudaaaaaa *[Dad, I need heeeeeelp]*
2. **Sergio (father):** Mira m'hija. Está muy fácil. Mira. Fíjate nomás. Te pones... *[Look m'hija. It's very easy; look, just pay attention. You put...]*
3. **Berta:** Yo lo tengo que hacer *[I have to do it!]* (raising her voice)

4. **Sergio:** ¡Ya sé! Ya sé. Mira. No te lo voy a hacer. Si tienes setenta, ochenta, noventa, cien. ¿cuánto? ¿cuánto es? Diez, veinte, treinta. Pero como ya tienes tres, no serían treinta. Serían ¿cuánto? Si tienes treinta [I know, I know; look; I'm not going to do it for you; if you have seventy, eighty, ninety, one hundred, how much; how much is it? Ten, twenty, thirty. But since you already have three, it wouldn't be thirty. It would be, how much? If you have thirty]
5. **Berta:** Mí... mí... ¡Mil! [One, one... one thousand!]
6. **Sergio:** No. Tienes tres aquí... [No. You have three here...]
7. **Berta:** ¡Noventa! [Ninety!]
8. **Sergio:** No, un momeeento. [No, just a mooooooment]
9. **Berta:** ¡Ochenta! ¡Setenta! [Eighty! Seventy!]
10. **Sergio:** Espérate, espérate. Si tienes setenta y tres aquí, setenta y tres para ochenta, hay siete. De ochenta a noventa, hay diez. De ésta acá, va otros diez. ¿Cuántos serían? Siete, diez, y diez, ¿cuántos serían? [Wait, wait. If you have seventy-three here, seventy-three to eighty, it's seven. From eighty to ninety, it's ten. From here to there, another ten. How much would it be? Seven, ten, and ten, how much?]
11. **Berta:** ¡¡¡Veintisietee!!! [Twenty-seven!!!] (yelling)
12. **Sergio:** ¡Pues sí! A ver... pero bórrale, bórrale. Y hazlo bien. [That's it! Let's see...so, erase, erase. And do it well.]
13. **Berta:** (at the same time and screaming)) Pá, pá, ¡pero lo tengo que hacer asíiiii! [Dad, dad but I have to do it this way!]
14. **Sergio:** Y ¿cómo te lo enseñaron? [And how did they teach you?]
15. **Berta:** Así. Le tengo que hacer así. Así como uno, así, y cuánto hace, y luego esto plus cero, seis ceros... [Like this, I have to do it like this; like one, one, and how much, and then this plus zero, six zeros...]

In this interaction, once again, the father takes over the task, but the daughter resists that, as she wants to do it herself (line 3). Her father says that he is not going to do it for her (line 4) and asks her questions to get her involved but as we can see, the daughter seems to be yelling out numbers that have no bearing on the problem (line 5) or that it is not clear how she is relating them to the problem (lines 7 and 9). The father uses an approach similar to what was expected in Vignette 2 (but he did not do that for that one), by going from 73 to 100 in steps (line 4 and again, line 10). In line 10, he basically tells his daughter what to do “seven, ten, and ten, how much?” so that she “gets” the correct answer. Yet, Berta does not like this approach and is concerned that this is not the way she is expected to do it. Berta seems concerned that her father’s method is not going to be accepted, in part because she is not going to know how to explain it:

Berta: pero si tú me lo hiciste a mí, para mí, y luego me dicen: ¿qué era? Porque la maestra me dice: “¿cómo lo hiciste tú?” Yo no voy a saber, y entonces me va a decir la maestra: “¿quién te lo hizo?” Entonces. Yo no voy a saber cómo funcionan todas esas cosas en la cabeza.
[But if you did it for me, to me, and then they tell me, what was it? Because the teacher is going to say, “how did you do it?” And I'm not going to know, and then she's going to say, “who did it for you?” I'm not going to know how all these things work in the head.]

As in Vignette 2 we see that Berta wants to know how to do things herself. She does not want to just be told how to do it. The interaction goes on for quite a while until finally Margarita and the researcher bring up another tool that they had seen at the workshops, the 100 chart and it seems that this is what Berta thought she had to do. In the paper clip problem Berta had used the 100 chart and it is possible that since this interview took place not very long after that workshop, that Berta felt that that was the way she had to do it.

Analysis of parents' perceptions of their children mathematics teaching and learning

The case of Margarita, Sergio and their daughter Berta illustrates different kinds of interactions between parents and children. Margarita seemed to see herself as learner in the

workshops and in general tended to engage in the activities within that frame of mind, that of an adult learner. So, in the paperclip task (Vignette 1), Berta and her mother had worked on it independently from each other and the facilitator wanted to get them to talk about their approaches. Sergio came to the workshops to work with his daughter and in general his approach was direct teaching and a direct teaching based on how he had learned (Vignette 2). Vignette 3, which captures an interaction in the home, offers a different glimpse of these interactions. Here (in the home), Margarita is helping her daughter and she does that by making a connection to one of the mathematics workshops (the one with the paper clip problem); Margarita does not quite tell her daughter how to solve the problem but mostly tries to remind her of this prior experience. Sergio also helps his daughter but in a more direct way. However, in this particular example, he does use one of the alternative approaches to subtraction instead of the “traditional” one he had learned. In fact, he uses the approach that was expected in Vignette 2.

This case is not representative in the sense that we can say that all parents in our study interacted along similar ways with their children. We have parents who use direct instruction (along the lines of Sergio) but we also have parents who mostly ask questions, and others who “just” watch their children. But this case does reflect the influence of parents’ prior learning experiences. Margarita was eager to keep on learning (we have evidence of that from interviews with her); she was not only attending our mathematics courses since the beginning but was also attending English classes in a community center. Hence her identity as “learner” is what predominates in the workshops. Sergio saw his role more as teaching his daughter and teaching her as he had learned.

Previous research suggests that parents’ prior experiences with mathematics affect how they perceive it (Abreu, 2004; O’Toole & Abreu, 2005). Data obtained in our study confirms this idea. Parents in our study comment on how their own experiences as learners of mathematics influence their approach to helping their children. Many of the parents in our study perceive schooling in Mexico as being quite different from what they see their children experiencing now in the United States. Their memories of learning mathematics as children are full of references to school practices that emphasized memorization of facts, computation, and sometimes problem solving. This, to them, looks very different to the type of activities that their children are doing in the U.S. schools. All these differences produce both positive and negative effects regarding children’s mathematics education.

Experiences parents have had as students filter their perceptions on the education their children receive and shape the type of interactions parents have with their children when it comes to mathematics education. A generalized perception is that the level of mathematics education in Mexico is higher than that of the United States; this assessment is made in reference to the curriculum and the teaching practices. Based on their experiences, parents favor some school practices more than others.

About the mathematics curriculum. Almost all parents interviewed for this study reported that they thought that the teaching of mathematics was more advanced in the Mexican schools than those in the United States. This is a common perception that we have documented elsewhere too (Bratton, Quintos, & Civil, 2004; Civil & Planas, 2008). We will not discuss this much here, though here is a typical example of a comment from one of the mothers in this study:

Lucrecia: Más elevadas, son más elevadas, porque el niño aquí está con una división de una matemática por fuera, y allá ya están casi entrando con tres afuera, el niño, entonces ya es más baja. Es más baja. Sí, porque aquí están haciendo las tablas, repasándolas y ellos las tablas pues en segundo año, por eso se me

hace un poquito más bajo, o será al niño también se le hacen más fácil aquí porque como viene más adelantado de allá, a lo mejor por eso al niño se le hacen más fácil a él por eso, yo digo...
[More advanced, they are more advanced, because the boy is with a division of one [digit] mathematics on the outside, and over there they are starting almost with three outside, the boy; then it is lower. It is lower. Yes, because they are doing the multiplication facts here, reviewing them and they, the facts, well in second grade. That's why I think it is a little bit lower [here] or it might be because it is easier for the boy here, since he comes more advanced [from there], or maybe it is just because it is easier for the child here, and that is why I tell him...]
(Lucrecia, Interview 1, Feb. 2005)

As we have argued in prior writing, this issue of comparison of levels is complex. In fact, one of the mothers in our current study has a different perception, as she sees that what her child is currently learning in kindergarten is more advanced than what she remembers learning at that age (but of course, we need to be cautious as to how much does one remember from being in kindergarten):

Javier (interviewer): Esta otra pregunta dice que si las matemáticas que tú aprendiste en la escuela piensas que son diferentes a las que tu hijo está aprendiendo ahora.
[This other question asks is your think that the mathematics that you learned in your school is different to the math that your son is learning now.]
Dorotea (mother): . . . hasta ahorita como él está en kínder pues no he visto mucho. Pero lo que me he dado cuenta que, que más rápido le empezaron a poner matemáticas que a mí. Él ahorita esta en kínder y ya está sumando, y a mí en kínder, pues yo no me acuerdo que me hayan puesto sumas.
[... until now, since he is in Kindergarten, well, I have not seen much. But what I have noticed is that they started to teach him mathematics earlier than to me. He is in Kindergarten right now and he does additions already, and in Kinder, I don't remember that I had learned addition.]
Javier.- Y tú de qué, de kínder ¿qué?, ¿guardas algún trabajo, alguna?
[And you, form Kinder, what? Do you keep any work from kinder? Anything?]
Dorotea: No.
[No.]
Javier.- ¿Y qué recuerdos te vienen de kínder?
And, what memories do you have from Kinder?
Dorotea : De kínder yo recuerdo nomás que era pintar, dibujar, recortar, pegar; más ese tipo de cosas manuales que letras y números no me acuerdo yo. Y ahora pues el está en kínder y ya se sabe las letras y ya tiene que aprender los números, y pues sumar. *[From Kinder I only remember painting, drawing, cutting and pasting, more of that kind of manual skill than of writing or number, I don't remember about that. And now, well he is in Kinder and he knows the alphabet already, and he already has to learn the numbers and to learn how ho add.]*
(Dorotea, Interview 1, Jan. 2006)

About the teaching practices. A recurrent theme among the parents in our study has to do with the approaches to teaching and learning that they recall being used when they went to school in Mexico. Learning (*memorizing*) the multiplication facts is one of the topics that comes up the most often, as the parents feel that this is not an emphasis at their children's school. In the quotes below Victoria comments on how in Mexico she had to learn the multiplication tables by heart and know them in any order while her children in their current schools do not know them and refer to the back of their notebook to look at the multiplication tables. She then comments on how she is trying to teach them the multiplication facts but she implies that it is a struggle. Similarly, Mónica also talks about her having to memorize the multiplication facts when she went to school in Mexico. It is interesting to note that she does wonder if things are still like that in Mexican schools. Mónica does not comment on her trying to teach how she learned to her child. She was actually attending the "Mathematics For Parents" workshops to learn how they were teaching multiplication now to be able to help her child.

Victoria: . . . y hago mi lucha para.. y ocupo las matemáticas, y luego pues a veces los niños por ejemplo los que están en cuarto, es muy difícil para ellos porque aquí no les exigen que se aprendan las tablas y en México sí. A nosotros, cuando estábamos en la escuela, nos exigían que nos aprendiéramos la tabla del 1 al 10 y todas y revueltas y como sea, porque nos las preguntaban. Y aquí no, aquí los niños batallan mucho para poder hacer una cuenta sacan el cuadernito; aquí les dan un cuaderno y atrás traen las tablas y ahí están. Y les digo: no, tienen que aprendérselas. Y a veces que los agarro y sí, en ese ratito se aprenden las tablas pero ya otro día ya no se acuerdan.

[and I fight for... and I use mathematics, and then, well, sometimes the children for example, the ones in fourth grade, it is very difficult for them because here they are not asked to learn the multiplication facts, but in Mexico, yes. We, when we went to school, were asked to learn the multiplication facts from 1 to 10, and all of them, and mixed and in any way, because they quizzed us on them. But not here, here the kids struggle too much to make a calculation; they take out a little notebook. Here they get a notebook and on the back cover they have a chart with the multiplications facts, and there they are. And I tell them: No, you have to memorize them. And sometimes when I get a hold on them, then they learn the multiplication facts by heart but by the next they don't remember any longer.]
(Victoria, Interview 1, Nov. 2005)

Mónica- Pero no es como aquí, no es. Y creo que allá también está cambiando, no sé, no he ido a la escuela ahora en México, pero era demasiado estricto, you know, vamos a la escuela a aprender. Y es lo que yo te digo, yo me acuerdo que por ejemplo en matemáticas, especialmente en la multiplicación. Aprendíamos porque nos las, las hacíamos en una tonada . . . yeah...

[But it is not like here, it's not. And I think that it is changing over there as well, I don't know. I have not gone to school in Mexico now, but it used to be too strict, you know, we go to school to learn. And that's what I tell you, I remember that, for example in mathematics, especially in the multiplications. We learned because we turned them into a song . . . yeah...]
(Mónica, Interview 1, Nov. 2006)

The quote below captures this same idea of memorizing the multiplication tables, but comes from a classroom observation that we conducted with Margarita. Hence, she is drawing not only on what she may have perceived from what her daughter brings home, but she is also building on what she sees happening in the classroom (in bold in the quote):

Margarita: los números del 1 al 20, y luego ya empecé en segundo, ya del 20 hasta como al 50, 60. No era mucho, y ya no teníamos la bolita, las piedritas ni los cerillos. En tercero nos daban, unos palitos como paletas, como paletas y canicas. Canicas y no había material de escuela, y aprendimos en el pizarrón. Teníamos que ver al maestro, que hacía $1+1$, en vertical. Vertical, ¿se llama así? [ella hace un gesto con la mano haciendo una línea vertical] y las restas también. Y en segundo llegamos a hacer, hasta, así también hasta el 100, y hacíamos las sumas y las restas, y en tercero, nosotros sí estudiamos las tablas, desde el, hasta el 3. Hasta el 3 nos las sabíamos, y nos las teníamos que aprender de memoria, **y aquí no: va a ver en el tercero de la niña, no va a ver nada de memoria. Y sí hay materiales. Y voy a seguir yendo a la clase de matemáticas de la niña.**

*[The numbers from 1 to 20, and then I began in second grade, from 20 to like 50, 60. It wasn't much. And we did not have the little ball, the pebbles, or the matches anymore. In third grade they gave us little sticks like lollipops, like lollipops and marbles. Marbles, and there was no school material, and we learned on the blackboard. We had to watch the teacher do $1+1$, vertically. Vertically, is that what it's called? (she gestures pointing with her finger a vertical line) and also the subtractions. And in second grade we got to do up to, up to, that way up to 100, and we added and subtracted, and in third grade, we did study the multiplication facts, from the, to the 3. We learned them up to 3, and we had to learn them by heart. **Not here: you would see in third grade, se is not learning anything by heart. And yes, there are materials. And I will continue going to girl's mathematics class.]***
(Margarita, Classroom Observation, Oct. 2005)

Most parents comment that learned their multiplication facts by heart and they try to use this approach with their children, as Norberto tells us here about how he works with his nephew:

Norberto (uncle): Y eso es una, unas, es una...lo más básico de las matemáticas. “Y es cuestión de práctica” le digo, ¿no? “Es cuestión de práctica. Te las vas a aprender, pero tienes que seguir las usando.” Y sí, ya le preguntaba. Sí, sí se las sabía. Y ya se las preguntaba al revés, y ya se, ya se confundía. Pero ya hasta que si se...

[And this is one, one, it's one... the most basic thing in mathematics. “And it is a matter of practice” I tell him, isn't it? “It is a matter of practice. You are going to learn them [by heart], but you must continue using them.” And yes, I quizzed him on them. Yes, he did know them. And I asked them to him backwards, and got confused. But you already did...]

José María (interviewer): ¿Cómo que se las preguntabas al revés?

[What do you mean by asking them backwards?]

Norberto: Pues, en lugar de empezar del cuatro por uno, empezaba cuatro por nueve, o le decía nueve por cuatro.

[Well, instead of beginning four times one, I started by four times nine, or I would say nine times four.]
(Norberto, Interview 1, Nov. 2007)

In this section we have illustrated how parents' own learning experiences color their perceptions of how their children are currently learning mathematics. Their perceived differences in content (e.g., learning arithmetic) and in approaches (e.g., learning through memorization) between their experiences as school children and what they see their children doing may lead to conflict between children and parents (Civil & Planas, 2008; Civil & Quintos, 2006). Some parents in our study said that they reinforce their children's mathematical skills at home (e.g., practicing their multiplication facts). Some of these home practices could place children in an uncomfortable position because they are in the middle of two different teaching “cultures” (the one from the school and the one from the home). One example of this is in the interaction between Berta and her father, in Vignette 3, when Berta is concerned that the approach her father is showing her is not the way she is expected to use.

Analysis of cultural elements that mediate parents' perceptions

In this section we look at cultural elements (in particular as the result of parents' prior schooling) that seem to mediate parents' perceptions of and actions in their children's mathematics education. A clear influence of prior schooling is at the level of practices and approaches to doing mathematics. When Latino children ask their parents to help them with their mathematics homework, parents apply methods that they learned at school in Mexico. This is particularly the case in arithmetic, where parents often feel more comfortable helping their children. In Civil (2006), we present a case in which the first author is trying to explain to one mother's one of the subtraction methods in the reform-based curriculum in place at that school. But the mother thinks that her approach (the “standard” algorithm of regrouping) is easier and that is the one she proceeds to teach her son. This is similar to what another mother, Tamara, describes in the next excerpt:

Tamara: Pues yo pienso que es diferente porque cuando yo le enseñé la, la... resta, ella no sabía. “¿Qué hago?” me decía, “¿qué hago?” pues tuve que enseñarle: pídele prestado uno al que está enseguida y luego ya le pones, si es un nueve al que le pediste uno, pon un ocho arriba, le digo. Va a cambiar le... tu, tu... ecuación allí, tu cuenta pero así te va salir. Y para que estés segura si está bien, nomás súmale, le digo, el resultado y lo que le restaste. Y así lo empezó a hacer ella.

[Well, I think that it is different because when I taught her subtraction, she did not know. “What do I do?” she told me, “what do I do?” so I had to teach her: Borrow one from the one next to it, and then you write, if it is nine the one you borrow from, put down eight on top, I tell her. You are going to change the.. your, your... equation there, your calculation but it you are going to solve it that way. And so that you are sure about your answer is good, just add it up, I tell her, your result and the amount you subtracted. And she started doing it that way.]

(Tamara, Interview 1, Nov. 2005)

Tamara and the mother in Civil (2006) try to use their prior knowledge (which is grounded in their cultural experience with their own schooling) to help their children at home. They try to make meaningful connections between the children's current homework and their knowledge grounded on practices coming from another cultural system of reference. But these methods are often different from the ones used by the teacher in their children's school, and this may lead to conflict, as we have said above; sometimes, however, this exchange may actually be an opportunity for children and parents to learn from each other. For example, in the excerpt below, we see how one of the mothers, Selena, is telling the interviewer an issue that she has encountered when trying to teach multiplication to her son. She teaches him as she was taught and the child points out that her method is different from how they are teaching. Here we cannot infer that the child or the mother necessarily see it as a conflict:

Selena: No, él me pregunta, él me pregunta, yo le digo nada más la, que la diferencia, que quince... que igual que en la multiplicación se las enseñan de una manera y luego le dicen de otra.

[No, he asks me, I only tell him that the difference is fifteen... that it is the same than with multiplication, that they teach him one way and later they tell him in a different way.]

Javier: ¿y tú se las enseñas igual que aquí?

[And you, what do you teach him here?]

Selena: Yo se las enseño como a mí me la enseñaron, pero hay veces que él me dice, me entendió como se las dije, pero me dice: mira mami, está bien, pero a mí me la enseñan así.

[I teach him they way I was taught, but some times he tells me, he understood the way I told him, but he tells me: look mommy, this is fine, but this is how they teach me.]

(Selena, Interview 2, Feb. 2006)

But it is the case that most often this difference in approaches does lead to confusion or conflict. This confusion is not only with the parents or with the children, as we have had examples of teachers being confused by the methods the parents (directly or through their children) use (Civil & Planas, 2008). Sometimes these situations could interfere in children's learning, because the argument "My teacher taught me in a different way, so yours is wrong" could be used by individuals to justify an answer that is wrong, independently from the way used to get the result, as the following quote points to:

Victoria: El niño lo está haciendo mal. El niño dice que la maestra empieza al revés, y le digo "no, las cuentas se empiezan de aquí para allá", "no" dice, "la maestra empieza de allá para acá". "No", le digo. Entonces hace él, hace la resta y la hace mi esposo, y le dice mi esposo: "Mira, ésta está bien y la tuya está mal". La saca en la calculadora y le sale como la hace mi esposo pero a él no le salen los números, entonces ya le hace la prueba, no, la prueba que hacemos nosotros. Le dice: "mira haz la prueba". Y le enseña mi esposo a hacer la prueba y todo y le dice: "¿Ves? la tuya está mal y la mía está bien". "Pero no, es que la maestra me enseña así". "No", le digo; "es que no te enseña así la maestra; es que tú estás mal".

[The boy is doing it wrong. The boy says that the teacher begins at the other end and I tell him, "no, you begin the calculations from here to there." "No," he says, "my teacher begins from there to here."]

"No," I tell him. So he does, he does the subtraction and my husband does it as well, and my husband tells him, "look, this is right and yours is wrong." He takes out the calculator and he gets what my husband tells him but he does not get those numbers, and then he performs the test, right? The test we do. He says, "look, do the test." And my husband teaches him to do the test and all and he tells him, "do you see? Yours is wrong and mine is right." "But no, this is the way my teacher teaches me." "No," I tell him, "your teacher doesn't teach you that way. You are wrong."]

(Victoria, Interview 1, Nov. 2005)

Another effect of parents' prior schooling experiences is at the affective and confidence level. Several parents (mostly mothers) have shared with us that they did not have very good experiences with mathematics when they went to school. This may affect

their interaction with their children, as is the case of Lucrecia who told us that she stays away from mathematics and that she lets her husband help their child with mathematics homework because, “he knows a lot of mathematics, since he uses it everyday at work.”

Lucrecia: Pues yo no me meto con las matemáticas con mis hijos. A mi esposo sí le gustan las matemáticas y se los dejo a él (risas) yo no! En México teníamos exámenes con varias materias pues en la escuela, yo me encargaba de todas menos matemáticas, porque yo no tengo paciencia es lo que te digo, como no me gustan soy muy desesperada y yo no sé qué me pasa es cuando yo... (risas) siento que me enoja con mucha facilidad y por eso prefiero no encargarme yo de las matemáticas para que los niños no perturbarles eso por eso prefiero yo dejárselo a mi esposo, y como mi esposo pues le gustan, él tiene facilidad para explicar y todo..., él, pues el se encarga, el se encarga.

[Well, I don't deal with mathematics with my children. My husband likes math, and I leave it to him (laughter) not me! In Mexico we used to take exam in several subjects at school, and I was in charge of all of them but mathematics, because I have no patience, I'm telling you, since I don't like it, I get desperate and I don't know what happens to me when I... (laughter). I think I get upset too easily and that is why I rather not take responsibility of math so that I don't make the kids upset, that is why I prefer to leave it to my husband, and since my husband likes it, he has an ability to explain it and all... he, well, he takes care of it. He takes care of it.]

(Lucrecia, Interview 1, Feb. 2005)

How parents see themselves as doers of mathematics has direct implications in terms of helping their children with their homework in mathematics, as we can see in the previous quote. This identity is defined by prior experiences. Lucrecia reports in the interview how she disliked mathematics when she was a child:

Javier: Mira, si quieres empezamos ya. La primera pregunta es: ¿Cómo describirías tu experiencia como estudiante de matemáticas, cuando ibas a la escuela, cómo la describes?

[Look, if you want we can start now. The first question is, How would you describe your experience as a mathematics learner when you used to go to school? How do you describe it?]

Lucrecia: Pues regular.

[Well, so, so.]

Javier: ¿Regular?

[So, so?]

Lucrecia: Sí. No creas que era muy buena ni me gustaba mucho.

[Yes, don't you think I was good or that I liked it a lot.]

Javier: ¿No, por qué?

[No? Why not?]

Lucrecia: Como que, no sé si yo era cerrada de cabeza o los maestros no se daban para entender.

[It's like, I don't know whether my brain was closed or my teachers didn't explain themselves.]

(Lucrecia, Interview 1, Feb. 2005)

Not only do we see how prior school experiences in mathematics affect parents' perceptions on their children's mathematics education and the way parents interact with children doing mathematics, but also how parents' identities (in this case Lucrecia identifies herself as not being good at mathematics), get molded and this in turn shapes their interactions with their children. A final cultural element that we look into and that is of key importance in our context with immigrant parents is language.

Vygotsky (1978) reported the importance of language as a cultural tool. He found that human beings use language to solve everyday problems and suggested that there is a connection between the cognitive development and language as a cultural artifact. In our context, English is the language of instruction in the schools (for a more detailed discussion of the impact of different language policies on parental engagement in mathematics education see Acosta-Iriqui, Civil, Díez-Palomar, Marshall, & Quintos-Alonso, 2008). We agree with Moschkovich (2002) in that a view that focuses on English Language Learners

(ELLs) learning mathematics as essentially learning vocabulary is a limiting view of what learning mathematics entails. Teaching and learning mathematics in a context in which the home language and the language of instruction are different is certainly complex and it is not “just” about translating terms. The parents in our study are certainly aware of some of this complexity and often refer to their limited knowledge of English as a barrier. We want to point out, however, that some parents do act on this concept of barrier by, for example, as is the case of Selena and Jacinta (below) or Margarita (mentioned earlier) who say that they are taking English classes.

Selena: porque hay cosas que verdaderamente no le puedo ayudar... hay cosas que me las, me dice “mami yo te voy a leer aquí a ver dime tú,” y él me lo traduce en español; hay veces que le entiendo lo que me está diciendo en inglés, hay veces que definitivamente no le entiendo nada, por eso yo estoy yendo a clases de inglés, entonces, este, hay cosas, que le digo yo, “m’hijo, no pues no le entiendo aquí.”

[Because there are things that I really cannot help him with... there are things that, he tells me, “mom, I’m going to read it here, let’s see, you tell me” and he translates it into Spanish; sometimes I understand what he’s telling me in English, but others, definitely I don’t understand anything, that’s why I’m going to English classes, so, hmm, there are things that I tell him, “m’hijo, no I don’t understand it here.”]

(Selena, Interview 1, Nov. 2005)

Sometimes parents comment on the effect of their children’s limited knowledge of English on the children themselves:

Jacinta: ... y dice, que... él batalla en lo de inglés, porque los problemas se los saca mal, ¿por qué? Porque no lee bien.

[...and he says that... he struggles with English, because he gets the problems wrong]

Why? Because he does not read well.]

Javier: Ya, no pone atención...

[Right, he does not pay attention...]

Jacinta: No pone atención...

[He does not pay attention...]

Javier: ¿O lee muy rápido?

[Or, does he read too fast?]

Jacinta: No... o como no sabe mucho inglés todavía...

[No,... or since he does not know much English yet...]

Javier: Ah... es más problema del [idioma]

[Oh... it’s more a [language] problem]

Jacinta: Sí, ése es el problema de él.

[Yes, that is his problem.]

(Jacinta, Interview 1, Nov. 2005)

Jacinta goes on to elaborate on the affective impact that their limited knowledge of English had on her children:

Jacinta: Les está costando mucho por la [lengua]. Primero se deprimieron bien feo: se querían ir. “No, yo no quiero estar aquí... es más, no voy a estudiar, no quiero hacer nada.” Por él... sí yo, que voy a una escuela de inglés...

[It’s being difficult for them because of the [language]. First they got depressed very bad: They wanted to leave.” No, I don’t want to be here”... even worse, I won’t study, I don’t want to do anything.” It’s because of him ... yes, that I go to English classes...]

(Jacinta, Interview 1, Nov. 2005)

Emilia, a mother who already knew some English when they arrived to the United States, comments on how in her case she is the one who translates for her sons who did not know

any English when they first arrived. In the excerpt below she is talking about her oldest son who was in 6th grade when they first arrived.

Emilia: yo lo que les digo a ellos para que no se me desesperen, porque estamos hablando ahorita que el niño entró en enero, ¿eh? Estamos hablando de tres meses, a lo sumo, el niño, el niño va a tener. Y es un cambio, son 11 años de su vida, bueno, más bien vamos a decir, 5 años casi de su vida, que ha estado escuchando español, aprendiendo en español, de repente tú le dices que lo mismo lo va a hacer ahora en otro idioma, sí se frustra un poquito, ... porque dice: “ay! Mami”, dice, “y cosas que preguntan que son bien fáciles, y yo desesperado porque yo quiero contestar porque yo sí entendí. Y hay otras cosas que no entiendo, y después puso la respuesta, y yo ya me lo sabía pero no entendí la pregunta. Si no entendí la pregunta, no puedo dar la respuesta, porque no les entendí.” Eso es lo que lo desespera.

[what I tell them so they don't get anxious, because we are saying that the child came in January, huh? We are talking about three months, at most, the child, that's how long the child has been here. And it is a change, it is 11 years of his life, well, let's say, almost 5 years of his life, that he has been listening to Spanish, learning in Spanish, all of a sudden you tell him he will be doing the same but now in another language, yes, he does get a little frustrated...because he says, "Oh! Mommy," he says, "and things they ask that are so easy, and I get anxious because I want to answer since I did understand. And there are other things that I do not understand, and then he/she put the answer, and I already knew it, but I did not understand the question. If I did not understand the question, I cannot give the answer, because I did not understand them." That is what gets to him.]

(Emilia, Interview 1, March 2006)

Conclusion

In this paper we have addressed these three questions:

1. What kind of practices do parents use to help their children with their mathematics?
2. How do parents' different learning experiences affect their perceptions of their children's mathematics teaching and learning?
3. What are the most prominent cultural elements that mediate parents' perceptions of and reaction to practices related to their children's mathematics education?

In terms of our first question, we have found that parents interact with their children in different ways and intensity, as the case of Margarita and Sergio with their daughter Berta illustrates. They are both interested in their daughter's learning of mathematics. They come to the workshops to support her in her learning, and in the case of Margarita to be a learner herself. We see that Sergio's style of interaction is very direct; he wants to show her how to do it but also respects his daughter request to having to / wanting to do it by herself (Vignette 3, lines 3&4). When parents do not know or do not understand the school methods, they rely on their knowledge from school to promote mathematics learning, as Norberto's quizzing his nephew shows. Using a different interaction style, Margarita acts as a model of using mathematics by doing mental computations and using logic (Vignette 1, line 10); although we have no evidence to say that Berta recognizes her mother's capability and knowledge as of yet, we believe that Margarita's role as a model of a mathematics doer may help Berta's growth in mathematics. All this leads us to state that

- 1.1. *Parents engage in a dialogue with their children, as they do mathematics, varying in the degree of how directive parents are.*
- 1.2. *Parents are intellectual resources as brokers of knowledge coming home from school and as models of mathematics users/doers.*
- 1.3. *Parents use everyday situations to help their children learn mathematics.*

Regarding our second question, data discussed show that parents' perceptions of their children's mathematics teaching and learning are mediated by their previous experiences

with school mathematics. A common perception is that the level of mathematics education in Mexico is higher than the one in the United States. This perception is based on concrete school practices such as the role of memorization and choice of algorithms. We have shown a small sample from a larger set of instances that illustrates this assertion. We brought up the voices of Victoria, Mónica, Margarita, and Norberto to share their memories of how they were taught in school in Mexico: largely based on memorization techniques. They value this skill, in particular knowing the multiplication facts, as fundamental for learning mathematics, as Norberto explicitly says. Parents also bring in algorithms that differ from the ones being taught to their children, as Selena, Tamara, and Victoria report. The difference in valorization or emphasis of memorization over other skills and the discrepancies in the algorithms are at the same time a potential source of conflict, confusion, and frustration, and an opportunity to complement the mathematics education that children are receiving in the schools. We summarize these findings as

2.1. Parents' school experiences in mathematics, different from those of their children's, can be used to enhance the children's education.

With respect to our third question, data discussed in this paper suggest two relevant cultural elements that mediate parents' perceptions of their children's education and the corresponding reaction. The first one is schooling in general, as parents identify with the more tangible expression of different content and approaches used for teaching and learning mathematics. These differences tend to become a source of confusion for everyone: children, parents, and teachers. In some cases these differences turn into a learning opportunity, as may be the case with Selena in which she implies an exchange of information with her son, but more often than not, they have a negative impact at a cognitive level, creating confusion with different algorithms, as well as at an affective level, diminishing the confidence of the participants as mathematics doers, and therefore their identities and potentially self-esteem. The second element is language. We observe that the implications of English being the only language of instruction are also at both levels: cognitive and affective. At a cognitive level we find the following ways in which instruction in English only becomes an obstacle for learning: For children, especially recent immigrants, (a) it is more difficult to learn the concepts in a language that they have no command of; (b) they may feel (or be) excluded from participating in classroom practices and therefore deprived from learning opportunities. For parents, the natural source of help outside school, they are limited in their ability to help because it is much harder for them to understand what is being taught in school in a language other than their own. At the affective level, the most evident frustration comes from not understanding the concepts, but underlying this discomfort it is also the sense of not belonging and a reduced confidence in the children's ability to participate and thus to show their mathematical competence. Recapitulating, we assert that

3.1. Differences in schooling (different approaches to doing mathematics) and in language may lead to challenges as parents try to help their children with school mathematics.

3.2. The impact of the aforementioned elements is at both the cognitive and the affective levels.

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