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WHEN THE HOME LANGUAGE IS DIFFERENT FROM THE SCHOOL LANGUAGE: IMPLICATIONS FOR EQUITY IN MATHEMATICS EDUCATION

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In this paper I highlight some of the activities carried out within CEMELA (Center for the Mathematics Education of Latinos/as). I center on aspects of our work that address the difference between home language and school language and I raise issues related to the impact of this difference in languages on the teaching and learning of mathematics. In particular I focus on a context with a current language policy that severely restricts bilingual education. I address issues related to English Language Learners (ELLs), equity and mathematics teaching and learning.

This paper highlights some of the activities carried out within CEMELA (Center for the Mathematics Education of Latinos/as). In particular I focus on aspects of our research and outreach that directly address issues of language and mathematics in our work in Latino/a communities in the U.S. CEMELA brings together four universities and several school districts in an effort to understand the interplay of mathematics education and the unique language, social, and political issues that affect Latino communities, particularly Mexican-American communities.

CEMELA’s research is grounded on a sociocultural perspective with a particular emphasis on community knowledge (Civil, 2002; 2007; Civil & Andrade, 2002; Civil, Bratton, & Quintos, 2005; González, Moll, & Amanti, 2005) and language (Khisty, 2006; Khisty & Chval, 2002; Moschkovich, 2002; 2007). CEMELA takes a holistic approach to the mathematics education of Latino/a students through a research agenda that centers on teachers, parents, and students. Current research reveals a startling pattern of progressive underachievement, whereby third and later generations of Latino students perform less well in school subjects than first and second generation immigrants (Valenzuela, 1999). This process has been identified as the consequence of policies and practices that, in essence, fail to utilize or place little value on the cultural and linguistic resources students bring from their families and communities. Instead, in CEMELA we emphasize students’ language, culture,

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family, and communities as positive and valuable resources for mathematics learning. In this paper the focus will be on the work in Arizona where a rather restrictive language policy currently in place brings to the foreground several issues related to English Language Learners (ELLs), equity and mathematics teaching and learning. For purposes of this paper I center on aspects of our work that address the difference between home language and school language and we raise issues related to the impact of this difference in languages on the teaching and learning of mathematics.

**CONTEXT**

In order to better understand our context it is important to give a brief explanation of the language policy in our state. I am aware that in many countries, immigrant students are schooled in the language(s) of their receiving countries with often some kind of language support provided. But in our local context bilingual education (which in our case meant mostly English / Spanish) was available up to the year 2000 when Arizona voters approved a proposition based on a similar one approved in California two years earlier. Both laws severely restrict bilingual education programs, replacing them with “Structured English Immersion” classes for a period “not normally intended to exceed one year” (ARS, 15-752). The law allows teachers to use a minimal amount of the child’s native language for clarification, but “all children in Arizona public schools shall be taught English by being taught in English and all children shall be placed in English language classrooms” (ARS, 15-752). The impact of this change has to be seen within the larger political scene in which there is currently a big debate on immigration reform at the national level. In our local context, feelings of anti-immigration and racism seem to be particularly intense with the passing of different laws on immigration issues. These feelings of rejection and discrimination are particularly strong towards Hispanic immigrants, and more so towards those coming from Mexico (we are located very near the border with Mexico). Most of the families we work with are immigrants and in some cases it is possible that they, or close relatives, or friends are in a difficult situation, due to their immigration status. Even when they are legal immigrants, they know that their status may be questioned based on what they look like, the language they speak, where they live, or the kind of work they do.

Thus, the current situation in our local context goes against what we believe in CEMELA, which is building on the cultural and linguistic resources that all students bring to the classroom. Valenzuela (1999) writes about subtractive schooling as encompassing “subtractive assimilationist policies and practices that are designed to divest Mexican students of their culture and language” (p. 20). In our work we look at the impact of these policies on the teaching and learning of mathematics. We work in several elementary and middle schools with students, parents and teachers. Much of the work reported here is based on our research at Agave 2 elementary school where

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2 All names of schools and individuals are pseudonyms
90% of the students are Latino (Hispanic is the label used by the official documents); 26% of the students are ELLs; 95% of the students are eligible for free or reduced lunch (an indicator of poverty level). I present two small snippets of our research at that school, one with students and one with parents. I end the paper with some reflections related to language and mathematics from students, parents and teachers.

METHOD

Our research methods are essentially qualitative. Our approach relies heavily on phenomenology (Van Manen, 1990); hence, the lived experience of each participant is considered significant. We attempt to capture these lived experiences through a variety of sources of data, which include observations (field notes), interviews, focus groups, and artifacts from activities. Most events are videotaped and then transcribed. The data analysis is then based on the specific research questions that each study addresses. For example, one of our interests in the classroom studies is that of the participation of students, in particular ELLs. Thus the analysis of these data focuses on interactions, and on who, when and what is said.

WORKING AT AGAVE ELEMENTARY SCHOOL

The principal and other administrators at the school are quite knowledgeable about mathematics education and in particular are very supportive of the NCTM (2000) recommendations. The school uses a reform-based mathematics curriculum. Teacher turnover is low with several of them having been at that school for over 10 years. Many of them are bilingual and in fact are themselves Latino/a. The school was very open to our work there. Besides regular observations and support with mathematics instruction in some of the classrooms, we have several projects in place. One of the projects is an after-school mathematics club targeting children in grades 3 -5 (ages 8-10). There were multiple goals to this after-school mathematics club, one of them being to encourage the use of both languages (English and Spanish) when doing mathematics. This provided a different setting from that of the regular classroom where interactions were largely in English. Another project had us working first only with parents and then with parents and children in a series of bilingual mathematics workshops aimed at familiarizing parents with the mathematics curriculum used in the school. And in a third project we work with teachers from that school (as well from two other schools) in a teacher-study group format in which we address issues of language and the teaching and learning of mathematics. I next present one example from a classroom observation and then I look at some of the work we did with parents.

Small Group Work in a 4th and 5th Grade Combination Classroom.

One of our research interests is students’ participation in the mathematics classroom (Civil & Planas, 2004). Since English is the language of instruction, those students
who are Spanish dominant were hardly ever heard in whole class discussions in our observations at Agave. But the teachers did make clear efforts to encourage the participation of these students though small group work. To illustrate some of the issues with language, mathematics, and participation I focus on a group of four students who are working on the teacher’s question “what do you notice about the fractions 1/2, 1/3, 1/4, 1/5; look at the board.” On the board was a chart with the fractions 1/2, 1/3, 1/4, 1/5, 1/6, 1/8, 1/10, and 1/12 and two columns labeled balloons and brownies. This question was in preparation for a task in which students were to determine whether a group of 12 balloons and then a group of 12 brownies could be split by those fractions (i.e., finding 1/5 of 12 balloons and finding 1/5 of 12 brownies). In the transcript below there are two fourth graders (Darla, who speaks English only; and Griselda who is Spanish dominant with little knowledge of English since this was her first year in the U.S.) and two fifth graders (Anthony who is “bilingual” and Carolina, Griselda’s sister (hence, also Spanish dominant)).

1. Teacher: What do you notice about the fractions 1/2, 1/3, 1/4, 1/5? Look at the board.
2. Darla: But what if they [referring to Carolina and Griselda] want to say something and we don’t understand.
3. Teacher: Well he [Anthony] can translate for you.
4. Darla: OK.
5. Teacher: Así que lo… ¿qué es lo dijiste tú ahorita? [So what… what was it that you just said now?]
6. Griselda: Que es diferente cada fracción que están ahí, ahí como un, así están diferentes cada fracción que hay diferente en cada una. [That it’s different each fraction that is there, there like one, like there are different fractions that are different from each one.]
7. Teacher: Ok, so tell her [Darla] in English what she said.
8. Anthony: Ah, oh... ¿Qué dices? [What do you say?]
9. Griselda: Que esas, esas fracciones son diferentes… [That those, those fractions are different…]
10. Anthony: Those fractions are different
11. Griselda: Tenemos que… [We have to…]
12. Anthony: We have to
13. Griselda: ¿Cómo se dice? Oh yeah. Que... que, cuáles están diferentes de cada uno… [How do you say? Oh yeah. That... that, which ones are different from the other.]
14. Anthony: and we’re trying to find which one is different.
15. Darla: What?
16. Griselda: Que, qué diferencia tiene cada una. [What, what difference is there from each one.]
17. Anthony: Which... which difference, which difference does each one have?
18. Darla: I don’t know.

This excerpt illustrates how difficult it can be to translate from Spanish into English in a content area. Griselda seems to be saying that the fractions are different. Anthony is somewhat caught off guard (this is more obvious by his facial expression on the videotape) when the teacher tells him to translate. Anthony tries to do a word-by-
word translation but does not seem to be understanding the overall mathematical meaning of what Griselda is saying. Griselda’s Spanish expression is not the clearest either (e.g., in line 15, “cuáles están diferentes de cada uno”). All throughout this exchange, Carolina is looking somewhat annoyed and getting ready to intervene, which she finally does (line 2 and then line 6, where she asserts herself):

1. Griselda: Porque tenemos que ver mira, como ésta, un, dos, tres, cuatro, cinco, seis. [
Because we have to see look, like this one, two, three, four, five, six.]
2. Carolina: Un medio. Cada vez se va haciendo más chico. [One half. Each time it’s getting smaller.]
3. Griselda: Un tercio, un cuarto. [One third, one fourth.]
4. Darla: Hey, she’s talking [referring to Carolina].
5. Griselda: Se está haciendo más grande. [They get bigger.]
6. Carolina: Griselda, estoy hablando. No digas más grande. Se hace más chiquito porque un medio es más grande y un tercio es más chiquito. El número, el numerador de abajo quiere decir que cada [vez] se va haciendo más y más... ¿cómo se dice?...más...
[Griselda, I’m talking. Don’t say it’s bigger. It gets smaller because one half is bigger and one third is much smaller. The number, the numerator on the bottom means that each [time it] gets more and more... how do you say?... more...]
7. Anthony: ¿Largo? [Bigger?]
[No, smaller. So if it’s one twelfth, it’s something really small, like this (gesturing with her hands) and one half is huge. The smaller the numerator the bigger and the bigger the numerator is more... it’s smaller. Less quantity.]
9. Darla: I have to learn Spanish.

In this exchange Carolina explains in Spanish that as the numerator grows the fraction becomes smaller (lines 6 and 8). With gestures she shows that 1/12 is much smaller than 1/2. Anthony does not translate anymore as he is trying to understand what Carolina is saying. Darla is lost and says, “I have to learn Spanish.” Of course we have more information on these students than what this short excerpt captures. In particular we know that Carolina was quite strong in her mathematical knowledge, at least when it comes to the topic under discussion in this activity. She had worked on fractions in Mexico and looked somewhat bored by the overall discussion on this task. In a group interview the following year (6th grade), Carolina confirmed that some of what she was learning at Agave elementary school, she had already learned it in Mexico:

Carolina [translated from Spanish]: Well I remember that in Mexico what, some of the things that we are barely learning here, I was taught over there in fourth grade. Like, the fractions, the, the, what do you call them? The fractions of figures, I was taught that in fourth grade, third and fourth, that I do remember, I even have books from Mexico. (…) Things that we are barely being taught here in sixth grade, were taught to me in third and fourth over there. […] In fifth grade they were teaching us, and I knew
it already, I knew everything already because they had already taught me that in fourth grade [in Mexico].

The other students in that group of four were having a harder time working with fractions. For Anthony the demands of the task combined with the language made it very hard for him to translate. Although he is considered “bilingual,” his command of academic Spanish was most likely limited since he does not have an opportunity to work on it in the classroom and academic language takes longer to develop than language used for social communication (Cummins, 2000).

There are several equity issues that this episode raises: what did each of these students learn (about mathematics) from this exchange? Carolina has a good knowledge of fractions; will she have a chance to share this knowledge with the whole class? Could other grouping arrangements have been made to enhance the mathematical participation of all students? What knowledge of the students (and of what else?) does the teacher need to have to promote a wider participation?

We followed Carolina into 6th grade (usually by 6th grade students move to the middle school, but that year Agave had one 6th grade class) and are currently analyzing those data. Although she seems to have a good understanding of the mathematics (e.g., based on her performance on a task-based interview), overall her participation in class discussions was low. She seemed to do best when paired with Dolores, a strong student in mathematics with a very good command of both languages. We are concerned, based on the research on subtractive schooling (Valenzuela, 1999) as well as from our own data from a middle school, with what may happen to students like Carolina as they reach middle school. Valdés (2001) in her study of middle school immigrant Latino students talks about how some of these students who had strong mathematics backgrounds when they arrived were not placed in classes that challenged them (mathematically), hence getting bored.

Work With Parents.

We have been working with Latino/a parents and mathematics for over a decade now. At Agave we first started with mathematics workshops for parents only. Through bilingual sessions we introduced parents (mothers actually) to some of the contents of elementary and middle school mathematics. Issues of language and mathematics soon came to the surface. For example in a discussion on decimals, the question of comparing 0.6, 0.60, and 0.06 arose. The session facilitator was bilingual; Spanish was her first language but in this particular part of the discussion she used more English than Spanish. In an exchange in English one of the mothers has explained that 0.06 is smaller than 0.60 because “the point zero six is going to be at the bottom” (Indicating a point near one end of her number line, held vertically). The facilitator then poses the question of whether 0.60 is the same as 0.6. At this point two of the Spanish-speaking mothers complain that the facilitator is using too much English:

1. Facilitator: It’s the same, it doesn’t matter, right? (pointing at the number 0.6)
2. Sonia: ... Porque mire... Es que no te entendi. ...Es que te vuelas hablando en inglés y
[Because look] …[It’s that I didn’t understand you.] [It’s because you talk so fast in English, and…]

(laughter)

3. Facilitator: Perdón, perdón… échale la culpa al inglés (laughing).
[Sorry, sorry… blame it on the English! (laughing)]

4. Sonia: No, no, ¡es verdad! ¡No te entendí!
[No, no, it’s true, I didn’t understand you!]

5. Marisol: Hoy, hoy vienes muy, mucho hablando en inglés, y no español.
[Today you are speaking a lot in English and not in Spanish]

6. Facilitator: (laughing) ¡Perdón! Pues ya les dije… Sí, reclámenme, reclámenme, está bien. OK, la primera pregunta era: ¿es lo mismo decir punto sesenta a decir punto cero seis? ¿O sesenta centésimos y seis centésimos?…
[(laughing) I’m sorry! Well, I told you …] [Sure, pick on me, pick on me, it’s okay. OK, The first question was: is it the same to say point sixty as it is to say point zero six? Or sixty hundredths and six hundredths?]

This excerpt illustrates how confusing it can be for learners to try to make sense of content in another language while at the same it also emphasizes these mothers’ agency. They were engaged in the discussion and wanted to understand. They were not going to let the language become an obstacle. By then, we had established a rapport with this group of mothers and thus they were comfortable asking the facilitator that she use more Spanish. The confusion with whether 0.60 and 0.6 were different or the same persisted though for a while, as one of the mothers argued that they were different because 60 is bigger than 6. This confusion is not surprising (Pirie, 1996). What we want to point out here is the complexity of the situation as the two languages come into play and in fact seem to interfere with each other as the following excerpt seems to indicate:

1. Facilitator: OK. Ahora la siguiente pregunta era: ¿punto sesenta es lo mismo que punto seis?
[OK. And now, the next question was: is point sixty the same as point six?]


3. Facilitator: No, ¿por qué? [No, why not?] (Holding up the number line). So I’m saying, is point sixty the same as point six or sixty [cen]... sixty hundredths equal to six DECIMALS / DECIMOS [tenths]

[Because sixty is greater than six].

In line 3 the facilitator is speaking in English and is referring to 0.60 as sixty hundredths and to 0.6 as six… this is where things are not clear: she seems to be saying “decimals”; she may have said “décimos” which would correspond to “tenths” which is what one would expect for 0.6 (6 tenths) (or she may have thought “décimo” but indeed said “decimals” because the two words sound so close). This example underscores how difficult it is even for a facilitator who is quite bilingual to combine both languages (English / Spanish) and the language of mathematics. When we analyzed the data and we looked at the interactions from a semantic point of view, we wondered if there was confusion among the participants between the mathematical
idea, its symbolic representation with numbers and the linguistic expressions that the facilitator used to communicate that mathematical idea (the place value). The confusion was resolved when one of the mothers brought up money and these different representations were interpreted in terms of money. But the exchanges once again show the confusion between “decimal” /“décimo” (tenth):

1. Marta [I sometimes co-facilitated]: Ustedes me dijeron que éste [pointing to 0.06 on the overhead] era 6 centavos (...) and that this [pointing to 0.60] era el sesenta centavos. Yo quiero saber ¿qué es éste? [pointing to 0.6].
   [You told me that this (pointing to 0.06 on the overhead was 6 cents) (...) and that this (pointing to 0.60) was sixty cents] [I want to know what this one is. [0.6]]
2. Facilitator: ¿Cómo se lee? [How do we read it?]
3. Sonia: Se lee, se lee cero punto seis DECIMALES … o...
   [It’s read zero point six DECIMALS … or...]
4. Elisa: Si se trata de dólares, y hay un dólar con seis, va a ser un dólar con sesenta centavos. (...) Entonces si fueran seis centavos fuera uno punto cero seis. (...) El de arriba [referring to $1.6 on the overhead] es un dólar con sesenta centavos.
   [If it has to do with dollars, and there is a dollar with six, it will be one dollar and sixty cents] [So if there were six cents, it would be one point zero six] [The one above (referring to $1.6 on the overhead) is one dollar and sixty cents.]
6. Marta: O... o... [pointing at $1.6] [or... or...]
7. Sonia: o seis DECIMALES [or six DECIMALS]
8. Marta: O seis… ¿Cómo se llama la moneda?… [or six… what is the coin called?]

In my last sentences (6 and 8) I was looking for six dimes to make the connection between sixty cents and six dimes, but I did not succeed. The issue of DECIMALS meaning maybe “décimos” kept coming up. I want to point out that we did not realize this confusion till we watched the videotaped session. This points to the complexity of teaching in multilingual settings (and in this case it is “only” bilingual; see Setati, 2005 for more on this complexity).

Our recent work with parents at that school follows a different format in that children and parents come together. Our current study focuses on the interactions between parents and children about mathematics. Our preliminary findings show the complexity of a situation in which valorization of knowledge (parents’ knowledge and school knowledge), different approaches (reform-based and “traditional”), and language (Spanish speaking parents with children schooled in English) interact.

ABOUT LANGUAGE AND MATHEMATICS

The quotes I have selected for this final section are meant to raise questions around equity as participants bring up issues related to language and the teaching and learning of mathematics. I focus on homework because this is a context where parents, teachers, and children interact. Children expressed some concern at not always being able to count on their parents for help because of the language:
Daniela [fifth grader]: Well, since I have two brothers that are already working and my mother does not understand everything in English, I need to ask one of my brothers or a cousin who is in high school.

Students commented that they often had to translate the homework into Spanish for their parents and that this was hard because as two boys said, “what we know how to say about mathematics in English, we can barely say it in Spanish” (paraphrased).

Parents also feel at a loss:

Selena: Sometimes I cannot explain it to him because I hardly know English. There are things that he reads to me and he translates them into Spanish; sometimes I understand what he’s telling me in English, but others, definitely I don’t understand anything.

Unfortunately by not being able to develop their academic Spanish, children whose parents do not speak English well are put in a difficult position when they try to communicate with them about mathematics. This is well captured in the following quote from one of the CEMELA teachers:

Nadia: And so here’s the difficulty with the language again in the fact that they’re learning English here, they’re doing everything in English and at home the parents don’t know English. So there is a disconnect right there. There is a disconnect as to what they’re doing. So I have to think and I have to kind of really understand how to work that out. How can you go about asking your child about certain things if what he or she has is all in English and at home it’s all in Spanish? There’s that disconnect.

I wonder about the effects of this disconnect on the relationships parents-children and on children’s academic achievement. But I also wonder about the power and valorization issues embedded in this situation. As Olsen (2000) writes,

They [immigrants] and their families are saddened by the discovery, which comes too late, that becoming English fluent usually is accompanied by a loss of home language use, fluency and development. The longer immigrant students are in the United States, the greater is their awareness of being caught in a power struggle over the use of English and other languages. (p. 197)

References


