

A Transnational Study of Latino/a Students' Access to Opportunities to Learn Mathematics

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Introduction

For the past several decades there has been a large influx of immigrants in the United States, particularly from Asia and Latin America. These immigrants are a heterogeneous group that challenges simple generalizations. They include “highly educated, highly skilled workers... and large numbers of poorly schooled, semiskilled, or unskilled workers, many of whom are in the United States without proper documentation” (Suarez-Orozco, 2001, p. 350-1). According to the U.S. Census Bureau (March, 2000), over 50% of all immigrants in the U.S. are from a Latin American country, the majority of whom are from Mexico. Across the U.S., significant numbers of immigrant children from Latin America, particularly from Mexico, are entering classrooms. Needless to say, American teachers of mathematics are struggling to meet the needs of these students.

Transnational and borderland research studies across sending and receiving communities in Mexico and the U.S. are important comparisons to pursue for several reasons. First, many children experience the transition between Mexican and U.S. mathematics classrooms as disruptions in their mathematics learning trajectories. It is crucial to examine this transition in order to be able to better support recent immigrant children in learning mathematics in the U.S. Second, many families and children cross these borders more than once in their lives and belong to communities on both sides of the national border. Therefore, it is important to examine the mathematical aspects of

this population's experiences across two countries. Lastly, anecdotal evidence comparing mathematics instruction in the two settings has been persistently reported. It seems crucial for research to examine this anecdotal evidence more closely, collect more data, and explore hypotheses.

This pilot study explores Latino/a students' opportunities to learn mathematics in Mexico and U.S. by researching the characteristics of curriculum and instruction, teachers' practices and teachers' conceptions in both countries. The research question addressed in this study is: How are teachers' views of mathematics and on teaching mathematics similar and different in Mexico and the U.S.?

Research Methodology

Data Collection

The data reported here is from interviews conducted with three regular education teachers at one primary-level, public school in Chihuahua, Mexico and with three regular education teachers from different primary-level, public schools in the southwestern United States (U.S.). Each participating teacher was observed teaching twice – two distinct lessons on consecutive days, for a total of two observations of each of the three participating teachers in the sample. Semi-structured interviews were conducted with each teacher immediately after the two classroom observations. Copies of academic tasks (e.g., handouts) were also obtained during classroom observations. These tasks and classroom activities were then used as a context to examine teachers' conceptions during interviews. In addition, the concrete and immediate nature of the tasks and activities facilitated interviews with the teachers.

To examine teachers' conceptions (knowledge and beliefs) about mathematics and teaching, semi-structured interview protocols were adapted from existing instruments and the literature used to develop the observation scales (Newmann, Secada & Wehlage, 1995). The interviews were designed to examine teachers' (a) general perceptions of the lessons, (b) conceptions of the nature of mathematics, (c) conceptions of student diversity, and (d) conceptions of integrating mathematics with student diversity. Each question was followed with probes. Each interview lasted approximately 45 minutes to one hour. All the interviews were audio-taped and transcribed.

Data Analysis

The teacher interview transcripts were initially read as a complete dataset and coded for structural categories according to base data, interview questions, individual questions, other conceptual categories, students, and schools. This structure provided the initial database, allowing for flexible grouping and coding of teachers' conceptions. Data were sorted by interview questions to examine (a) teachers' conceptions of curriculum, instruction, and assessment in mathematics and (b) teachers' conceptions of student diversity in mathematics.

The data subsets were analyzed using interpretive methods (Erickson, 1986). Each data subset was read as a whole, followed by a period of open coding to allow for the emergence of themes. An iterative process of coding, memo writing, focused coding, and integrative memo writing followed (Emerson, Fretz, & Shaw, 1995). Creation of the codes went through multiple revisions, as the data were repeatedly read to check the consistency of themes. This process continued until either no new categories were developed or consistency was achieved. After a set of themes were obtained from the

dataset, I searched for commonalities and differences in teachers' responses. I also sought both confirming and disconfirming evidence by searching for supportive and non-supportive evidence (Erickson, 1986).

Research Results

Interview Data – Mexico Teachers

Three common themes were discovered in the analysis of the interviews conducted with the three teachers in Mexico. First, the teachers believed that students learn mathematics best when they have the opportunity to “touch/feel” mathematical ideas; that is, to learn mathematics by working from the concrete to the abstract. Related to this theme, the teachers discussed the importance of students learning mathematics as a means to develop their capacities as learners. Secondly, teachers believed that they could become better teachers from learning from each other. The teachers expressed how they needed to be continually open to learning more to improve as teachers of mathematics. Lastly, teachers talked about the importance of relating mathematics to their students' immediate “medio” or home environment.

Learning from the concrete to the abstract

Two of the three Mexican teachers expressed the belief that students learn most effectively when they first engage in a mathematical idea concretely and make sense of it before moving on to examine more abstract notions of the idea. ALM, a 4th grade teacher expressed this idea quite succinctly:

Mira bueno para mí para enseñar las matemáticas primero tiene que ser con material concreto de lo fácil a lo complejo...

[Look, well for me to teach mathematics first it has to be with concrete material from the easy to the complicated/complex...] (ALM interview, March 2005).

LVP, a 2nd grade teacher expressed the idea in a similar way:

Bueno si porque... porque de esa manera las matemáticas el niño comprende mas por mas que estar simplemente en el libro registrando y platicando... Experimentando, el niño aprende mas palpando los materiales y observando, o sea poniendo sus cinco sentidos que solamente estaría escribiendo y escuchando a la maestra... entonces es mas fácil así que el niño comprende.

[Well yes because... because in that way the child comprehends mathematics more than simply in the book registering and discussing... Experimenting, the child learns more touching/feeling the materials and observing, or rather using his five senses than only writing and listening to the teacher... then it is easier for the child to comprehend.]

More generally, TGC, a 6th grade teacher expected her students to “learn to learn.”

From this perspective, the focus of the mathematics classroom becomes fostering students’ mathematical thinking:

En toda la educación primaria se pretende que los niños aprendan aprender... es una frase de un autor no me acuerdo de cual... entonces a los niños se les dan herramientas para que ellos mismos vayan construyendo su conocimiento... entonces no es tanto que les enseñe yo matemáticas lo que yo pretendo enseñarles a ellos son habilidades que ellos solo se apropien de las matemáticas que ellos solos busquen soluciones.

[In all of primary education we expect that the children learn to learn... this is a phrase from an author I do not remember which one... so then the children are given tools so that they themselves can construct their understanding... so then it is not so much that I teach them mathematics what I expect to teach them are abilities that they themselves can appropriate themselves in mathematics that they themselves look for solutions.]

Importance of learning from each other

TGC had recently moved from teaching in the lower grades to become a 6th grade teacher. She expressed how she frequently sought the help of her colleagues to be more effective at the new grade level:

... todos eso instrumentos de evaluación nos permiten darnos cuenta cuando estamos fallando... cuando yo me doy cuenta que estoy fallando... cambio mi forma de trabajar... busco porque no todas las respuestas las tengo entonces yo me auxilio con compañeros que ya han tenido grados

anteriores porque esta yo tengo veintidós años de servicio y es la primera vez que tengo sexto grado... todo el tiempo trabaje con primero y segundo [*... all these evaluative instruments permit us to realize/find out when we are failing... when I realize that I am failing... I change my way of working...I look for because I do not have all of the answers so then I will seek help from my colleagues/partners that have taught these grades previously because though I have 22 years of service, this is the first time I have sixth grade...all of the time I worked with first and second.*]

LVP also discussed the importance of being open to continually learn more herself:

Si estoy así como recibiendo puras enseñanzas y me gusta mucho porque... no soy de las personas que me encierro y mi forma de trabajar así va ser siempre... yo estoy recibiendo de los padres de los maestros de. Me gusta aprender y no estoy cerrada a ninguna experiencia ni. [*Yes I am receiving a lot of lessons and I like it a lot because... I am not one of those people that closes myself off and my way of working will always be like that... I am receiving from the parents, the teachers. I like to learn and I am not closed off/opposed to any experience.*]

Mathematics needs to be relevant to students

All three teachers from Mexico believed that for them to be effective, mathematics instruction needs to be relevant to their students. LVP expressed this idea in the following way:

Este bueno es algo que ya había mencionado... que el niño experimente que el niño... que lo relacione con su medio. Por ejemplo, cuando hablamos con en la clase si yo le digo cuando van al centro comercial... o sea tan solo con decirles el niño ya se esta imaginando con las cosas que hace y lo va acercando con su con su realidad... entonces es mas fácil que lo comprenda a que...a que vea algo que esta lejos. Pues, si de su realidad yo creo que dos cosas, que sea algo que el utilice fuera de la escuela en su casa y en su entorno, y que aquí en la clase... lo experimente que utilice material.

[*Well then it is something I had already mentioned... that the child experiments, that the child... that he relates it with his environment. For example, when we talk with the class if I tell when you go to the mall... or rather with just telling them the child is imagining these things that he does and that brings it closer to his reality... then it is easier for him to comprehend what... than to see something that is far. Well, from his reality I believe two things, that it be something that he utilizes outside of*

school in his home and in his environment, and that here in class he experiments utilizing the material.]

ALM described how important it was to make mathematics relevant by citing specific examples of how she accomplished this goal in her class:

Mira... necesitas que darles a los niños algo que les interese por lo tanto tiene que ser por medio su medioambiente en que ellos se manejen que ellos se manejen a donde ellos les interese. Por ejemplo, tengo un niño que le fascina el, va manejar carreras entonces. El dice que la escuela dice que no le va servir si va ser chofer. Pero, los demás de matemáticas si vas a caminar tantos kilómetros en tu camión, cuantos kilómetros vas a necesitar de gasolina si por cada kilómetro vas a gastar tanto de gasolina? Entonces, a el le va llamar mas la atención por que es lo que a el le gusta.

[Look... you need to give the children something that interests them because for the most part it has to be through their environment that they motivate themselves that they motivate themselves to where it interests them. For example, I have a boy that is fascinated by, he is going to drive race cars. He says that school is not going to benefit him if he is going to be a driver. But, the rest of mathematics if you are going to drive so many kilometers in your car, how many kilometers of gasoline are you going to need if for every kilometer you are going to use so much gasoline? Then, it is going to interest him because it is what he likes.]

Interview Data - U.S. Teachers

Three common themes were discovered in the analysis of the interviews conducted with the three U.S. teachers. First, the teachers wanted to develop their students' confidence in mathematics. One teacher also talked about how "every student needs to be validated" for their efforts while problem solving. Secondly, because all three U.S. teachers taught in both Spanish and English, they focused attention on the importance of language while teaching mathematics. Lastly, the teachers attempted to incorporate their Mexican-American students' cultures into their mathematics instruction.

Developing student self-efficacy

When asked to describe three important mathematical ideas that he wanted his students to learn in fifth-grade, JO discussed the importance of developing his students' sense of self-efficacy in mathematics:

Ok, basically for me, one of the most important ones is that they feel confident about working with math, which means there is not only one way to do a problem. Maybe I have Edgar doing the problem in one way and then I have Javier doing the problem in another way. But, I told them, you know, there is not just only one way. It is the same thing with fractions, there is not just one [way].

MZ wanted his students to be validated while solving problems:

... There is not one set way to problem solve. There are many ways to do it. Every student needs to be validated for his or her efforts in problem solving, whether it is the wrong answer or the right answer they still need to be validated for what they have done, just for going through the process of doing it. I guess [students] being able to feel successful and not afraid to go into these kind of problems, the word problems, the reading problems, and all that is another thing.

Language and mathematics

If students were struggling to understand mathematical ideas, MZ focused on language:

First in language, I try to utilize the [mathematical] vocabulary as much as I can; what vocabulary they are going to see in the lesson and try to ask them, 'Do you understand it? Do you get it?' Of course they are going to say yes, but I just keep on with that, keep on with that. And for those that are still having problems with the problem solving aspect of it, we just keep on, keep on pushing it.

JO did not want students to fall behind in mathematics because they could not understand the language of instruction:

... and I don't want the language to be a barrier... all of them know Spanish. So for me it's really just change it to Spanish whenever a concept is like kind of complicated, meaning or difficult, just to do it in Spanish and then switch back to English. And they don't mind. I ask English and they return Spanish, I ask Spanish and they return English, so I don't mind

the switching. What I don't like is this combination of "Spanglish", this is what I don't encourage.

ME believed that difficulties her students experienced in mathematics were related to their lack of knowledge of mathematics, not to a lack of mathematical ability:

I have a couple that I'm really concerned about, though I've seen enormous progress this year. Basically it's like language. It's a really, really rich environment both in English and in Spanish for vocabulary that's been really fun for me this year.

Incorporate students' culture in instruction

ME was very open about how she was from a culture other than her students and had to work to understand their Mexican American culture. She expressed a desire to incorporate her students' culture into her mathematics lessons:

I do struggle with that and partly for me is because I'm from a different culture, but I try to be very aware of [that]... It's a struggle for me [to incorporate my students' culture into math lessons, but] I think I'm sensitive to it. I'm not sure that I always recognize what I might want to do. I know my girls are really interested in quinceañeras and so if we have like word problems... I might use that rather than a birthday party or something less exciting to them or less meaningful.

JO who was Puerto Rican modified his curriculum to incorporate elements of the Mexican-American culture, since the majority of his students were of Mexican descent:

If I see like examples that I can modify a little bit maybe in the terms they use instead of using like a pizza; using, I don't know tamales or if they are using Elliot maybe using Elias, Juan, instead of John. You know changing the names to more typical names or what they work with. So, this Anglo name is like "Oh, no Elliot" or whatever, is more like reachable, like "Oh, is Juan, you know that one, I know tamales." I try to adjust that more for what they talk about, maybe cars, pokemon, or whatever they want; you know, what they are watching or doing. For the girls, [I try] using like items that they like, like the headbands or I don't know earrings or whatever they see in the classroom that they are working with or they care about a lot. So, I try to incorporate that because that gets their attention. So, I try to do that a lot, I try to make it real, reachable like 'Oh, yes I know, I know tamales, I know how to make them. I know the measurements that way. Maybe if I talk about harina de maiz [instead of]

cornstarch or something they say ‘Oh yeah, it is at home,’ something that they can actually connect for real life. Yes I do that all the time.

Discussion

In this pilot study, my goal was to begin to address how teachers’ views of mathematics and on the teaching of mathematics are similar and differ in Mexico and the U.S. From interviews conducted with three primary school teachers in Mexico and with three primary school teachers in the U.S., a common theme that emerged across the two countries was the importance the teachers ascribed to relating mathematics to their students’ cultural backgrounds. Differences that were found concerned the value that the teachers in Mexico placed on teaching concretely and on learning from one another, while the U.S. teachers placed more emphasis on “validating” students and the importance of teaching bilingually to support their students’ learning of mathematics.

Teachers across the two countries believed that incorporating their students’ home environment (Mexico) and cultural values (U.S.) into mathematical lessons was a means to more effectively engage students in learning. Participating teachers in this study worked with students of Mexican descent and all discussed their goal of incorporating cultural referents that their students could relate to (e.g., tamales instead of pizza) in their mathematics lessons. This is an interesting finding because it demonstrates how teachers across two nations believe, based on their experiences in the classroom, in the importance of connecting mathematics to their students’ home/cultural backgrounds as a means to engage students in learning.

Perhaps little should be ascribed from the differences found in the teacher narratives, except that the context of particular teachers’ experiences impact their views of mathematics and the teaching of mathematics. In Mexico, several participating

teachers expressed how much they valued learning from their colleagues. For one teacher, this was critically important given that she had just shifted from teaching in the lower primary grades to become a sixth grade teacher. The U.S. teachers expressed the importance of teaching mathematics bilingually so that language would not interfere with student understanding. So, if students did not understand what was being taught in English, they simply shifted instruction to Spanish. Given that almost all of the students in the participating teachers' classrooms spoke Spanish as their first language, it makes sense that shifting the language of instruction to meet the needs of their students was common for the U.S. teachers.

It is interesting that the Mexican teachers discussed teaching from the concrete to the more abstract, while the U.S. teachers wanted to “validate” their students in the mathematics classroom. The value the Mexican teachers placed upon teaching in ways that appear to align with constructivist learning theories, while the U.S. teachers were concerned about student affect inspires a few hypotheses. First, the focus on teaching in ways that align with new theories of learning in Mexico may point to the value being placed on preparing teachers to teach mathematics in ways that align with constructivism. Though this may be a bit of an over-generalization, it is still interesting that the teachers in Mexico said how highly they valued teaching mathematics in ways that have been demonstrated through research to most effectively support student learning of mathematics. In terms of the value the U.S. teachers placed on affect, this finding aligns with some of the findings of the Third International Mathematics and Science Study [TIMSS] (Martin, Mullis, Gregory, Hoyle, & Shen, 2000). That is, U.S. teachers, independent of student achievement, believe that a primary goal of instruction is for students to feel good about

themselves in the mathematics classroom. Though this pilot study is quite limited and only includes finding from interviews with three U.S. teachers, it is intriguing that the teachers' words match this very specific finding from TIMSS (Martin, Mullis, Gregory, Hoyle, & Shen, 2000).

Final Remarks

In this pilot study, commonalities and differences in terms of themes found in primary-level teacher narratives across Mexico and the U.S. were discussed. While these findings are extremely tentative, they do point to some common goals of instruction of participating teachers (i.e., making mathematics relevant by incorporating students' cultures in lessons), and potential differences that appear to be contextual (e.g., the need for U.S. teachers to teach bilingually to support student understanding). The goal expressed by the teachers in Mexico to teach in ways that align with the constructivist learning theory and the desire expressed by the U.S. teachers to help students feel good about themselves generate potential hypotheses. To understand if other teachers across the two countries have similar beliefs and goals, more teachers need to be interviewed to explore whether other teachers hold similar beliefs and values.

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