

Immigrant Latina mothers' participation in a community mathematization project

Craig Willey

University of Illinois at Chicago
Chicago, USA
cwille3@uic.edu

Abstract

This paper shows how Latina, immigrant mothers expanded their mathematical boundaries by participating in a community mathematization project. These mothers were not only participants, but also curriculum designers in collaboration with university researchers. By involving the mothers in the design of the project, researchers improved the likelihood that the project would reflect Latina/o *funds of knowledge* and capitalize on Latina/o epistemology. This contrasts with typical approaches to mathematics teaching and learning that ignore the knowledge of parents or do not define them as collaborators. The data collected by children and parents from community sites were collaboratively analyzed by teams of undergraduate student facilitators, elementary students, parents, and researchers. The final products were digital stories that illustrated the mathematics in the daily operations of a particular community site as well as posed a potential mathematical problem that the worker might encounter. Our findings reveal the mathematics that is evident to the mothers, as well as how social networks function to support Latina parents' development of mathematical knowledge and agency.

Key words: mathematization, collaboration, Latina parents, mathematical knowledge, agency

Introduction

In the United States, current federal and local discourse around education, and in particular mathematics education, is dominated by proclamations of an achievement gap between White students on the one hand and African-American or Latina/o students on the other (Martin, 2007; see National Centre for Education Statistics, 2007). As a result of such discourse, images are created that portray non-White students as less capable than their White counterparts and a huge thorn in society's side that needs to be dealt with by more stringent methods of accountability. It is quite easy to see how the public can become influenced by the rhetoric and fall victim to notions of a seriously deficient population of minority learners. Embedded within this context, there is a large and growing population of Latinas/os, one that includes a foreign-born, adult population that has fewer years of formal education than other ethnic groups (United States Census Bureau, 2007). Implicitly and almost by default, Latinas/os are being subsumed under a category of mathematically incompetent.

It has been the position of many critical mathematics educators to reject the notion and language of deficiency as it pertains to certain minority groups set against the standard of high-achieving, White students (e.g. Khisty & Willey, in press; Martin, 2007, in press; Martin & McGee, in press). This is not an effort to ignore the reality that Black and Latina/o students consistently have lower levels of educational attainment than White students, but rather an effort not to contribute to a discourse that manifests into a dangerously powerful ideology that inhibits the production of the necessary social structures to reverse this trend and move towards a more equitable educational system. With this in mind, and as we stretch our minds to understand the role of mathematics in Latina/o parents' lives, we are grounded in notions such as funds of knowledge (Moll, Amanti, Neff, & Gonzalez, 1992; Gonzalez, Andrade, Civil & Moll, 2001), which puts forth an alternative theoretical framework and highlights empirical evidence

that non-dominant groups are bearers of vast amounts of social and cultural capital that is not effectively utilized – but could be – in the US school system as we currently know it.

The issues surrounding the mathematics education of Latinas/os are numerous and multi-faceted. They include macro-socioeconomic forces and ideologies such as racism and education to serve the evolving workforce. Also, they include practical obstacles like language proficiency and the role of parents in the school system, and thus, their child's academic development. This article addresses one aspect of mathematical association among Latinas/os: the mathematical base, processes, and development of immigrant, Latina mothers in an urban context.

In particular, this paper reports the results of a community mathematization project. Before the details of the project are discussed, a few words need to be said about mathematization and the assumptions and foundations from which the research team worked. First, it is acknowledged that mathematization is not something that has historically been included in the formal, U.S. mathematics curriculum. Therefore, the research team does not claim to have formal experiences in mathematization. We assume the same is true for the formal Mexican curriculum, the one that was learned by the mothers of this study. From this standpoint, the researchers and the mothers began from equivalent positions. This idea is nuanced, however, because our initial interviews with the mothers revealed that the mothers, in general, had limited opportunities to engage in whichever curriculum the Mexican schools presented for an assortment of reasons. Regardless of this fact, none of the participants have participated in an activity of this nature, and no one knew precisely what to anticipate. One thing was clear from the beginning, however: we could not realistically expect the students and mothers to mathematize community practices automatically. It has been documented that even mathematicians have struggled to understand the mathematical practices embedded in work and those that reflect individuals' unique way of knowing (e.g. González et al., 2001).

The basis for the creation of this project is two-fold. First, the research team collectively agreed that mathematics was used to varying degrees in the majority of complex work practices. – even if it was not recognized. More importantly, the team hypothesized that if parents and their children could experience mathematics together in the community, it would promote and facilitate informal mathematical discourse that would both support students' formal mathematical development, as well as transform each actor's mathematical identity (internalized and perceived) into a mathematics “knower” and a mathematics “doer.”

In the sections that follow, I will expand upon the concept of funds of knowledge, in addition to other perspectives that showcase the assets of non-dominant groups. Then, I will describe a community mathematization project, collaboratively designed with Latina mothers, that aimed to expose Latina/o epistemology and the expansive mathematical knowledge bases of five immigrant mothers. This mathematization project is part of a larger study of Latinas/os' mathematics learning that I will also elaborate. Next, I will describe the ways in which the mothers translated the information provided by the community members into ‘real’ mathematical substance. This is reflected in their final products, digital stories. Finally, I will conclude with the implications of this study and question to probe in the future.

Theoretical positioning

Moll and an interdisciplinary team of researchers at the University of Arizona has constructed, refined, and empirically supported the concept of *funds of knowledge* for over 15 years (Moll et al., 1992; González, Moll, Floyd-Tenery, Rivera, et al., 1995; González et al., 2001). Funds of knowledge began as a tool to concretely illustrate to pre-service teachers the social and cultural capital found in perceptively deficient homes that could potentially be utilized in literacy instruction. Since then, it has crossed disciplinary borders and been applied to such fields as mathematics (e.g. Civil, 2002; Civil & Andrade, 2002; González et al., 2001; Díez-Palomar, Simic & Varley, 2006).

A derivative perspective of funds of knowledge places Latinas/os' cultural and social capital (e.g. epistemology, experiences) at the centre of the learning experience (Díez-Palomar, Simic, & Varley, 2006). This is a striking contrast to many U.S. classrooms that frequently

neglect to acknowledge the fact that Latinas/os are not like their White counterparts in many ways, in terms of language, culture, and socio-historical experiences. It has been documented that non-dominant group members have proven competent in academic tasks when they view them as relevant (Saxe, 1991; González et al., 2001), which speaks to the importance of moving away from curricula and activities architected by and for the majority population if we are to better-serve subjugated groups in schools.

The study

Our research is conducted in a large, urban school district in a very large, post-industrial city in the Midwestern United States. Within this school system, there are approximately 421,000 students enrolled in the more than 620 schools. Of these students, nearly half (48%) are African-American and nearly an additional two-fifths (39%) are Latina/o. This leaves only 8% White and 5% Asian/Pacific Islander, Multi-Racial and Native American students. Furthermore, 85.6% of students are classified as coming from low-income families and 14.4% are categorized as “Limited English Proficient” (School District Data, 2007).

In the middle of this huge school bureaucracy lays Wilson Dual Language Academy, our research site. The Academy is made up of approximately 425 students in Pre-Kindergarten through 6th grade. Demographically, the school is 99.4% Latina/o. The school has a relatively large transient population reflected by the 25.6% mobility rating. Additionally, 98.3% of students are eligible for the government’s free or reduced lunch program, and 68% are categorized as English language learners (ELLs) (School District Data, 2007). The Academy advertises itself as a “World Language Magnet Cluster School, offering a Dual Language Program in Spanish and English. The school’s goal is for all students to be bilinguals by the end of 6th grade (School District Data, 2007).”

The research reported here is based on data gathered in an after-school project loosely modelled after the work of *The Fifth Dimension* (Cole et al., 2006) and *La Clase Mágica* (Vásquez, 2003). The after-school is designed to give Latinas/os experiences doing non-remedial mathematics in curriculum topics beyond the students’ grade level (4th). Such topics include probability, algebraic thinking/patterns, and complex problem solving. Students are encouraged to be self-directed, to work collaboratively, to verbalize their thinking, and to ask questions. Playfulness between adults and children is a critical part of interactions in the after-school.

Fourteen to twenty third and fourth grade students have voluntarily attended *Los Rayos de CEMELA* for nearly two years. They meet twice a week for one and a half hour sessions. Within the sessions, students are allowed many freedoms to choose their activities and to dictate the course a project will follow. This design is deliberately chosen by researchers to create a drastically different environment than the one which is typically found in the traditional classroom. The activities are designed to foster high-order thinking and reasoning skills. All sessions of *Los Rayos* are captured by multiple video cameras and are later analysed both by individual researchers and through collective group analysis.

In general, our research goal is to find intersections between mathematics learning, language, and culture. More specifically, CEMELA seeks to describe patterns that emerge regarding how Latino children use Spanish and English in mathematics, the cultural resources they draw on, and how social networks develop because of and around language and culture. This is part of understanding the processes in which students develop identities as mathematics learners through their interactions with university students and researchers and participation in the after-school mathematics program. We wish to better understand and map how networks (learning communities, for example) form around language, culture, and mathematics activities, and influence children’s identity as having math competency. In other words, we recognize language and cultural resources and redefine them as learning capital. The focus is on the nature of learning as one of interdependence between social networks, resources, and contexts.

The community mathematization project

As previously indicated, this article reports on one project within the larger study just described. The focus is primarily on the Latina mothers, however, in order to capture the full context, there will be references to the other participants, namely, the elementary school children, the undergraduate group facilitators, and university researchers. The project is rooted in the paradigm of interactive research (Gitlin, 1990; Pizarro, 1998), which necessarily requires activating and utilizing the voice of research subjects in collaboration with researchers with the ultimate goal of benefiting all constituents. Parents were asked to collaborate with researchers to develop a design for a project in which students would venture into the community and interview local community members regarding the mathematics they used in the work environments. A main objective of the project was to find and understand mathematical practices in the community that people likely overlook in their day-to-day lives, even though these practices are within sight. First, since the parents are already networked within the community, each parent identified at least one business or service provider that would be willing to work with students and explain the daily operations. A flower shop, mechanic, beauty salon, fire station, travel agency, physical therapy office and produce store were examples of such places. Then, the parents escorted the students to these sites to become acquainted with the tasks of the workers. Eventually, the list of sites was reduced to four that were sure to accommodate students on subsequent visits and be fruitful for the benefit of mathematization.

In order for the parents and researchers to create common objectives for the project, many discussions took place around the idea of mathematization (Hoyles, Noss, & Pozzi, 1998; see also Freudenthal, 1991; Gravemeijer, 1997; Gravemeijer & Doorman, 1999; Greer, 1997; Streefland, 1991); that is, the exploration and raising awareness of the mathematics in the surrounding environment (in this case, the sites mentioned above). The objective was to demonstrate to all participants that mathematics is reality as well as abstract. Furthermore, we aimed to scaffold this experience so participants would realize that mathematics is more inclusive than just arithmetic operations.

Because mathematization is a somewhat unfamiliar practice, researchers and parents took part in a series of preliminary activities that moved them to a shared understanding of mathematization. For example, we collectively examined snapshots of a butcher and convenience store worker, made a list of all the tasks constituted in their respective work, and hypothesized potential problems they might encounter, all with the objective of getting to the hidden and embedded mathematics involved in various business and social practices. Another motive for these preliminary activities was the initial intention for the parents to become versed in mathematization in order to guide the children through the extensive process. By working through hypothetical situations, the parents indirectly learned how to isolate mathematical practices done by a typical worker that largely are unrecognized as mathematical practices. The culmination of this project was the creation of a digital story that illustrated the business practice and posed a potential mathematical situation that the worker might encounter. Our research questions for this study are:

- What role do cross-generational networks and interactions with elementary school students, university student facilitators, parents, and other community members play in the development of Latina/o parents' mathematical identity?
- How do children and parents support each other's reasoning and learning of mathematics, language, and literacy during the digital story project?
- How do children and parents translate stories told by community members into more mathematical language?
- How might social networks function in supporting Latina parents' development of mathematical knowledge and agency?

These questions are too involved to simultaneously elaborate and satisfy the scope of this paper. Although how children and their learning may be positively influenced by the funds of knowledge their parents bring forth and related issues are major considerations in the larger

study, children are not the focus here. Therefore, I will focus primarily on the fourth question, while incorporating aspects of the first three questions in the Results and Discussion sections.

In order to answer these questions, we used the data embedded in the digital stories developed by parents and students as well as video documentation of the entire process. Focus group interviews with the parents also informed researchers as to what phenomena were occurring. The data were analyzed by multiple members of the project, and emergent themes were noted and discussed. Then, all data were reviewed at least once more with special attention paid to the particular instances of mathematical sense-making, agency, formation and utilization of networks, and identity transformations.

Mathematical sense-making

We defined mathematical sense-making as any stage in the process of understanding, visualizing, abstracting, or applying a particular mathematical idea. These stages can take a variety of forms, some of which are indexed by acts of mathematical struggle, collaboration, or success.

Agency

Agency was defined as any act that indicated a participant was undergoing mathematical empowerment. That is, the participant was not being acted upon by the activity, but rather was a critical actor in the process of moving from one level of mathematical schema to a more advanced level.

Formation and utilization of networks

Networks, in this sense, are the social interactions that occur within a space in which actors are connected by a particular activity system. In this case, the activity system is the after-school mathematics club, and more specifically, the activity is the mathematization project. This network has been forming for nearly two years. We are interested in marking instances in which the network is evolving and in which the participants are relying on various network members.

Mathematical identity transformations

At the beginning of the after-school program, participants assumed a certain place (both physical and intellectual), or role, within the activity system. This is a reflection of their internalized identity. With respect to the scope of this paper, we have isolated a portion of the activity system to include only the mathematization project. Therefore, we are more specifically concerned with participants' mathematical identity; that is, the ways in which a person views themselves as a mathematics "doer" or "knower." Inevitably, these identities have changed based on a series of interactions around mathematical tasks and activities. We are particularly interested in the transformations that have occurred through the mathematization process in terms of the active role participants assumed as mathematical "knowers" and "doers."

Results

In order to capture the depth and breadth of this project, as well as an example of a transformation that took place, I will present the case of one mother, Carmen. Carmen visited the mechanic with one group of children, a university researcher, and an undergraduate pre-service teacher. After her first two visits, she struggled to identify an area of mathematics in which she was interested. Carmen expressed concern that she wanted to "talk" about something important in her digital story. Eventually, she realized that it was the exhaust system – specifically, the pipes – that she was interested in, and she went to visit the mechanic again on her own to obtain more information. At the next after-school session, Carmen shared the information that she had learned, but noted that some of the ideas still were not clear. She began to formulate and ask questions of the other participants in the after-school program. They discussed terms like diameter, angles, inches, and degrees. The parents seemed unsure about the specific applications of these terms to the pipes.

Chaley, a university researcher who serves as the coordinator of the after-school program, was requested to join the group of parents and other participants when they were having conversations about these issues. When he came into the room, he inquired about the progress of their digital stories. The mothers mentioned that they wanted to work on the mathematics that they saw at the different places in order to create a problem for their stories, but at that moment, they were trying to make sense of the pipes. They had questions like, how does one measure the diameter of a pipe? What does the symbol “ ” mean (referring to the symbol commonly used to represent inches)? Chaley reported that he felt as if they wanted him to tell them, but he tried not to do so. Instead, they had a lengthy discussion surrounding these topics.

Chaley, who is from Central America, reported that he led the mothers to what he thought they might already know and helped them connect this knowledge to these concepts. Regarding the diameter, he started by giving them examples of objects from which the diameter could be found rather concretely, like a glass and a plate. Then, he found other examples of geometric shapes, like a circle, and asked them, “Where do you think the diameter is in these objects?” As a group, the mothers began sharing their ideas about what it might be. One mother said, “If I’m not wrong, I think it is the space...distance from one edge of the circle to the other, across it all.”

The conversation soon evolved into a question-posing session. The question, “How do we measure things?” was the basis of the discussion. Based on their observations and their experiences, the group talked about how one might go about measuring the length, diameter, and angle of a pipe in order to appropriately and accurately bend it to fit underneath the car. The participants used protractors and rulers and measured some local objects and angles. This led them to the units of measurement in each case, and they talked about centimetres and degrees, respectively. However, the conversation also brought up the difference in the metric system used in Latin America compared to the standard system used in the United States. They were well-informed about the conversion, or equivalence, of unit parts to whole units (i.e., 12 inches in one foot), however, the mothers still did not know about their symbolization. Chaley thought of using the height measurement on their identification cards as a resource to give the group more contextualized information, and they noticed that on their cards, the symbols: “ ” and “ ” represent inches and feet, respectively. As a result, the group successfully figured out the unique mathematics symbol system for this measurement situation. After this, Carmen was still unsure about what to use in her problem, so she offered an explanation to the group about the different pipe diameters used for different cars, and she wondered whether that would be a good problem to include in her digital story. The researchers responded that that was a great idea and that it just had to make sense to her. At this point, Carmen needed only to develop her explanation a little more so that it would be clear to the rest of the participants and children in the digital story.

To be sure of her understanding and explanation, Carmen independently created three different-sized replicas of exhaust pipes made of construction paper. Later, she mounted the hand-made exhaust pipes on a backdrop and included this representation in her digital story. Figure 1 below shows the result.

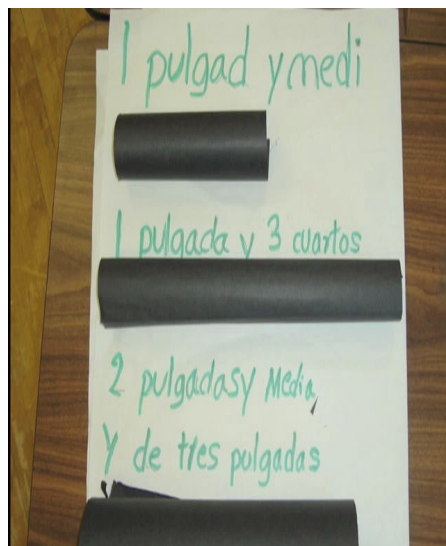


Figure 1. Carmen's representation of three different-sized exhaust pipes.

Carmen's digital story – a compilation of digital photos, strategically organized, narrated, and choreographed to background music – focuses on a combination of two topics: the interviews conducted by the students and the questions she raised about the exhaust pipes, which occurred independently of the first three visits with the children. The students' questions focused primarily on how much the mechanics charge in order to repair a car. The mechanic responded that it depends on the time spent on the repairs.

Carmen's interactions with the mechanic pertained to the exhaust system on cars. He informed her that there are four sizes of exhaust pipes, and the different sizes are based on the diameter of the pipe. The four diameters are $1\frac{1}{2}$ inches, $1\frac{3}{4}$ inches, $2\frac{1}{2}$ inches, and 3 inches. The mechanic told Carmen that if she knew the size of her exhaust pipe, she could tell the mechanic, and they could more efficiently repair the car. She was intrigued by the practicality of this insight, and it spurred the following questions for the conclusion of her digital story (speaking to her audience at *Los Rayos*): What is the diameter of your exhaust pipe? How can you measure it? Would you measure it with a ruler or a protractor?

Analysis and discussion

The crux of this study lies in the process through which the mothers moved from one level of mathematical understanding to a more advanced level that could be communicated mathematically. In the case of Carmen, there were three critical components that facilitated this process to varying degrees: social networks, agency, and mathematical sense-making. Of course, these factors are not mutually exclusive. Certainly, social networks contributed to mathematical sense-making, and agency was driven by a desire to make mathematical sense, to show merely two examples of the interplay of these ideas. Also, while mathematical identity transformation may or may not have facilitated the mathematization process, it undoubtedly was an end result.

Agency

Whether in formal schooling or in informal contexts, it is not uncommon to struggle with a new or unfamiliar concept. This is especially true if one is deliberately trying to advance their current knowledge base, as in the case of Carmen. Surely, she could have selected a mathematical topic that she was comfortable explaining to others, but she took seriously her responsibility to expose mathematical practices of the community that are beneath the surface, or beyond simple arithmetic. Her conscious and intentional efforts to choose a worthwhile topic to explore

reflected her role as a parent, community member, *Los Rayos* participant, and an individual who simply desires to develop mathematically.

Perhaps most important to note is the fact that Carmen returned to the autoshop independently and without a prompt. This act embodies the objectives of the project: to find and understand a mathematical practice in the community that people likely overlook in their day-to-day lives, even though the practices are within sight. Furthermore, this individual sense of agency that Carmen demonstrated indicates that this mathematization project will not end when the semester is finished. Rather, it will likely become embedded in casual conversations and activities within which Carmen's family participates, one of the precise outcomes the project had in mind when it was conceptualized.

It is our position, based on our ethnographic presence, that Carmen very well could have completed the mathematization and production of the digital story with the initial three visits to the mechanic. But this additional act of agency is evidence that she has moved beyond the narrow instructions and design parameters of the project; she understands that her roles as a parent and project-design collaborator are to aim to meet the intended objectives; and, she sees the value in portraying a unique mathematical situation that is not likely to be thought about in our regular interactions with cars. Therefore, Carmen epitomizes the idea that the activity did not dictate how she manoeuvred through the series of steps in the project, but rather, how she took ownership of the project and consequently shaped it in order to maximize its value for all participants.

Mathematical sense-making and social networks

As alluded to, these factors are not mutually exclusive. Carmen's sense of agency surely contributed to her struggle to make sense of mathematical topics that were slightly beyond her current schema, and as a result, she actively searched for more knowledgeable others to assist in her meaning-making process. Vygotsky (1978) called this the zone of proximal development.

When Carmen realized that she might have a topic to explore (the exhaust pipes), she searched for any available adult that could potentially provide clarity or suggestions as to how to develop her ideas. Chaley and Carlos, a researcher who worked with the parents regularly, were two examples of people Carmen approached. While their guidance was primarily logistical, they still suggested pathways by which she could accomplish her goals.

More importantly, it was the mothers that provided the bulk of support and suggestions that made the mathematization process possible. Over the past seven months, the mothers had grown increasingly more cohesive and comfortable talking amongst the group about a variety of issues, some very personal. The trust and respect they placed on the group served as the foundation from which they could partake in mathematical discussions, ones that likely would have been more intimidating among strangers, especially given their limited opportunities for formal schooling. The group acts as a single unit, most likely the result of sharing similar social and ethnic backgrounds. A demonstrative example of the mathematical conversations that could take place was when the mothers could discuss measurement and units, concepts that could be interpreted by some as elementary skills and knowledge. Nonetheless, the mothers spoke freely, partially because all of the mothers were raised utilizing the metric system and had similar difficulties adapting to a foreign system, and it was clear that the aim of the conversation was to arrive at distinct conclusions about these topics in order to be able to pose an appropriate problem situation.

Mathematical identity transformation

It is easy for researchers or an observer to speculate that the participants' mathematical identities were transformed. After all, the research team maintains that this was a substantial, multi-faceted project that incorporated a lot of previous knowledge and opened up opportunities for individual and collective mathematical development. As a result, each participant's perception of mathematics in the community, including our own, has likely changed. Certainly, mathematical situations emerged that had not previously been considered. Furthermore, participants were challenged to articulate a particular mathematical situation in depth, as well as attempt to make sense of other participants' mathematical scenarios. Shifts in mathematical

identity are difficult to detect from the dialogue and work that took place during the project. Therefore, we rely on follow-up focus group discussions in order to determine what exactly occurred as a result of this project, in terms of mathematical identity, if anything at all.

Carmen reported that as a result of this experience, she now sees mathematics everywhere. Below is an excerpt from the focus group:

1. Chaley: Y, siempre ha pensado así? Siempre pensaba que todo llevaba matemática, o cambió de pensamiento por alguna razón? *And, have you always thought like that? Have you always thought that everything involved mathematics, or did you change your mind for any reason?*
2. Carmen: No, ahora sí lleva más matemáticas. *No, now I see more math.*
3. Chaley: Pero, cómo se dio cuenta usted de que las matemáticas están en todos lados? *But, how did you come to realize that math is everywhere?*
4. Carmen: Porque para todo estamos ocupándolo. *Because we use it for everything.*
5. Chaley: Pero entonces, yo le creo eso a usted y estoy de acuerdo con usted, pero siempre ha pensado así? O hasta ahora piensa diferente? *But then...I believe you, and I agree with you, but have you always thought that way, or now do you think differently?*
6. Carmen: No, hasta ahora pienso diferente, que pues para todo necesitamos matemáticas. *No, now I think differently, that we need math for everything.*

This exchange clearly shows a transformation from a person who was not inclined or prepared to extract the mathematics from a given situation to a person who cannot help but notice the mathematics embedded in a given situation. It also should be noted that Carmen's mathematical disposition has changed over the course of the year. At the beginning of the year, Carmen freely offered her opinion and insights about the general topic at hand, but it appeared as though she lacked confidence when discussing mathematics (with the exception of arithmetic). During and after this project, as described above, she embraced the mathematical challenge of the project, and her confidence in working with a variety of mathematics topics was virtually visible.

Collaborative processes

Not exclusive to the mathematical context, another finding revealed that the collaborative process is not automatic. This is particularly true of inter-generational collaboration, as our study shows. The interactions between the parents and the children, and between the parents and the undergraduate facilitators, did not occur as naturally as we had anticipated. Recall that we intended to first work with the parents as mathematizers so that they would, in turn, facilitate the mathematization process with the children. However, collaboration is not as simple as "plugging" someone into a pre-existing group and expecting it to be a natural fit. We underestimated the existing dynamics of the groups, some of which had been working together for a year.

As we are currently learning in subsequent studies, certain measures can be taken in order to make clear the roles of participants. For example, more emphasis should be put on grounding participants in the notion that all collaborating members have a significant amount of knowledge and experiences upon which to capitalize (*funds of knowledge*). All participants should know that not only does this knowledge exist, but also that it has substantial value in the context of the learning process. Finally, the notion of funds of knowledge should not only be discussed with participants, particularly pre-service teachers, but also complementarily demonstrated through explicit examples. The objective is to transform dominant perceptions of Latina/o parents from non-participatory bystanders in the educational process to critical partners, ones who maintain an invaluable epistemological basis that educators need to access and capitalize upon (Moll et al., 1992; Pizarro, 1998). This is an important aspect to consider when planning activities with Latina/o parents and students, or for any multi-generational groups engaged in a network to promote learning in mathematics through collaboration.

Implications

Undeniably, there is much more to learn about the resources and learning capital that Latinas/os bring to the mathematical context. In the big picture and considering the relatively new demographic shifts in the United States, the mathematics education field has just begun work that aims to systematically and thoroughly understand the inter-sectionality of mathematical development, language, and social practices as they occur in Latina/o communities. In a way, any assertions made at this point could potentially have the counterproductive effect of reducing the complexity of the situation. We are cautious as to not contribute to society's desire to obtain "quick fixes" to the teaching and learning of mathematics to Latinas/os in the United States. With that in mind, there are still a few implications we wish to reiterate.

First, this study implies that all adults, regardless of race, ethnicity, socioeconomic status, gender, or educational achievement, have the capacity to understand existing and conceptualize new mathematical situations of various genres (i.e. measurement, algebraic thinking, geometric reasoning, number systems) based on community practices. Not only this, but they draw upon an assortment of resources, including innumerable life experiences, in order to make sense of these practices. Witnessing the mothers' development is a key instrument in challenging the dominant perception that Latina/o families are a hindrance, rather than a support, for the educational achievement of Latina/o youth. While this is an important consideration for changing research paradigms with respect to Latina/o communities (Pizzaro, 1998), it is a critical component in the development of pre-service teachers (undergraduate facilitators) who will soon be responsible for the formal mathematics instruction of Latina/o children. Certainly, this experience is a more powerful demonstration of the potential of Latinas/os than any lecture or literature can convey.

Secondly, while there were many successes and valuable insights gained from the community mathematization project, the researchers realize that more efforts are needed to promote effective collaborative processes. It cannot be assumed that all parents – especially immigrant, Latina/o parents, many of whom have limited, formal educational opportunities – fit comfortably into the school environment, regardless of the intellectual task. Moreover, if there are already pre-existing norms and group dynamics, the context is confounded even more. While we advocate valuing the knowledge and experiences of Latina/o parents, we simultaneously call for heightened sensitivities to the historical and social backgrounds of parents on behalf of school personnel.

Concluding remarks

In the United States, there is a great need for a paradigm shift in how we view the knowledge bases and capacities of minority families. The current perceptions of Latinas/os from dominant groups have serious effects on both the children in schools, as well as their parents. Our research agenda aims to chip away at the harmful ideologies that have permeated the classrooms and homes of non-White populations. Certainly, this study is a counter example to those who maintain that the problem lies within the family or the home, as if there is some kind of deficiency prohibiting Latina/o youth from achieving at high levels. Instead, we view this study as evidence of the willingness and potential of Latina/o parents to engage in change in their communities, starting with fostering mathematical development in themselves so that they can readily support their children's learning and aspirations.

It is our intention to build upon the theoretical position presented here and advance our research agenda in an effort to support this community and maximize the effects of the parental efforts we have witnessed here, as well as those that are quietly taking place nation-wide. While we have touched upon the complex nature of collaboration between parents and the community, we insist that this collaboration has tremendous promise and that it is the only way to instigate impacting change on communities that have historically suffered from a lack of equal educational opportunities.

Acknowledgements

The author wishes to thank his colleagues in CEMELA (Centre for the Mathematics Education of Latinas/os), which is funded by the National Science Foundation under grant – ESI-0424983. The views expressed here are those of the author and do not necessarily reflect the views of the funding agency. Particular thanks go to Lena Licón Khisty for her patience and continual willingness to share her knowledge, Aria Razfar for his intellectual guidance, Kathleen Pitvorec for reading and commenting on an earlier version of this article, Carlos López Leiva for his contributions, and Javier Diez Palomar for his encouragement.

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