SUPPORTING MATHEMATICS UNDERSTANDING THROUGH FUNDS OF KNOWLEDGE

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Parents are often criticized for the types of roles they play in their children's education. Rather than assuming parents do not contribute to their children's learning, this study identified the various ways Hispanic parents support mathematics learning in the home. Using a funds of knowledge lens, the history, practices, and experiences of families that contributed to their children's mathematics understanding was explored. The purpose of this study was to identify the unique funds of knowledge among three Hispanic families living in the same city, specifically, how parents supported their children's mathematics learning through funds of knowledge. Five Hispanic parents from three households participated in a series of three home interviews. The semi-structured interviews addressed family, school, and educational history of the parents, routines of the household, and perceived roles parents played in their children's mathematics learning.

Participants contributed to their children's mathematics learning through various funds of knowledge including time management, music, sports, construction, shopping, and cooking. Participating parents shared knowledge with their children through questioning and discussion, providing experiences, and promoting practice. In this study, participants valued education and supported their children's mathematics learning at home and school activities. This study contributes to the existing funds of knowledge research by expanding the work on how Hispanic parents support mathematics learning.

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SUPPORTING MATHEMATICS LEARNING THROUGH FUNDS OF KNOWLEDGE

As noted by González (2005), “culture” has been used to explain lack of success in schools among certain groups of people. Teachers, administrators, and policy makers too often consider the “culture” of minorities and those in poverty as deficit. Parents bring unique sets of knowledge into the home known as funds of knowledge which are socially, historically and culturally developed bodies of knowledge and skills necessary for functioning in the household and as an individual (Moll, Amanti, Neff, & Gonzalez, 1992; Vélez-Ibañez & Greenberg, 1992). The purpose of this study was to identify funds of knowledge among three Hispanic families living in the same community, revealing the functional characteristics of these households’ everyday practices and the types of knowledge and resources these families provide their children, debunking the belief that minority families must be dysfunctional because of the challenges they may face (González, Moll, & Amanti, 2005a, 2005b). Specifically, the purpose of this study was to explore how parents support their children’s mathematics learning through funds of knowledge.

This study shared the voices and lived experiences of participants, highlighting how they support their children’s mathematics learning, and contributing to the idea that funds of knowledge are unique to each household. Contributing to the existing literature, this study identified unique ways Hispanic parents participate in their children’s learning. This study also contributed to the limited literature regarding funds of knowledge that reflect mathematical thinking and understanding. Although the data collected from this study is not generalizable, identifying funds of knowledge that encourage mathematics learning among three different Hispanic families provides transferable knowledge beneficial to K-12 teachers and

administrators. This study of the funds of knowledge of three Hispanic families was guided by the following research questions:

1. How did the family's funds of knowledge contribute to children's mathematical understanding?
2. How were funds of knowledge shared with their children?
3. How did parents conceptualize their role in their children's mathematics learning?

Theoretical Framework

The Funds of Knowledge project, funded in 1990 by the W.K. Kellogg Foundation, was a cross-discipline effort by González (anthropologist), Moll (educational researcher), and Amanti (teacher) (2005a) to develop the theoretical framework and research methodologies to uncover families' funds of knowledge. Avoiding the term "culture" which tends to overgeneralize a group of people, the goal of this study was to discover "what households actually do, and how they think about what they do" (p. 10). Believing that classroom instruction could be improved through teacher understanding of the knowledge present in children's households, teachers were used as ethnographic researchers to uncover the essence of the funds of knowledge (Moll et al., 1992).

Funds of knowledge include skills, abilities, ideas, practices, and bodies of knowledge necessary to the functioning and well being of a household. Historical characteristics may be similar, but the combination with individual characteristics that shape households makes each household unique from others even within the same community, pointing to the need to take a closer look at individual families. This concept developed around the idea that families can and do promote learning, yet it may not be obvious to teachers. As mentioned by Moll, Amanti,

Neff, and González (1992), typically university researchers conducted ethnographic research regarding families and the information was then transmitted to classroom teachers. They argued this methodology posed a problem, resulting in teachers playing an inactive role and less likely to implement needed changes in the classroom. Gonzalez and colleagues (2005a), responded to this problem by using teachers as researchers . This method allowed teachers to observe and learn firsthand from families, making it more likely for them to change teaching methods by integrating funds of knowledge that are present in the households of their students.

The interviews teachers conducted were designed to be conversational and were held in the homes of the students' families making it easier to identify and understand the funds of knowledge present. The goal of the first interview was to explore the family history, labor history, and social networks. During the second interview, regular household routines were discussed in order to identify literacy and mathematical activities present in those routines. The final interview involved discussions of what parents believed about their roles as parents and caretakers (González, Andrade, & Carson, 2001; González et al., 2005a).

This lens was intentionally developed to shed light on how Hispanic families are involved in their children's learning and that they provide knowledge, skills, and resources that are valuable for success in life. By revealing these funds of knowledge, teachers can alter instruction by integrating real-life prior knowledge making content more accessible to these students. Studying Hispanic families to develop this concept, made it appropriate for this study, in which I explored how particular Hispanic families in one community support mathematics learning in the home. A key element of the funds of knowledge theory is the avoidance of the

use of the term “culture” (González, 2005) and the belief that a population should not be generalized. By visiting households and interviewing families, funds of knowledge can be identified for that particular family rather than making generalizations about a particular group of people. For this study, the concept of funds of knowledge served as an appropriate lens to identify how parents support their children’s mathematics learning.

Literature Review

Few funds of knowledge studies have been published that highlight how parents support mathematics learning. Some funds of knowledge research has excluded parent perspectives altogether, only exploring funds of knowledge of students (J. Andrews & Yee, 2006; Johnson, Baker, & Bruer, 2007; Moje et al., 2004), pre-service teachers (Aguirre et al., 2013), teachers (J. Andrews, Yee, Greenhough, Hughes, & Winter, 2005), and a para-educators (Monzó & Rueda, 2003). The focus of the early funds of knowledge research was on language arts and social studies, not emphasizing mathematics and science learning. To remedy this, Gonzalez, Andrade, Civil, and Moll (2001) sought to determine what qualifies as mathematics, how mathematics could be identified in economically disadvantaged homes, and to help parents and communities see themselves as mathematicians.

González and colleagues (2001) specifically examined mathematics knowledge in homes and how to link it to classroom instruction. The authors found that households visited used mathematics, particularly in cooking, construction, sewing, and time management. However, they found that the mathematical processes used were not always clear to the members of the household. Often the members were unable to explain why their method worked. It was noted that family members had difficulty finding the “mathematics” in some activities, like sewing.

The researcher believed her own lack of knowledge about sewing and her formal education created a barrier from understanding the mathematics in everyday activities.

Civil and colleagues have conducted most of the research regarding Hispanic households' mathematical funds of knowledge. However, Foote (2011) studied the perspectives of teaching and learning mathematics of two Dominican mothers with elementary-aged children. Both mothers supported mathematics learning in the home, but described their roles differently. One mother viewed herself as teacher, but the other did not. Both mothers were pleased with the classroom lessons, appreciated the use of manipulatives, and mentioned the personality of the teacher, reflecting the importance they place on social exchanges.

As pointed out by Auerbach (2007), parent involvement is a socially constructed phenomenon. The literature regarding involvement includes a variety and range of how parents participate in their children's learning. Therefore, the beliefs about what constitutes parent involvement often differs among educators and families. Most of the research describes two categories of parent involvement in education – activities directly related with the school and activities that promote learning in the home.

Parent involvement directly related with the school is described as formal (De Gaetano, 2007; LeFevre & Shaw, 2012) and visual or external (Valencia & Black, 2002). These activities include attendance at school events (Turney & Kao, 2009), communication with teachers (LeFevre & Shaw, 2012; Valencia & Black, 2002), and volunteering time (De Gaetano, 2007; Turney & Kao, 2009). The literature also identifies parent involvement outside the school setting. This type of involvement is described as internal (Valencia & Black, 2002), informal (De

Gaetano, 2007; LeFevre & Shaw, 2012), and less visible (Ryan, Casas, Kelly-Vance, Ryalls, & Nero, 2010) as other types of involvement. Academic and non-academic parent-child discussions, educational expectations of children, emotional support, and help with homework are considered types of parent involvement outside of the school setting. Qualitative studies examining Hispanic parent involvement have revealed other types of involvement not always recognized by the dominant culture in the United States.

Ethnographic studies have uncovered some alternative types of parent roles held by Hispanic parents. Carreón, Drake, and Barton (2005) identified three roles of participation. The first is most closely aligned to educators' definitions of parent involvement. Celia, a Hispanic immigrant mother, chose to attend as many after-school activities as possible and volunteer in her child's classroom. This type of participation was described as "strategic helper." Pablo, an undocumented immigrant father, chose to participate in his children's education by teaching by example at home and communicating the importance of school. Due to his undocumented status, Pablo, a "questioner," felt the need to keep a low profile, and learned about his children's education by asking them and neighbors questions. Isabel believed school personnel did not want to help her with concerns she had about school issues, and was afraid to initiate conversations with teachers, fearing that teachers would punish her child. For these reasons she did not participate in activities at school, but served as a "listener" by engaging in conversations about school with her daughter and examining school communication closely.

Exploring parent involvement of both Hispanic and African-American working class parents, Auerbach (2007) found three alternative types of parent roles. "Moral supporters" were made up of Hispanic immigrant parents who had a hands-off approach to participation.

These parents supported their children using consejos or indirect guidance. They wanted to launch their children for success, and chose to offer support at home and not at school, trusting their children to take the necessary steps to be academically successful. “Struggling advocates” aimed to improve life chances for their children and were likely to support children both at home and school. This group consisted of one Hispanic immigrant parent and U.S. born Hispanic parents, with the most college knowledge among participants in the study, yet they still had achieved various levels of education. They had a hands-on approach, and supported their children’s education through monitoring and advocating. These parents relied on social networks that did not always include teachers and administrators, rather they learned from other parents and school staff that were more approachable. The final group identified was “ambivalent companions,” and included a Hispanic immigrant and U.S. born Hispanic single mothers. Their approach to supporting their children was described as “hands-up,” meaning they accompanied their children on their journey serving as “cheerleader” types by boosting their children’s self-esteem. These mothers chose to support children through encouragement and protection, tended to maintain close relationships with their children, and typically chose to support children at home. Both Carreón et al. (2005) and Auerbach (2007) presented alternative types of parent roles, but it should be noted that these are not believed to be inclusive of all types of roles Hispanic parents hold.

Although Valencia and Black (2002) found Hispanic parents reported helping with homework, other studies found parents used academic supervision as a method to help with homework (M. Andrews, 2013; Ramirez, 2003; Zarate, 2007). Asking about homework daily, listening to their children read, and asking friends and family to help children with homework

were some of the ways Hispanic parents promoted learning (Zarate, 2007). Some Hispanic parents also reported supervising academic learning by checking completion of homework (M. Andrews, 2013) and knowing when to expect report cards and picking them up (Zarate, 2007).

Hispanic parents identified transportation and financial support as methods of academic involvement. Some Hispanic parents reported going to the library with children, driving students to tutoring and school activities (Zarate, 2007), and walking students to and from school (Valencia & Black, 2002). Zarate also found parents felt they were academically involved when they purchased materials required for class.

Parent involvement in education, when defined by Hispanic parents, includes activities not directly related to homework or school. Hispanic parents support education by providing moral support and teaching values through the use of *consejos*, which are nurturing advice used by parents to promote specific values to their children (Delgado-Gaitan, 1994), and through repetition are believed to help children understand what is expected of them (Valdés, 1996). Some Hispanic parents felt they supported learning by emphasizing the importance of school (M. Andrews, 2013; Carreón et al., 2005; Zarate, 2007) and connecting academic success to later financial security (Carreón et al., 2005). Hispanic parents also address the importance of teaching values of respect (Valdés, 1996; Valencia & Black, 2002), cooperative behavior (M. Andrews, 2013; Delgado-Gaitan, 1994; Zarate, 2007), and hard work (Delgado-Gaitan, 1994) as important to educational success.

The types of Hispanic parent involvement are a result of parent beliefs about their role as parents, but also the barriers they face in participating in more external or visible ways. According to some Hispanic parents, their limited education and limited English proficiency

prevented them from helping children with homework (M. Andrews, 2013; Zarate, 2007).

Some Hispanic parents felt even less confident helping older children with advanced homework (Quiocho & Daoud, 2006; Zarate, 2007). Parents also described their inability to participate at school because of the times events were scheduled. Zarate (2007) found parents had difficulty attending school events during the day, because many parents reported as hourly employees they had inflexible work schedules.

The beliefs Hispanic parents feel teachers hold about them may also be a barrier to certain types of school involvement. Some Hispanic parents felt they were being tested by teachers when work was sent home (Zarate, 2007). Other parents believed teachers' had low expectations and did not care for them and their children (Ramirez, 2003). Some Hispanic parents did describe K-3 teachers as more welcoming, but felt teachers became less welcoming as children grew older, and admitted one reason for not attending school events was because they had not been invited by school personnel (Ramirez, 2003). According to Zarate (2007), some Hispanic parents desired more personalized, frequent, and timely communication with teachers about their children's progress, but felt a problem had to exist in order for them to call teachers. After attending a culturally relevant mathematics event, several parents felt more welcomed in the school and more likely to attend future school activities (Tunks & Williams, 2014).

Methods

Although an underlying theme of funds of knowledge is that families do support their children's learning, it is believed they do so in unique ways. By using multiple case studies, one goal of this research was to confirm the concept that even when families share some historical

characteristics, the individual characteristics make them different from any other family, and that they contribute to their children's learning in unique and varying ways. By visiting the homes of students and learning from families, classroom instruction can be improved. According to Yin (1994), multiple sources should be used to gather data for case study research. For this study, interviews and observations were used to explore how individual families support mathematics learning and understanding through funds of knowledge.

Interviews were conducted in the homes of the three participating Hispanic families. Traditionally, funds of knowledge interviews are conducted in the homes, using an ethnographic approach to learn from families (González et al., 1995). For this study, three Hispanic families living in the same North Texas city served as participants. Particularly, five parents living in the homes served as participants.

Celia and Tomas Cruz were the parents of seventh grader Robert and fourth grader Nelson. The Cruz parents were in their mid-thirties and both identified as Hispanic. Tomas was born and raised in Texas. He had never been to Mexico, and did not identify as a Mexican-American. His family had resided in Texas for several generations. Celia immigrated to the United States from El Salvador before she began school. English was spoken in the Cruz household.

Denise Gomez was the mother of five children and married to Erik Gomez. The interviews were held when Erik was at work, so he did not participate in the study. Denise was in her early thirties and identified as both Hispanic and Mexican, "we're all from Mexico, so it doesn't matter, Mexican or Hispanic." Both Denise and Erik were born in Mexico, and Denise immigrated to the U.S. when she was ten years old. Spanish was predominately spoken in the

home, and Denise mentioned she did not often practice her English. However, the interviews were conducted in English, and there did not seem to be any communication problems between Diana and me. Her oldest daughter, Stephanie was in middle school, and her four youngest children, Carlos, Annie, Lucy, and Rocio attended the same bilingual elementary school.

Cristian and Rocio Perez were the parents of two children, Pablo and Miriam. In their late forties, Cristian and Rocio identified as Latino or Hispanic, but never as Mexican or Mexican-American. Both Perez parents were born and raised on the U.S. side of a U.S.-Mexican border city. Their son was a sophomore in high school and daughter was an eighth grade student.

The use of personal networks, a teacher in a middle school, and principals at three elementary schools assisted in recruitment by sending flyers on my behalf to potential participants. Submitting flyers to all students did not result in interested parents contacting me. It appeared to be more effective when the teachers identified a few parents and shared the information with them, capitalizing on personal networks. I also attended after school events to meet potential participants.

For the purpose of selecting participants and establishing an interview relationship, I made initial contact visits with families who showed interest and who met the participant criteria. Some visits were in person and some were on the phone. After families were chosen and agreed to participate during this meeting, informed consent was completed and interviews were scheduled, allowing the participants to choose times within a given time frame (Seidman, 1991).

Interview transcriptions and field notes from observations served as the data sources for this study. The interview methods of the early funds of knowledge research were followed as closely as possible. Interviews for this study were conducted in the homes of the participants, allowing the opportunity to observe the home environment, community, and possible interactions between family members. Observations began even before entering the homes, by examining possible funds of knowledge in the neighborhoods (González, Andrade, & Carson, 2001). Interviews were audio recorded with the permission of the participants, and pseudonyms for all members of the family were used (González et al., 2005a). Audio recordings provided a more accurate interpretation of the interview, than just taking field notes (Yin, 1994).

A phenomenological based three-interview series developed by Dolbeare and Schuman (Schuman, 1982) was used in this study. This series aligned directly with the traditional methods of funds of knowledge research, in which three interviews were conducted with participating families. The interviews were semi-structured and open-ended questions guided the interview.

The first interview focused on the life history, in which participants were prompted to reconstruct their early experiences in their families, schools, and communities. Through questioning, the conversations easily transitioned from family history to labor history, which uncovered rich and various funds of knowledge. During the second interview, conversations concentrated on the concrete details of the present experiences of participants, by asking them to reconstruct a typical day (Seidman, 1991). The goal of this interview was to understand the daily, weekly, and monthly routine practices of the household, specifically the activities children

participate in. The more details gathered about these activities, the easier it was to identify possible funds of knowledge. Parents were asked about the types of mathematical activities embedded in their household routines, attempting to connect out-of-school knowledge to formal academic knowledge (González, Andrade, & Carson, 2001; González et al., 2005a). The goal of the final interview was to reflect on the meaning of the participants' experiences (Seidman, 1991). Questions prompted discussions of what parents believed about their roles as parents and caretakers. During this interview, parents were asked about their experiences of being a parent and raising children. Parents also described their own school experiences and how those experiences compare to their children's experiences in schools.

For this study, an analytic approach was used to examine the interview transcriptions, field notes, and analytical memos. Provisional coding methods were used, meaning a list of codes was established before fieldwork. The tenets of the theoretical framework served as the codes; however as data was collected and analyzed, the codes were edited, deleted, or expanded (Miles, Huberman, & Saldaña, 2013; Saldaña, 2013). The following codes were used by Feild (2013) when investigating one's family's funds of knowledge that supported literacy development – family history, labor history, educational history, values and goals, family networks, knowledge transmission, and resources in the home. NVivo was used as an aid during data analysis.

To help ensure credible and dependable findings prolonged engagement, persistent observations, and triangulation were used. An initial meeting followed by three observational interviews helped build trust, learn more about the family and their home, and to minimize distortions. Visiting and observing the families several times also aided in focusing on the

details of relevant characteristics. Triangulation was achieved through multiple observations and interviews. A doctoral student conducted peer debriefing by providing an external check on the inquiry process. Member checking was used throughout the study, allowing participants to react to the reconstruction and representation of their lived experiences.

Findings

The tenets of funds of knowledge - family history, labor history, educational history, family networks, knowledge transmission, resources in the home, and values and goals were used as categories in the qualitative analysis of the transcribed interview and observation notes data.

Family History

Among the five participants, three were born and raised in the United States, while the other two were born in Latin countries. Celia, born in El Salvador, and Denise in Mexico, immigrated to the United States during elementary school and learned English quickly. Although all five of the participants were at least somewhat fluent in Spanish, the Cruz and Perez families spoke English in their homes. The Gomez family spoke Spanish in the home, and all their children were bilingual. All of the participants discussed busy work schedules of their own parents during their childhood, sometimes putting additional responsibilities on the eldest siblings.

Celia: We're both the oldest, and I think that's kind of a different dynamic, too, when you – when you're the oldest versus – I mean, we see our brothers and how they – you know, what their lives are like. I know we were more mature.

Educational History

All five participants graduated from high school, however Tomas and Denise both mentioned struggling to finish for various reasons. As a teenage mother, Denise persevered through the difficulties and finished school. Tomas finished high school in an alternative program, after becoming disinterested in school and performing unwell because of it. The Perez parents both held Bachelor's degrees, while Cristian also held a Master's degree and was enrolled in a doctoral program. Tomas and Celia Cruz earned some college credits, but chose not to finish a degree. During the interviews, Denise was considering enrolling in college courses.

When discussing how their educational experiences compared to their children's educational experiences, all of the families commented on some differences. Denise believed her schooling was more difficult and teachers were stricter in Mexico than the teachers in the U.S. In the interviews with Tomas and Celia, they specifically discussed the differences in how they solved mathematics problems compared to how their youngest son is expected to solve mathematics problems. They described the procedures of solving mathematics problems as different from the traditional algorithms they learned in school.

Tomas: Well, it's more think outside the box. And creative thinking. And, solve it any way you can. Any way you want to visualize it, whether it be pictures or whether it be boxes and sticks, or –whatever. And they did a lot more of the grouping and the – where instead of just doing “seven times seven is this,” they were doing seven sevens, and then they were like, “Oh, this one's 14, and-” you know? I'm not even sure what they called it. I forget what they called it. But this whole concept was just crazy to me, because it was just – it's so much simpler the other way, but because that's the way I learned it. You know, you're more comfortable with what you're familiar with.

Cristian and Adriana discussed how they had resources as parents that their parents did not, like online grade books and email communication with teachers. Cristian also commented that his children had access to technology like graphing calculators and he did not.

Labor History

The labor histories of the participants varied. Tomas and Celia had held various positions within the same phone company. The Perez parents both worked in education, Adriana a high school mathematics teacher and Cristian a staff member at a university. Denise worked as a stay at home mom, as did Adriana before her children started school. From an early age, the Perez and Cruz parents began earning wages for various jobs. According to Cristian, "I think we have always worked in some way or another." The labor history of the three families included positions in data analysis, teaching, community outreach, radio, clothing retail, tutoring, childcare, customer service, aeration, data entry, food industry, music, and telemarketing.

Adriana and Tomas were the only ones that mentioned the mathematics in their most current job. Adriana discussed the various strategies like singing and physical activities she uses to make mathematics accessible to high school students. Tomas discussed analyzing data in his job at the phone company.

Tomas: Basically what happens is that we are the billing support for large enterprise business, so that whenever they buy resources from us, our teams manage their billing services. So, I actually support the executive team and do presentations and analyze the data to see how the team is performing, how much money are we losing from revenue corrections, and everything like that.

Family Networks

The families discussed strong immediate family networks, with each family member contributing to the functioning of the household by completing household chores and other duties. All the participating parents mentioned they helped their children with homework when their children needed help, typically waiting for their children to ask for help.

Denise: I check their homework, especially – well most of the time I check it when I know for sure that they're having questions, just because I want to make sure that it's, you know, correct. But when they don't have any questions, I know for sure that they understand what they're doing.

Although all three families discussed extended family, none of them depended on extended family for childcare or other household needs. Neither did any of the families heavily rely on neighbors for help with the functioning of the household. The youngest sons in the Gomez and Cruz families were connected with the neighborhood through sports, and were often found playing outdoor sports with neighborhood children. The Perez children did not live near children their age, and typically connected with their friends through online social media or by visiting friends across town. The Perez parents willingly drove their children and friends to and from home and events to build networks. All of the families were active in church. The Perez and Cruz parents mentioned that their connections with other families were dependent on their children's connections with friends.

When discussing networks with schools, all of the families commented on the challenges of connecting with teachers and schools as their children grew older. They seemed to be comfortable communicating with elementary school teachers, but were not always sure

how to communicate with middle school and high school teachers, or at least found more difficulty in doing so.

Denise: Well at middle school, that's another story because it's a lot of teachers. They don't really have any meetings at school. Elementary is really good. I like it because you know if you have questions, it's only one teacher and you go and ask and they tell you because the kids are there the whole day with them, and at middle school, it's another story and yeah, because I don't have a lot of communication with the middle school teachers, only with the elementary ones.

The parents used different methods of communication with their children's teachers.

Denise preferred to communicate with teachers in person, but the remaining four participants typically communicated with their children's teachers via email.

Resources in the Home

All of the families mentioned various resources in the home that supported learning. The three families mentioned school supplies, books, work books, technological devices, online social media, and email that could promote learning. When helping with homework, The Cruz and Gomez families turned to Internet resources when they did not understand mathematics homework, and the Perez family mentioned their children used online videos to learn how to do various activities. Denise also discussed checking out books at the library to help with mathematics homework.

Mentioning the creativity of their children, the Cruz and Perez parents seemed to be comfortable allowing their children to use various items around the home for school and personal projects. According to Adriana, their son is often working on projects with a variety of tools, "you'll hear the drill going on. Or he's got a blowtorch, he's got a soldering iron." All three

families supported their children's interest by allowing participation in extracurricular activities, and transporting them to and from events.

The parents in each family served as educational resources. All of the parents commented on helping their children complete assignments from school when their children needed help. The Perez and Cruz families utilized calendars and other visual organizers to help their children balance and maintain their busy schedules. The flexibility of work schedules of at least one parent in each of the families also served as a resource.

Knowledge Transmission

Initially, the Cruz parents and Denise had difficulties determining household activities that promoted mathematics learning, not believing that they intentionally supported mathematics reasoning often. However, all the families agreed that their children used mathematics in cooking and shopping. The participants discussed asking questions about cost, discounts, and budgets during shopping experiences, and encouraging proportional reasoning and measurement when cooking. All the participants discussed financial literacy, and the Perez family specifically discussed their allowance system which involved charitable giving and short and long term savings. Demonstrating that knowledge transmission occurred through experiences and questioning.

Adriana: Since they were four we've been doing allowance and so it's their age, that's how much they get a week...So they know how to manage money...The first thing they had to take out was ten percent for charity...Then the remainder of the money they divided it three ways. So when they were four, because they didn't really know how to divide or ten percent, so I just showed them like you take off a zero, what's that number? And so they would look for coins. So I always would give them the money so that they were able to find like if it was \$0.40 that they could find a quarter, a dime, and a nickel, and put that aside. And then the remainder of the money was easy to just divide. Here's a dollar, here's a dollar, here's a dollar.

Other home activities with embedded mathematics mentioned by the participants included sports, music, household chores, and construction. According to the participants, their children constructed creative projects by knitting, sewing, and welding, and creating inventions using materials found in the home. All families' transmitted knowledge by providing a variety of resources that promoted learning.

All parents discussed allowing their children to complete their schoolwork, but the parents were there to help when needed. Celia and Denise both discussed looking up mathematical solutions via the Internet or books to be able to help their children when they did not understand. The Perez parents mentioned sharing the methods they used to succeed in school with their children. Yet, the Cruz parents preferred to reinforce the teaching methods of their sons' teachers, but did not always know how. Tomas discussed the difficulties they faced during homework time when solving mathematics problems using unfamiliar methods.

Tomas: But it alienates the parents, what I think it's – where I think the struggle is. It definitely puts us into a position to – it's not just we don't understand math. It's we don't understand the way of thinking, and so as a parent, where I think my role is, is to help reinforce the ideas; help solidify their knowledge and their understand, and – like what you're trying to do here. Liken it to their world. You know? When I bring it home and I teach him, when I try to give him examples, I use our real life examples.

Values and Goals

All three families placed value on their children earning high grades and understanding academic content. At least one child in each family was taking advanced coursework or had been tested for the district gifted and talented program. The parents also held high educational goals for their children, expecting their children to attend college.

Celia: I think that my school experiences help me want them to be better. I think it's always like that. My parents wanted me to be better than they were, and I wish that I

had gone to college and finished, but it's like, I know that that's what I want for my kids. And I hope that it doesn't take another generation to even get there.

Teachers and communication with teachers was valued by the families as well. The Cruz parents discussed their trust in several of their eldest son's teachers, appreciating their understanding of his personality and their efforts in helping him excel in mathematics. According to Cristian, communicating with teachers is important for them to understand your expectations as a parent, "sometimes we had to remind the teachers, our kid's going to go to college. We want him to go to college so make sure you push him hard."

In regards to family values and goals, all three families valued spending quality time as a family. The parents attended their children's athletic events and band performances, and mentioned spending time as a family on the weekends. All three families seemed to value responsibility. The Cruz and Perez parents also appeared to place value on independence, wanting their oldest sons to learn to be responsible for schoolwork. However, both sets of parents mentioned their struggles with letting their children fail.

Cristian: I'm like, "Oh, my gosh. Do some work. You can do this. You can manage this. You're going to fall on your face completely." And then she [Adriana] comes back and she reminds me, well, maybe they [Pablo and Miriam] need to. So I think trying to find out the balance, you know. How much should they fall before we step in?

Discussion

Throughout this study, it was assumed that parents support mathematics learning. This assumption is the essence of funds of knowledge research, believing that parents promote learning even when it is not obvious to teachers (Moll et al., 1992). Finding the mathematics in household practices was not always easily identified by participants. González and colleagues also found parents had difficulties identifying the mathematics in everyday home activities of

Hispanic families (González, Andrade, & Carson, 2001; González, Andrade, Civil, et al., 2001).

Like the findings in previous studies, the participants in this study more easily identified mathematics in cooking, construction, and time management. However, all three families also commented on the use of mathematics in shopping and financial literacy. Some of the parents were initially reluctant to believe that they intentionally promoted mathematics understanding in various home activities. However, the Perez parents did not seem to struggle with the idea of promoting mathematics throughout activities, probably because Adriana was a high school mathematics teacher.

Mathematics could have been unintentionally promoted in practices not mentioned during the interviews. With a limited knowledge of certain activities, I did not always understand the possibility of mathematics within a particular funds of knowledge. Other researchers have commented on the difficulties of recognizing mathematics within contexts they were unfamiliar (González, Andrade, Civil, et al., 2001). Based on the discussions with families, I believe mathematics learning was both intentionally and unintentionally promoted throughout various household activities like pet care, household chores, exercise, sports, band/music, time management, financial literacy/shopping, cooking, and construction.

The educational histories of the participants contributed to the family's funds of knowledge regarding mathematics. Although the levels of higher education varied from parent to parent, most of the parents remembered excelling in mathematics in elementary school, with three of the parents excelling in high school, as well. Of those who struggled with mathematics in high school, they believed it was due to their lack of dedication to studying. Despite their previous academic success, all of the parents, with the exception of Adriana,

struggled helping their children with advanced mathematics, because they had not studied or used the content in so long. According to Quiocho and Daoud (2006) and Zarate (2007), some Hispanic parents felt less confident helping children with advanced assignments.

Studying the labor histories of adults can reveal mathematical knowledge (González, Andrade, & Carson, 2001; González, Andrade, Civil, et al., 2001). Two of the parents mentioned using mathematics regularly in their careers. As a high school algebra teacher, Adriana used mathematics on a regular basis. Tomas' job required him to analyze data. Adriana's knowledge and passion for mathematics resulted in helping her children with homework and providing mathematical opportunities throughout their childhood. Both of Tomas' sons were interested in data analysis, making it easy for Tomas to have mathematical discussions regarding data with them. Recognizing the mathematics in their careers allowed them to more often help their children make mathematical connections to real world experiences.

The second research question addressed how knowledge was shared between parents and their children. Participants described sharing knowledge with their children through discussions, questioning, experience, and practice. All of the participants expressed using questioning to help their children learn mathematical concepts. Mathematical questions were asked during activities like cooking and shopping. These parents found opportunities to question and lead mathematical discussions rather than waiting on questions from children, unlike the findings from a study of U.S.-Mexican families who expected children to ask questions first (Vélez-Ibañez & Greenberg, 1992; Vélez-Ibañez, 1988). However, when students were completing homework, the participants tended to wait for children to ask questions, only providing assistance when needed.

Not all of the discussions were as academic as the ones mentioned above. Hispanic families often used consejos or short talks about morals to influence their children's behaviors (Valdés, 1996). Adriana and Denise both mentioned these types of talks with their children to promote good decision-making. Denise emphasized the value of an education, so that her children, especially daughters, would always be able to provide for themselves and one day their children. Previous research highlighted that some Hispanic parents supported learning by stressing the importance of an education (M. Andrews, 2013; Carreón et al., 2005; Zarate, 2007), and linking educational success to financial security (Carreón et al., 2005).

Providing experiences for their children was another method used to share knowledge. Vélez-Ibañez and Greenberg (1992) described how parents allowed their children to learn through experimentation, which was similar to the findings from this study. The children of the participating families experienced mathematics through cooking, shopping, sports, music, and other activities. Both the Perez and Cruz families mentioned the creativity of their children, allowing them to create and develop projects, even ones not required for school.

All of the families expected their children to practice activities, including mathematics, in order to become more proficient. In regards to mathematics, providing workbooks, assigning additional problems or requiring children to complete optional homework were ways the families emphasized practice as a method of learning content.

The Cruz family discussed that their youngest son was learning to solve mathematics problems very differently than they and their oldest son learned. According to Civil and Quintos (2009), Hispanic mothers also described their mathematics learning experience as different from their children's experiences. Some of these mothers preferred their more traditional

methods to the newer methods. Both Cruz parents attended K-12 schools in Texas, meaning the differences in mathematics strategies were probably due to a shift in Texas curriculum. The Cruz family wanted to reinforce teachers' methods, but without an understanding struggled to find the value of different methods to solve mathematics problems.

Families provided their children with resources necessary for success in school and extracurricular activities. Several technological devices were mentioned and observed during the interviews, but only some were specifically suggested to promote mathematics learning. Some parents believed purchasing materials for school as a method of contributing to learning (Zarate, 2007).

The participants mentioned taking children to the library, and transporting them to and from school activities as promoting learning (Zarate, 2007). While attending school events made it difficult for some parents to be active in aspects of their children's learning (Zarate, 2007), the flexible work schedules of at least one parent in each household in this study posed as a resource to their children's learning, making it easier for children to attend before and after school activities, including tutoring.

Unlike the findings from early funds of knowledge research, the three families in this study did not typically depend on neighbors, friends, or extended family members for the functioning of the household (Vélez-Ibañez & Greenberg, 1992; Vélez-Ibañez, 1988). According to Vélez-Ibañez and Greenberg, it was common for children in U.S.-Mexican households to gain knowledge from multiple households, building "confianza" or multiple trust from adults other than their parents. The reasons for not depending on other families varied, but included distance from extended family, not trusting other families to care for children, and not having

neighbors the same age as children. Although the participants' children in this study did not seem to rely on adults in other households, they did rely on online resources from the Internet. All three families mentioned the use of the Internet or online videos as a method for learning new content. Adriana also mentioned how her children connected with their friends via texting, social media and online chatting tools. Perhaps meaning these families gained knowledge by building "zones of comfort" from resources online rather than from other adults.

All three families described helping children with homework, usually only after they asked for help. When they knew their children struggled with a concept or assignment, they would check over their work. In previous studies, Hispanic parents supported learning by both helping with homework (Valencia & Black, 2002) and through academic supervision (M. Andrews, 2013; Ramirez, 2003; Zarate, 2007). Among two of the families, parents occasionally relied on older children to help their younger siblings with homework, a practice mentioned in the literature by Zarate (2007). Vélez-Ibañez & Greenberg (Vélez-Ibañez & Greenberg, 1992; Vélez-Ibañez, 1988) found that adults in their studies did not volunteer help, allowing children to experiment and persevere. Findings from this study were similar, although the families did provide assistance often because their children asked often, especially with mathematics homework.

The final research question addressed how parents conceptualized their role in their children's mathematics learning. Most of the participants mentioned the busy schedules of their parents growing up, making it difficult for their parents to be involved in school activities. Sometimes this made participation in extracurricular activities difficult or impossible for the participants. The parents of the participants were sometimes unable to help their children due

to limited English proficiency (M. Andrews, 2013; Zarate, 2007), and difficulty attending events during the day because of work (Zarate, 2007). However, all of the participants in this study spoke English and most were able to adjust their work schedules to attend school events, even during the school day, making their participation in their children's learning more visible to educators.

The participants in this study discussed promoting learning through external and internal types of involvement in their children's learning. In the home, the participants all mentioned helping children with homework when needed (De Gaetano, 2007). Discussion about time-management were also common in the homes of the participants, demonstrating the use of academic and non-academic parent-child discussions (De Gaetano, 2007).

The types of participation in their children's learning seemed to be shifting and sometimes a struggle between married parents. When their children enrolled in middle school, the Cruz and Perez parents discussed trying to shift to a more hands-off approach, using discussions and support at home, rather than school. One parent in each of these households wanted to take this "moral supporters" approach (Auerbach, 2007) to parenting. However, the other parent and needs of the children required the parents to constantly reflect on their roles in their children's education, making them sometimes more active and other times stepping back to let their children learn from their mistakes (Vélez-Ibañez & Greenberg, 1992; Vélez-Ibañez, 1988).

The participants demonstrated external involvement by attending parent-teacher conferences, open house, PTA meetings, extracurricular activities, and eating lunch with children at school (Turney & Kao, 2009; Valencia & Black, 2002). The parents in this study also

initiated conversations with teachers (De Gaetano, 2007; LeFevre & Shaw, 2012) when concerned about their children's grades, were unable to help with homework, or confused about instructions. The mothers also mentioned participating in other non-instructional activities like school parties (De Gaetano, 2007).

The participants only mentioned a few barriers to participation in their children's education. Helping with advanced homework (Quiocho & Daoud, 2006; Zarate, 2007), and innovative methods of solving mathematics problem sometimes made it difficult for some of the families to assist children. Sometimes online resources and library books were useful, but not when helping with innovative and reasoning strategies in mathematics. The Cruz family expressed feeling unable to help and wished for more extensive training on these methods. Quiocho and Dauod (2006) also found Hispanic parents suggesting academic workshops for parents.

Although the parents seemed to be comfortable communicating with teachers at the elementary school either through email or face-to-face meetings, they were less comfortable communicating with middle school and high school teachers. The participants mentioned feeling unwelcomed at middle and high schools (Ramirez, 2003), and felt unsure of when it was appropriate to communicate with teachers (Zarate, 2007).

Like the parents in early funds of knowledge research, the parents in this study supported learning by teaching and promoting morals and values (González et al., 1995). These families held high educational expectations for their children (M. Andrews, 2013; Carreón et al., 2005; Zarate, 2007), emphasized respect (Valdés, 1996; Valencia & Black, 2002), and valued hard work (Delgado-Gaitan, 1994). All the parents in this study placed valued on spending time

together as a family both at school events and outside of school. They also placed value on supporting children's interests and talents.

Implications

Early funds of knowledge research employed classroom teachers as researchers, rather than relying on university researchers to transmit knowledge to classroom teachers (Moll et al., 1992). They believed teachers as researchers model was more likely to result in the integration of funds of knowledge into classroom instruction. As I am not a classroom teacher, I agree with Moll and colleagues that it will be less likely for teachers to implement the information I found into their classrooms. However, as a teacher educator and former K-12 classroom teacher, I acknowledge the value of the information gathered from the home interviews with parents.. Like teachers in the early funds of knowledge research, my beliefs about parents shifted from less generalizable to more dynamic (González et al., 1995; Moll et al., 1992).

Although this study is not generalizable, readers may find levels of “transferability” and “fittingness” (Lincoln & Guba, 1985). Teachers may recognize that families of their students have similar funds of knowledge or parental roles as the parents in this study. Because of those similarities, teachers might integrate these funds of knowledge into classroom instruction. Families promoted proportional reasoning, mental math, estimation, measurement, patterns, and data analysis through cooking, construction, sports, shopping, and other activities present in the home. The findings from this study also examined how and to what extent parents helped with mathematics homework, and about the confusion they had with certain methods or advanced mathematics. Through these types of interviews and discussions, teachers would know if parents were interested in resources or instruction about teaching methods.

As a classroom teacher, I sometimes struggled with communicating with parents, unsure if it was okay to call them during the workday. Through these interviews, I understood that the parents had a preference in communication – sometimes texting, email, or face-to-face communication. Middle and high school teachers should also consider initiating communication with parents, allowing them to know they are available and willing to communicate about the success of their students.

The findings from this study also hold implications for teacher preparation programs. The early funds of knowledge studies used teachers as researchers, but did not address how university faculty can improve teacher preparation courses through funds of knowledge research. To prepare pre-service teachers for the classroom, opportunities to interview and interact with parents and/or guardians of K-12 students should be provided. Teacher preparation programs using a Professional Development School (PDS) model provides ample opportunity for pre-service teachers to conduct funds of knowledge research. According to the standards for PDS (The National Council for Accreditation of Teacher Education (NCATE), 2001), PDS partners and pre-service teachers should “ensure equitable opportunities to learn” (p.14), by implementing curriculum that makes learning more accessible for students and teaching from multicultural perspectives. The diversity and equity standard also addresses the need for pre-service teachers and PDS partners to work with diverse learners and their families.

While enrolled in a PDS program, pre-service teachers could conduct funds of knowledge research with the families of one or more of their students enrolled in the partnering schools. As an instructional unit in the mathematics methods course, pre-service teachers could interview families of children to learn about their unique Funds of knowledge.

With the data gathered, pre-service teachers could create mathematics games or lessons used for the classroom. Methods instructors, pre-service teachers, and classroom teachers could participate in study groups that promote reflection and curriculum design that integrate families' funds of knowledge (González et al., 1995).

The initial funds of knowledge focused on knowledge in the home that promoted language arts and social studies, rather than mathematics and science. This shifted when González and colleagues (González, Andrade, Civil, et al., 2001) investigated how mathematics was used in economically disadvantaged homes. Yet, the research regarding how funds of knowledge supports mathematics understanding is mostly limited to the work of Civil and her colleagues, meaning more research should be conducted in this area.

During the home interviews, some of the parents seemed unsure in how they supported mathematics learning. Through the series of interviews, I was able to recognize various activities that could promote mathematics understanding, even if the families were unaware of the embedded mathematics. As mentioned by González and colleagues (2001), parents and researchers demonstrated difficulties in identifying the mathematics in everyday activities. Parents are familiar with their funds of knowledge, but did not always see the mathematics used, because it was second nature to them. Mathematics educators may be more equipped to identify mathematics, but struggled to find mathematics in activities they were unfamiliar with like sewing. Because of the knowledge limitation of the researcher, I probably emphasized funds of knowledge that were familiar to me, because I could more easily recognize the mathematics in them. By utilizing study groups, researchers, and teachers can reflect and collaborate on how unique funds of knowledge might support mathematics learning.

Pointed out by González et al. (2005a) and Moll et al. (1992), university researchers often had difficulty gaining access to families and their homes, while teachers were easily welcomed. Not being a classroom teacher and with limited connections to cooperating school districts, I experienced difficulties finding interested families. With the help of teachers and administrators I was able to find participants. A prominent reason for participating in the study was because the teachers directly mentioned this study to them, suggesting they would be good participants. Non-teacher researchers who are interested in interviewing and observing Hispanic families in the home, particularly if the researcher is non-Hispanic, should allow an ample amount of time for recruitment, and work with teachers to recruit participants.

Finally, using a funds of knowledge lens when examining how parents support mathematics learning is helpful in identifying unique characteristics of families rather than generalizing a population (González et al., 1995; Moll et al., 1992). Although funds of knowledge research has been used to predominantly explore how Hispanic and Native American adults support learning in the home, other populations should also be examined. The funds of knowledge lens could and should be used to learn from families of students.

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