

# Power and identity in immigrant parents' involvement in early years mathematics learning

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**Abstract** This study examined immigrant parents' involvement in early years mathematics learning, focusing on learning of multiplication in in- and out-of-school settings. Ethnographic interviews and workshops were conducted in an urban city in Japan, to examine out-of-school practices of immigrant families. Drawing from sociocultural theory of learning and the concept of appropriation (Wertsch, 1998), the role of power and identity was examined in relation to children's appropriation of an informal multiplication method that was taught by their parents. An intergenerational analysis, between immigrant parents and their children, revealed heterogeneous perspectives towards appropriation. Immigrant parents in this study framed their involvement in their children's early years mathematics learning in relation to their positional identities and the pressures to conform to the mainstream practices of their host country. During their early years of schooling, students in this study were already aware of academic tracking in the school and were aware of what was believed to be legitimate in school mathematics learning. The significance of diversifying mathematics curriculum and pedagogy was discussed to affirm the knowledge and identities of immigrant students and families.

**Keywords** Mathematics learning in and out of school · Parental involvement · Identity · Power

## 1 Mathematics learning in out-of-school contexts

Global population mobility has contributed to a growth in the number of immigrant students in schools internationally. For example, in the United States, 21% of households reported using languages other than English (United States Census Bureau, 2013). In Canada, 20% of the population reported speaking a language other than official languages at home (Statistics Canada, 2012). Certain areas of England are becoming more linguistically diverse: London had the highest proportion (22.1%) with people speaking languages other than English as their

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main language (Office for National Statistics, 2013). In Japan, where the study introduced here was conducted, some industrial areas are becoming ethnically and linguistically diverse, as represented in the percentages of registered immigrants in the following cities: Oizumicho, Gunma (14.5%); Minokamo, Gifu (7.7%); and Kikukawa, Shizuoka (5.4%) (Committee of Localities With a Concentrated Foreigner Population, 2012). In addition to these cities, large cities such as Tokyo, Nagoya, and Osaka have relatively high percentages of registered immigrants.

The Organization for Economic Co-operation and Development (2013) reported that immigrant students' performance in mathematics was lower than their native peers in many countries, although the gap between immigrant students and native students was smaller in Canada, Australia, New Zealand, and Macao-China. This report also revealed that the second generation of immigrant students performed lower than the first generation in certain countries such as the United Kingdom and New Zealand. In order to make mathematics learning accessible to all students, there is a need for research examining curriculum and pedagogy that are responsive to immigrant students' prior knowledge and backgrounds. Taken in this context, the purpose of this research is to highlight mathematical resources that immigrant students access at home and understand how power and identity influence appropriation and the use of those resources at school.

Investigating the connection (and disconnection) between children's out-of-school practices and their school learning is especially significant for immigrant students, whose practices can be different from the norm assumed in school learning and hence whose competence can be invisible in school contexts (Baker, Street, & Tomlin, 2003; Civil & Planas, 2010; de Abreu & Cline, 2005). As previously identified, immigrant students' mathematical performance can be shaped by valued practices at home (Guberman, 2004).

Previous studies examining non-dominant students' practices in and out of school contexts have challenged a deficit perspective towards non-dominant students and have collectively highlighted non-dominant people's and communities' competence in collective practices that involve mathematical tools (Baker et al., 2003; Brenner, 1998; Civil, 2007; Gonzalez, Andrade, Civil, & Moll, 2001; Nasir & Hand, 2008; Saxe, 2012; Saxe & Esmonde, 2005; Taylor, 2009). These studies foreground mathematical competence and "funds of knowledge" (Moll, Amanti, Neff, & Gonzalez, 1992, p.133), which have traditionally been neglected in school contexts. Seminal works in this area have provided ethnographic accounts of the practices in which children from non-Western countries engage. Ethnomathematics studies have challenged an ethnocentric perspective on the development of mathematics and offered emic accounts of mathematics linked to local historical and cultural practices (Ascher, 1994; D'Ambrosio, 2006).

Studies in this area have taken into consideration historical contexts and systemic changes affecting mathematics practices outside the school. For example, historical and longitudinal accounts of the Oksapmin people's 27-body-part counting system illuminate how the counting system has been reproduced and altered along with the shift in political, economic, and educational macro systems in Papua New Guinea (Saxe, 2012; Saxe & Esmonde, 2005). Taylor's (2009) analysis of low-income African American children's purchasing practices in the United States demonstrated the direct influences of macro system (such as concentrations of poverty and taxation policies) on the practices in which these children engage. Nasir and Hand (2008) compared students' practices in mathematics classrooms and basketball games, and highlighted practice-linked identity as one of the significant layers of practice that supported students' engagement. The current study further develops this vein of research by examining whether and how

immigrant students' in- and out-of-school mathematics learning experiences can be integrated by focusing on the role of power and identities.

This research also furthers the current body of literature on immigrant parents' participation in mathematics practices. Previous studies on this topic have highlighted immigrant parents' mathematics knowledge and resources that were embedded in their cultural practices (Civil, 2007; Willey, 2008). This line of research has also pointed out some of the conflict and struggles that immigrant parents experience (de Abreu & Cline, 2005; Civil & Bernier, 2006; Crafter, 2012; Gorgorió & Abreu, 2009). This study adds a new cultural and historical context that can reveal how power and mathematics learning are intertwined locally. By providing an intergenerational perspective on both immigrant parents and their children, I shed light on how parents and children differently appropriated an informal mathematics method. In response to the call by Gutiérrez (2013) for a sociopolitical turn in mathematics education, the current study examines the role of power through the analysis of cultural and historical practices surrounding the appropriation of informal mathematics knowledge. With regards to power, de Abreu and Cline (2007) revealed the process of social valorization wherein different kinds of mathematics (e.g., Brazilian peasant mathematics and school mathematics) are valorized or devalorized with reference to social classification. Set in the context of an urban city in Japan that is gradually becoming linguistically and ethnically diverse, this study examines how power and positional identities influenced early years mathematics learning for Filipina immigrant mothers and their children living in Japan.

## **2 Theoretical framework: Power and positional identities in appropriation of cultural tools**

In this study, I highlight immigrant students' appropriation of out-of-school resources and practices for mathematics learning. By appropriation, I refer to the categorization made by Wertsch (1998), as explained below. One of the central tenets of sociocultural theory is that human learning is mediated by technical and psychological tools including languages and culturally specific ways of approaching mathematics (Vygotsky, 1978). These tools are cultural; they are created, shared, and used in collective practices. Vygotsky maintained that the use of these cultural tools is first developed as an interpsychological process between people and later internalized into an intrapsychological process within a person.

This idea of internalization was later elaborated by Wertsch with careful attention to the tension between cultural tools and learners as active agents. Wertsch distinguished between mastery, appropriation, and resistance of cultural tools. Mastery is described as knowing how to use cultural tools, whereas appropriation is defined as "making a cultural tool one's own" (p. 145). Resistance relates to power and is considered to occur when agents distance themselves from particular cultural tools or when they perform actions with cultural tools under a forced circumstance. For example, in Wertsch's study, Estonians mastered the official and dominant account of Estonia's history of joining the Soviet Union learned in school and exhibited their understandings in forced situations, such as exams. However, they resisted appropriation of the official historical account and viewed it as someone else's history. Highlighted in Wertsch's study is how identity and power are strongly tied with appropriation of cultural tools. Polman (2006) further elaborated on the aspect of identity development in the process of appropriation and maintained that agents take up certain cultural tools while simultaneously creating possibilities for kinds of person one can be in the future.

While there has been a growing collection of literature laying out the relations between identity and learning, I draw on the definition of *positional identities* by Holland, Skinner, Lachicotte, and Cain (1998), which considers the role of power and hierarchy in the process of shaping and developing identity. Positional identities are defined as “the day-to-day and on-the-ground relations of power, deference and entitlement, social affiliation and distance with the social-interactive, social-relational structures of the lived world” (Holland et al., 1998, p. 127). Positional identities are shaped through one’s access to spaces, activities, speech genres, and voices, which are all embedded in the power relations that are also produced and reproduced in moment-by-moment interactions. Holland et al. contrast the positional identities with figurative identities which “have to do with the stories, acts, and characters that make the world a cultural world” (p.127). While figurative identities are “about signs that evoke storylines or plots among generic characters” (p.128), positional identities are “about acts that constitute relations of hierarchy, distance, or perhaps affiliation” (p.129). These two types of identities can be intertwined but this paper will focus more on positional identities. Analyzing both parent and student data will provide insights into how a particular cultural practice and resource were, or were not, appropriated and maintained across generations among transnational families and how power and identity influenced this process.

### 3 Methods

This project was conducted in an urban city of Japan that is increasingly becoming linguistically and ethnically diverse. In this study, my analysis draws from three types of data: (1) semi-structured individual interviews with 12 Filipina women who were living and raising children in Japan, (2) semi-structured individual interviews with nine elementary school-aged children of the women whom I interviewed, and (3) post-interview workshops with the women and their children who participated in the interview. Because the focus of the analysis was on elementary school curriculum, I excluded child interviews with older grade students. However, I included all 12 interviews with parents as they reflected their interactions with their children when the children were still young. Interview questions for parents included participants’ stories of coming to and living in Japan, participants’ practices related to mathematics and language teaching at home, and participants’ experiences with schools in the Philippines and in Japan. Interview questions for children included their experiences of school learning, parent-child communications at home, and out-of-school mathematics learning. Mathematical problem solving (computation problems and word problems) was also part of parent and child interviews. Interview questions were shaped through my ethnographic observations in the participants’ communities and schools. Each parent interview lasted approximately 90 min and each child interview lasted approximately 45 min. All the interviews were audio-recorded and workshops were video-recorded.

All the parent participants were multilingual. Ten participants answered Tagalog as their first language and two of them answered Bikol as their first language. All the participants answered they were comfortable in English as their second language because they received education for subjects such as mathematics and sciences in English. Except for two participants, they all answered that they felt comfortable communicating orally in Japanese but were not comfortable with reading and writing. The majority of the participants felt more comfortable speaking in English and chose to conduct the interviews in English. Interviews and

workshops were mainly conducted in English. If Japanese was used, I translated all quotes into English. Another person who was fluent in Japanese and English confirmed the translations.

The majority of child participants (seven children) were born in Japan. Two children were born in the Philippines. All the child participants were enrolled in Japanese public schools, at the time of this study. For six of the child participants, with one Japanese parent and one Filipino parent, the main home language was Japanese. For the other three participants, the main home language was Tagalog. All the interviews with child participants were conducted in Japanese. After conducting individual interviews, workshops were organized based on the themes that emerged from those interviews. For the purpose of this paper, I focused on part of the workshop data and I included two of the workshop sessions and 152 min of video recorded data. In the Findings section, I provide narratives that capture the details of the workshop interactions.

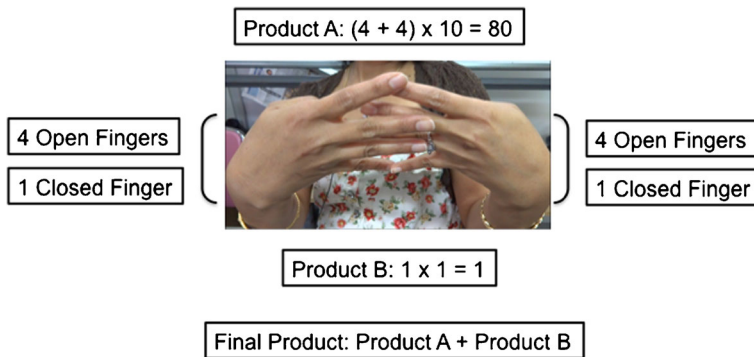
The analysis focused on two central themes discussed earlier: (a) appropriation of cultural tools (Wertsch, 1998), and (b) positional identities (Holland et al., 1998). Of all the out-of-school practices identified through ethnographic interviews and workshops, this article focuses on the informal finger multiplication method as one example of what these children learn at home. This finger multiplication method will be explained in further detail in the following section. Analysis was centered around two main research questions. The first question focused on whether and how participants appropriated a finger multiplication method. The second question focused on how participants' identities were embedded in relations of power, deference, and social affiliation/exclusion in relation to mathematics learning. Cross-case analysis and coding were conducted by using the qualitative analysis software *MAXQDA* (Verbi GmbH, Berlin, Germany). I analyzed both the commonalities and differences among participants.

## 4 Findings: Power and hierarchy affecting in- and out-of-school mathematics learning

In this section, I present findings obtained from both the interviews and workshops. First, I introduce the mainstream/formal and informal multiplication strategies that child participants encountered in in- and out-of-school contexts. Then, I connect participants' positional identities that affected appropriation of informal multiplication method. Subsequently, I describe whether and how child participants appropriated the informal method, drawing from the interviews and the workshops.

### 4.1 Informal and formal multiplication strategies: Finger multiplication method and *Kuku*

Participants used both the informal and formal multiplication methods—finger multiplication method and *kuku*— in the process of solving mathematical problems in the interview. The following informal method was observed when participants were solving a single-digit multiplication of numbers between six and nine (e.g.,  $9 \times 9$ ). Using two hands (each hand represents one factor), five is represented by the closed hand and any number above five is represented by the number of open fingers (e.g., nine is four fingers open; Fig. 1 is a participant's representation of  $9 \times 9$ ). Participants add the number of open fingers in each hand and multiply this number by ten (product A; e.g., in the case of  $9 \times 9$ , participants calculated



**Fig 1** A parent participant's finger multiplication method ( $9 \times 9$ )

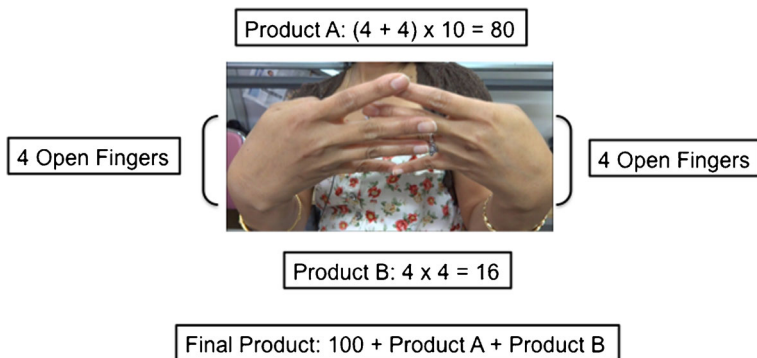
$(4 + 4) \times 10$ ). Then, the participants multiply the number of closed fingers in each hand (product B; e.g., in the case of  $9 \times 9$ , participants calculated  $1 \times 1$ ). The final multiplication product is calculated by adding the above products A and B.

This finger multiplication method can be also extended to the multiplication of numbers between 11 and 15. The closed hand represents ten and the open fingers represent the number above ten. First, add the number of open fingers in each hand and multiply this number by 10 (Product A; in the case of  $14 \times 14$ , participants calculated  $(4 + 4) \times 10$ ). Second, multiply the numbers of open fingers in each hand (Product B; in the case of  $14 \times 14$ , participants calculated  $4 \times 4$ ). The final product is calculated by adding 100, Product A and Product B (see Fig. 2).

Parent participants explained that the finger multiplication method was learned outside of school and used mainly to deal with the pressure in the school to complete computation quickly. For instance, Irene<sup>1</sup> said, "When we were at school and then we were doing some tests...that needs to be quick." Parent participants acquired this method from various sources: family members, friends, and at school. Child participants acquired this method exclusively from their parents. Neither parent nor child participants could identify the origin of this finger multiplication. Three parent participants stated that the method had spread throughout their communities in the Philippines. There is a record indicating that this finger multiplication was commonly used in Florence, Italy (Ball, 1888). This finger multiplication is also known as "Russian or French peasant algorithm" (Davis & Preciado Babb, 2015; Gray, 2001). However, it has not been recorded in English how the method came to spread in some communities in the Philippines.

In contrast to the informal finger multiplication method, there is a formal method to memorize a multiplication table, which is taught in the Japanese school system. In Grade 2, the Japanese mathematics curriculum (the official course of study) covers multiplication of single digit numbers and requires students to recite the entire multiplication table between one and nine. Students use a culturally specific recitation method called *kuku*, which is a language-driven rhythmic chant (Ministry of Education, Culture, Sports, Science and Technology, 2008). Similar rhythmic chants for multiplication are commonly observed in Asian countries. The Japanese version of *kuku* is considered to have originated in China, and there is a historical archive recording the use of *kuku* in the tenth century in Japan. Children learn this *kuku* either

<sup>1</sup> All the participants' names are pseudonyms. These names were chosen from the same language as the participants' real names.



**Fig. 2** Finger multiplication method for two-digit numbers ( $14 \times 14$ )

at school or at home from their family members. In the case of immigrant students in this study, their encounter to *kuku* tended to be only at school.

#### 4.2 Parents' positional identities and home practices

I will first describe the positional identities of Filipina mothers in this study by focusing on the reasons why they came to Japan and their language policies at home. As introduced below, these positional identities influenced these parents' decisions on how they displayed their ways of engaging in mathematics, including finger multiplication. These positional identities also influenced how their children would be involved in various home practices (such as engaging in international currency conversions and calculating international time differences). Women in this study came to work in Japan and the majority (10 of 12 participants) stayed in Japan after marrying Japanese men. Filipino is one of the major and the fastest growing ethnic groups in Japan. Since the late 1970s, Filipina women have been coming to Japan to fill the bride shortage in farm village areas, to work as entertainers in urban cities, and, more recently, to work as nurses, caregivers and English language teachers and tutors. All of the Filipina mothers I interviewed said that they were from a big family of lower socioeconomic status and that financially supporting their family was their main motivation for coming to Japan.

Home language policies were indicative of Filipina women's positional identities at home. In the households where a Filipina woman was married to a Japanese husband, participants' interviews revealed that the husband or husband's parents tended to decide the family language practices, which were often the exclusive use of Japanese (Takeuchi, 2016). This situation was often because their husbands or husbands' parents did not comprehend Filipino (Tagalog), the official language of the Philippines, or other languages in the Philippines. However, some participants reported that, even in the households where the husband understood Tagalog, the exclusive use of Japanese was still common practice. This home language policy influenced Filipina parents' participation in children's school learning. For example, Mariel described her involvement in her daughter's school learning as "I help her only in English."

As revealed through the following interview quotes, parent participants' involvement in their children's mathematics learning was shaped through these positional identities. Parental involvement in children's school learning was reported as limited partially because Filipina women in this study felt they did not know the curriculum and pedagogy in Japanese schools.

For example, in response to my question (“Did you teach mathematics that you learned?”), Mariel said, “No (...) It’s different ways I think.” For the same interview question, Karen said:

Maybe since it’s all in Japanese, we don’t know, really, exactly what kinds, how you solve the mathematics. We don’t understand your ways. One time, I taught my child and he got confused. I thought, maybe it was a different way. So, it’s hard to teach children, if they feel confusions. I think Japanese system, you have your own system.

In this narrative, Karen’s use of pronouns serves as a marker (Fairclough, 1989) to indicate a boundary between the Japanese ways (e.g., your ways, your own system) and her ways, through which she distanced herself from the Japanese system. This distancing from the mainstream was also observed in the following interview excerpt from Irene. She is describing her decision on teaching children mathematics.

It’s up to them. I used to compare. I can’t always tell them or demand all the things I learned. Because life here in Japan is quite different from where I grew up. So I used to compare but if they are okay, then it’s okay. They don’t need to learn whatever I’ve learned.

As these interview quotes represent, many parents described the distance they felt towards the Japanese school system. In addition, as I discussed elsewhere (Takeuchi, 2015), for some parent participants, their positioning as a “foreigner” or “outsider” in Japanese society hindered them from playing an active role in their child’s school learning (as represented in one of the participants’ interview quote, “I’m Filipina and I can’t offer anything as a parent because I’m a foreigner”). Sometimes, children commented that their parents’ ways of doing mathematics were wrong just because it was different from the way they learned at school. For example, Arlene and Karen both reported a difference in how a reminder is notated when computing multi-digit division. Karen said she fought with her son over ways of computing multi-digit division and was told by him, “Mom, yours is not a right way.” Arlene also said she was told by her children, “Mom, you’re wrong.” These episodes suggest that the difference between the Japanese school way and parents’ way of computation was perceived in a hierarchical manner: The parents’ ways were wrong and the Japanese school ways were correct.

Similarly, taking an example of teaching the informal, finger multiplication method, parents’ positional identities also shaped the contexts of their decisions. Parent participants in this study either chose not to teach the finger multiplication method or taught it only to the children who were struggling in school mathematics. All the parent participants positioned the finger multiplication method or the use of fingers as secondary to *kuku*, the formal memorization method for multiplication tables. For example, Nicole explained that she decided to teach the finger multiplication method at home as a “secret.” Karen also described that this method was “only for an emergency purpose” for her children, because using fingers would be considered to be illegitimate in Japanese schools. But because her son was falling behind academically, Karen’s husband taught the finger multiplication method. While teaching this finger multiplication method to her children, Karen said she and her husband also encouraged their children to memorize the multiplication tables with *kuku*, as taught in Japanese schools. Karen said, “You should only use your mind to compute. Or you can use scratch paper—but never fingers, because it’s cheating right?” She also commented, “Maybe it’s not a right technique to use for tests.”

Similarly, Irene taught the method to her child who was struggling with computation and memorization but not to her child who was doing well in mathematics. Regarding this point,



Irene, Ryan's mother, said, "I'm telling Ryan this because his memory is a little bit... slow. So, I told him, 'You can use this one,' and he said, 'Mommy, I think this is harder—I can't. I have to remember.'" As seen in these examples, teaching or not teaching informal knowledge was connected to how parents perceived their children's mathematical competence and became a locus of social valorization (de Abreu & Cline, 2007). In the following section, I describe how child participants appropriated or did not appropriate the finger multiplication method.

### 4.3 Children's appropriation of the informal multiplication method

The following stories from child participants demonstrate the discontinuity between home and school learning, experienced especially by immigrant families. I focus on three children whose parents taught them the finger multiplication method. May, who was in Grade 6 and had come from the Philippines to Japan when she was in Grade 4, had repeated Grade 3 in Japan because her Japanese language proficiency was perceived to be limited. Eric was in Grade 4 and had come from the Philippines to Japan after finishing Grade 1. Ryan was born in Japan. At home, none of them was exposed to the *kuku* method, the mainstream method taught at Japanese schools. Child participants' interviews revealed whether they had appropriated the finger multiplication method. May and Eric both used the method for single digit multiplication between six and nine. They both explained that they learned the finger multiplication method from their parents. Ryan did not use the finger multiplication method but used the *kuku* method. Findings from the child interviews demonstrate how the child participants had to negotiate between what was considered legitimate at school and what was taught at home. For the child participants, this negotiation meant hiding or not appropriating what was taught at home.

The interview with Ryan indicates how computation fluency was used to classify students academically at school. When I asked if he memorized *kuku*, he said he repeatedly practiced to memorize it because he was placed in the slowest group for computation in Grade 2. The following accounts of May and Eric's use of the finger multiplication method at school revealed how they were already aware of what was and was not considered to be legitimate. May and Eric both mentioned that they would not use the method openly at school. Eric said he never showed the method to school teachers. May also reported that she would not use this method during mathematics quizzes because she thought that only computation strategies taught by the teacher were legitimate. She provided an example of  $7 + 8$ . Outside of the school, she said she would usually compute addition by decomposing the number by 5 (such as  $5 + 5 + 2 + 3$ ). But in the mathematics quizzes at school, she would follow the teacher's method, which did not involve decomposing numbers. This example shows how these immigrant children came to be keen observers of what was considered legitimate at school and would strategically hide computation strategies that differed from what their teacher taught them.

The following quote from May provides a further account of how she appropriated the finger multiplication method and used it to maneuver within a competitive school environment. When asked in the interview if she wanted to show her finger multiplication method to the teacher, May said, "No, I don't want to [show it to the teacher]. Everyone else is very fast at computation. I shared this only with those who were slow [at computation]." She added, "Students who go to *juku* [afterschool cram schools] are very fast [at computation]." Attending *juku* during after-school hours is common among children in Japan and even among upper-grade elementary school students. At *juku*, students preview and review school subjects and also prepare for entrance exams. Fees range between 5000 YEN and 20,000 YEN per month.

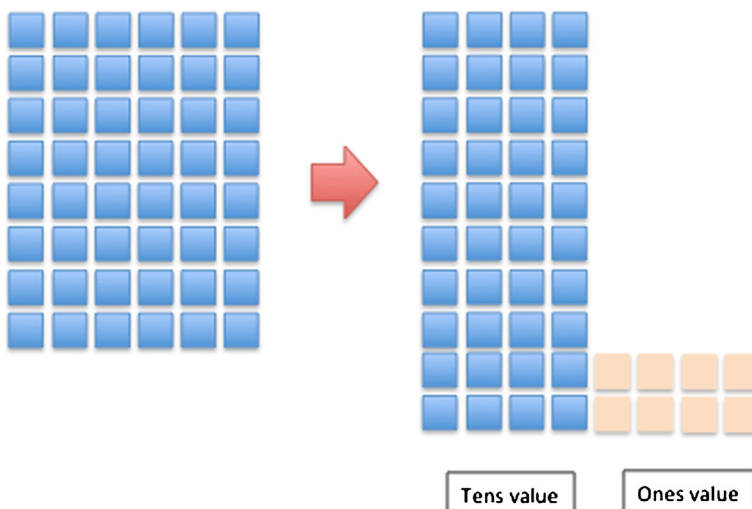
As such, there can be a social class divide between those who can attend a cram school and those who cannot. May described how she observed a gap in computation fluency, partially resulting from inequity in access to additional educational resources. In facing this gap, May selectively shared the finger multiplication method only with students like herself—those who were slower at computation and did not have access to *juku*. By sharing the method with other students, May tactically used the finger multiplication method to create a context where she could use the informal method meaningfully.

#### 4.4 Examining the finger multiplication method through the workshop

Based on the themes that emerged from the interviews, the workshops were organized. In the workshops, participants and I discussed different computational models for multiplication and the base-ten (decimal system) underlying the finger multiplication method. For example, an array model was used to highlight how whole numbers can be decomposed and regrouped (see Fig. 3). By letting  $x$  be one factor (represented with one hand) and letting  $y$  be another factor (represented with the other hand), the second way to understand the finger multiplication method is as  $(x - 5) \times 10 + (y - 5) \times 10 + (10 - x) \times (10 - y) = xy$ . In addition, this finger multiplication method can be examined by a statement of the identity:  $(5 + a)(5 + b) = (5 - a)(5 - b) + 10(a + b)$ .

In the process of engaging in the workshops, I observed resistance from child participants to unlearn the school knowledge, as can be seen in the following workshop narratives. Some child participants were reluctant to learn about this method because they had not learned it at school, as reflected in comments such as Ryan's question, "Do we learn about this at school?" The following narrative from the workshop reveals how child participants internalized the legitimacy of school knowledge over informal knowledge.

The facilitator asked Irene to introduce how she would use the finger multiplication method to compute  $6 \times 8$ . Irene stood up and started to introduce in Tagalog how she used the method. I, as a facilitator, asked Irene's child, Ryan, to translate her explanation into Japanese. Irene explained the method in Tagalog and the participants listened to Irene's



**Fig. 3** An array model to explain the finger multiplication method ( $8 \times 6$ )

explanation while looking at her. Ryan looked at me and said, "I can't translate." I said, "Can't you?" and explained the method in Japanese to the child participants. After the explanation, Ryan asked me, "Do we learn about this at school?" Irene laughed.

Because the children had been told to memorize the multiplication tables in one way (by using *kuku*) at school, they were disinclined to learn any other methods and ways of thinking about multiplication. Despite of the initial resistance, when parents taught the finger multiplication method for single- and multi-digit multiplication at our workshop, the children who did not know about or did not appropriate this method were amazed, as illustrated in the following narrative.

I, as a facilitator, used an example of  $7 \times 7$  and let all child participants try out the finger multiplication method. While watching the child participants trying out the method, Irene was nodding. After a while, Ryan all of the sudden shouted "Ah! You're right— This is amazing." I asked participants to try  $8 \times 9$ . Another child participant, Brian said, "Oh wow." Ryan looked at Irene and said, "I got it." Irene clapped her hands for Ryan.

## 5 Discussion and Implications

The findings presented in this paper offer insights into immigrant students' practices and resources for mathematics learning. Framed by sociocultural theory of learning and especially by focusing on the concept of appropriation, this study showed how appropriation of an informal multiplication method can be a site for negotiation of power and positional identities. By examining the case of Filipina mothers and their children living in Japan, the study offers insights into a global issue regarding mathematics learning that immigrant students experience both inside and outside the school. As the interview results revealed, immigrant parents framed their involvement in their children's learning while contending with the pressures to conform to the mainstream practices of their host country. Some child participants came to understand what is legitimate at school and chose a tacit strategy to maneuver competitive school contexts while also appropriating resources at home. At the same time, the workshop findings highlight that there were other child participants who were reluctant to learn and think about the informal multiplication method, partially because memorization without any external tools is encouraged at school and also because they were aware of what is legitimate and what is not at school. The fact that the curriculum required students to learn one cultural method and teachers had to enact that curriculum in daily teaching practices shows how students were molded into the culturally dominant computation method through schooling. I discuss the findings presented above in relation to power and identity in mathematics learning. I also discuss some limitations of this study and pedagogical implications.

### 5.1 Power and identity in mathematics learning

Highlighting the informal finger multiplication method as one of the examples of what children learn at home, this study illustrates how a seemingly politically neutral multiplication learning can be a space to negotiate identity and power for immigrant families. The findings from this study contribute to advancing the sociopolitical turn in mathematics education (Gutiérrez, 2013) by putting the issues of positional identities at the center of analysis. As previously discussed (Baker et al., 2003; Civil & Planas, 2010; de Abreu & Cline, 2005), by prioritizing certain ways of knowing as legitimate and valued at school, school practices can

suppress other ways of knowing. Because the finger multiplication method was considered to be illegitimate in schools, some immigrant students were taught to repeatedly practice and memorize multiplication tables with a mainstream way. Through the learning of multiplication, students were gradually socialized to conform to the mainstream and, already at Grade 2, some acquired the identity of being a “slow learner,” as the interviews with child participants suggested. At the same time, for another case, child participants’ agency was highlighted in their efforts to create a context in which this socially undervalued cultural tool could be used meaningfully, even when parent participants were reluctant to teach the tool.

By using the concept of positional identities, this study also adds to the ongoing discussion on parental involvement in school and children’s mathematics learning. Immigrant parents in previous studies have tended to value their knowledge and the mathematics they learned in their home countries (Civil, Díez-Palomar, Menéndez, & Acosta-Irriqui, 2008; Civil & Planas, 2010; de Abreu & Cline, 2005). However, Filipina mothers in this study tended to undervalue their knowledge and the mathematics they had learned. Not only the finger multiplication method but also other mathematical knowledge they had learned in the Philippines were not openly taught at home. This was partially due to their positional identities in Japan and their lived history: migrating to Japan, which had economic and industrial advantages, in order to financially support their family members in the Philippines. As such, findings from this study adds to the discussion of social valorization (de Abreu & Cline, 2007) by highlighting how different kinds of mathematics are valorized or devalorized with reference to social classification.

Considering that certain parental involvement at home (such as engaging in conversation involving critical thinking) can positively influence students’ academic engagement at school (Galindo & Sonnenschein, 2015; Lee & Bowen, 2006), it is important to understand the positional identities of parents and their impact on parental involvement at home. This intergenerational perspective will help design culturally responsive mathematics teaching that can connect with students’ ways of knowing mathematics, situated in their cultural and linguistic practices (Aguirre & del Rosario Zavala, 2013; Caswell, Esmonde, & Takeuchi, 2011; Gay, 2009).

## 5.2 Limitations

There are several limitations in the current study. First, my data draws from a relatively small number of Filipina mothers and their children living in Japan. This methodological decision allowed me to closely engage with them through this study, by talking with them in depth and designing workshops with them after the interviews. At the same time, I would like to acknowledge that the findings presented are based on this small number of participants and gathering more stories can help to reveal diverse perspectives on the themes discussed.

Second, this study revealed the norm of mathematics learning expressed as the child participants’ reluctance to learn about or even think about mathematics behind the informal finger multiplication method. These findings point to the significance of transforming the cultural practices of schools to embrace diverse ways of knowing. A successful mathematics unit reported by Civil (2007), the garden project, illuminated the possibility of bringing parents’ intellectual resources to schools when teachers view immigrant parents as academically resourceful. Booker and Goldman’s (2016) participatory design research on mathematics workshops with families highlights the significance of attending to the participants’ epistemic authority to confront institutional power. Understanding more about bridges between schools

and communities would be meaningful to achieve equitable mathematics learning opportunities.

### 5.3 Pedagogical implications

With regards to equity in mathematics education, recent reform movements have aimed to promote students' problem solving and conceptual understanding in mathematics. In fact, when teachers are trained to teach mathematics for understanding and use quality curricular resources, teaching for understanding can narrow the achievement gap, as has been shown among students in the United States (Schoenfeld, 2002). The public debate on mathematics education between emphasizing the basics and emphasizing problem solving and conceptual understanding has been observed in many countries and can affect the ways in which non-dominant students access opportunities to learn. Interviews with child participants in this study implied that acquisition of basic computation skills (in this case, memorizing multiplication tables with a specific recitation method) was expected as a necessary step before students moved on to problem solving and conceptual understanding. This context hindered students from mastering and exploring various computation strategies and also restricted opportunities for some students to challenge advanced problem solving until they had mastered basic computation skills in a mainstream way.

The underlying assumption prohibiting the use of the finger multiplication method in the school can be that mathematical thinking has to be "a pure mental activity — something immaterial, independent of the body, occurring in the head" (Radford, 2009, p.111). In school contexts, mathematics is often presented as "existing independently of the people who do it, and independent of their bodies, senses, desires, emotions, and aesthetics — everything that makes a person flesh and blood" (Greer, Mukhopadhyay, & Roth, 2013, p.6). Findings from this study suggest the significance of interrogating the assumption that mathematics is a pure mental activity, in order to enhance opportunities to learn for students who embody specific cultural tools.

This study underlines the significance of affirming and encouraging diverse strategies and methods that students learn at home, in classroom mathematics teaching. Such classroom practices will benefit not only non-dominant students, but all students as the ethnomathematics literature has shown (Ascher, 1994; D'Ambrosio, 2006). For example, unpacking the mechanism of the finger multiplication method highlighted in this study could be useful for challenging students' "fossilized" (Vygotsky, 1978, p. 64) knowledge with a recitation method of multiplication and for diversifying students' ways of approaching multiplication. Diverse ways of mathematical knowing can humanize mathematics and enrich the school mathematics curriculum.

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#### Compliance with ethical standards

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