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Building Family Partnerships in a Catholic School by Connecting After-School and Home with Mathematics

Bilge Cerezci, Ph.D.¹

Abstract: Parents need guidance, support, and motivation to learn how to support their young children's mathematical development in ways that are more foundational and effective. The In Addition Afterschool Mathematics Program serves 24 students in grades 3, 4, and 5 and their parents in an urban neighborhood at a Catholic elementary school. In the In Addition Afterschool Mathematics Program, we see families as partners and build our after-school program around supporting mathematics thinking and discoveries by engaging the whole family.

Keywords: after school, family math, partnership

How many ways are there to count the number of creatures in our cabin? What do you notice about them? What are some similarities and differences between them? Can we group them based on their similarities and differences? How many different ways can we sort them?

Mathematics is a shared universal language and an integral part of everyday experiences for all human beings. Asking children simple questions about the world around them and what they notice while encouraging them to ask questions can reinforce mathematical skills and help them turn their intuitive mathematics discoveries and understanding into more generalizable and sophisticated mathematics knowledge (Bahr & Garcia, 2010; Starkey et al., 2014; Rouse et al., 2005). Through such accessible, relevant, and challenging mathematics learning experiences, children can develop robust mathematics knowledge, which will potentially have positive long-term implications for their academic performance in mathematics and other subject areas (Duncan et al., 2007; Sanders & Rivers, 1996; Weiss & Pasley, 2004).

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Because children's learning begins in the home, families hold a critical place in laying the social and intellectual foundations for their children's learning and development (West et al., 1998). Empirical evidence from decades of research consistently highlights numerous benefits of family involvement for children's learning, including school readiness, promotion of academic achievement, and college preparation (Heystek, 2003; Hoover-Dempsey et al., 1995; Jeynes, 2010). In her extensive review of the literature on parent involvement, Epstein (1992) noted that "students at all grade levels do better academic work and have more positive school attitudes, higher aspirations, and other positive behaviors if they have parents who are aware, knowledgeable, encouraging, and involved" (p. 1141).

However, in the era of Common Core State Standards for Mathematics, the experience of learning and doing mathematics looks radically different than that to which many parents are accustomed. Today, many people view mathematics as a discipline consisting of a set of facts, formulas, and algorithms that one must memorize without uncovering or recognizing how mathematics is situated within one's life (Beilock et al., 2009; Chang & Beilock, 2016). As a result, many parents harbor anxiety about mathematics (Civil et al., 2003; Xolocotzin & Jay, 2012). The difficulties and frustrations are even more amplified for parents of children with mathematical learning difficulties (Abreu & Cline, 2005). Sometimes these attitudes toward mathematics can have a negative impact on their children's dispositions toward mathematics (Maloney et al., 2015).

Parents need guidance, support, and motivation to learn how to support their young children's mathematical development in ways that are more foundational and effective. Helping families understand the importance of (a) conceptual understanding of mathematics over rote memorization and (b) supporting their children's mathematics learning outside the classroom is one way to break a continuous cycle of mathematics anxiety and improve attitudes and achievement by motivating children to learn, grow, and improve (Boaler, 2015; Civil & Bernier, 2006).

Supporting Family Mathematics in an After-School Program

After-school programs are typically designed to support students' academic growth in different subject areas in the afternoon or evening, after they have finished school. Traditionally, the learning and teaching experiences provided in these programs are geared toward boosting academic performance and providing a safe and structured environment for the children of working parents. Studies increasingly show that engaging families in children's learning has a powerful and positive impact on students' future academic outcomes (Henderson & Mapp, 2002). Although this research has largely been carried out in traditional classroom settings, the findings are encouraging—indicating that such an approach may also be effective in programs that provide academic support to children and their families in after-school hours.

Well-designed partnerships with families not only have the potential to increase both students' and parents' self-confidence, in general—and in mathematics, specifically—but also make a substantial contribution to children's mathematics learning and achievement (Epstein, 2018; Garcia & Weiss, 2017). Family engagement activities around mathematics in after-school programs can create a space for educators, children, and families to learn and talk about mathematics and can help parents participate in their children's learning and support their academic success (Garcia & Weiss, 2017). Such experiences can also help parents develop positive attitudes toward mathematics and influence the ways they interact with their children in mathematics activities at home. Moreover, there is also the potential for parents to begin to embrace mathematics in their own everyday experiences.

Family Mathematics Engagement: The In Addition Afterschool Mathematics Program

The *In Addition Afterschool Mathematics* Program takes place in an urban neighborhood at a Catholic elementary school. An anonymous donor has funded the project, so there is no charge for children and families. In 2019–2020, the project's seventeenth year, it served 24 students in grades 3, 4, and 5 and their parents, representing a diverse group of African American, Latino, Chinese, and European heritage. At the time, our team consisted of a classroom teacher, a mathematics consultant, an administrative assistant, a theater arts instructor, two PhD students who worked in the after-school program, a university professor in the school of education, and an elementary school principal. Teaching responsibilities are always shared among all team members.

This program resonates the charism of St. Vincent as well as the current ideas about teaching and learning. More specifically, the program values and honors children's and parents' ideas (Meier, 2002) and uses social justice as the direction for learning (Nieto, 2003) where teachers create classrooms in which all students have ownership (Darling-Hammond & Bransford, 2005). These ideas are significant in the after-school program's work. Our philosophy also echoes the recommendations of the National Institute on Out-of-School Time (2000) and the National Council of Teachers of Mathematics (2000). These leading organizations emphasize that it is essential to provide children with opportunities to be active participants in the development of their own mathematical understandings and to be instructed by teachers using strategies that begin with children rather than with teachers or with a school-mandated mathematics curriculum.

In its after-school hours, *In Addition* facilitates the teaching and learning of mathematics without regular classroom constraints, such as high-stakes testing and grades. Our children do not take part in after-school test preparation offerings. Mathematics skills are developed by empowering children to depend on their own curiosity, to grow their ideas, and to work cooperatively with others and productively alone (McVarish, 2008). Everyone—children, teachers, parents, and community members—is involved in a variety of ways. Students' investigations, based

on their needs and impetus, are often linked to their neighborhood and homes. Parent participation, through monthly parent meetings and two weekend retreats, provides both a support system for students and links between home, school, and community. Our aim is to help children turn everyday questions into child-powered inquiries and to value persistence, revision, and struggle in learning.

Another aim of the program is to help shape parents' new or expanded understandings of mathematical thinking either at school or at home. Parents and their children attend two "Mathematics in the Woods" camping weekends, built around doing mathematics in natural settings as a family event. The two retreats are situated on the grounds of a children's camp located in a mountainous area about 60 miles north of New York City. At least one parent must accompany their child on these family retreats. The retreats are planned for one weekend in October, which sets the stage for our work together throughout the year, and another in May: Our May retreat is a celebration of our learning together that year.

Connecting After-School and Home with Mathematics: *Five Creatures*

In the *In Addition Afterschool Mathematics Program*, we often use literacy as a tool to provide context for mathematical discovery and questioning. Research has consistently shown that reading together as a family is an important experience that can be used to teach about many subjects—including mathematics—as it provides contexts that allow students to draw on their prior knowledge to bring meaning to the mathematics (Miller, 1998; Murphy, 1999; Whitin et al., 1990; Whitin & Wilde, 1992). During our "Mathematics in the Woods" camping weekends, we provide parents and children with several storybooks that encourage mathematical thinking and problem-solving skills. We find that using literature as a tool to talk about different mathematics concepts is a safe way for parents anxious about mathematics to engage with their children in an unpressured mathematics activity that is simultaneously enjoyable and intellectually intriguing. It also creates opportunities to introduce new mathematics vocabulary, make connections among mathematics concepts, and highlight ways that mathematics can be applied across different contexts (Whitin & Wilde, 1992).

In October of 2019, during our three-day "Mathematics in the Woods" camping trip, we provided families with a copy of *Five Creatures*—a storybook written by Emily Jenkins (2001). *Five Creatures* introduces five members (three humans and two cats) of a single family and sorts the family members by various attributes (e.g., size, hair color). In the book, the characteristics that family members have in common are examined, as are those attributes that set them apart. The following two foundational mathematical ideas are highlighted in the story: (1) attributes can be used to sort collections (e.g., family members) into sets (e.g., two with long hair and three with short hair); and (2) the same collection can be sorted in different ways (e.g., family members are grouped by their height, gender, and eye color). Sorting is an important mathematical

skill because it encourages children to use their analytical thinking skills, which are the basis of reasoning and higher-order thinking. Studies have shown that by comparing objects to one another and understanding the relationship between sets of objects, children engage in transitive thinking (Clements & Sarama, 2007; Ginsburg et al., 2008). For instance, blue blocks are bigger than red blocks and smaller than yellow blocks; blue blocks should thus be placed into the pile for medium-sized blocks.

Like all mathematical experiences, sorting is most effective when it is related to children's everyday life and when they are able to see mathematics in the real world to understand its place and uses (McVarish, 2008). We chose *Five Creatures* as a tool to explore and discuss mathematical ideas and concepts around sorting because it allowed us to provide opportunities for our families to make connections between mathematics and their own lives. These connections are crucial to making mathematics accessible and for helping families use literature and mathematics to make sense of their lives and appreciate the divergent thinking among family members. Therefore, each day of our camping trip, we tailored several activities to build around the foundational mathematics concepts showcased in the *Five Creatures* story. In this paper, we show how we weaved this story into the activities over the course of the October 2019 retreat.

Day 1: "Let's Read"

On the first day of the camping trip, all of the families arrived at the camping area late in the afternoon. After settling in and meeting with other members of the In Addition community, we came together as a large group and read the *Five Creatures* story before bedtime. As we were reading the story, In Addition members talked about some of the similarities and differences that they observed in the story and how it related to their own lives and families. We also left a copy of the book in each cabin and asked families to revisit the story during the camping trip.

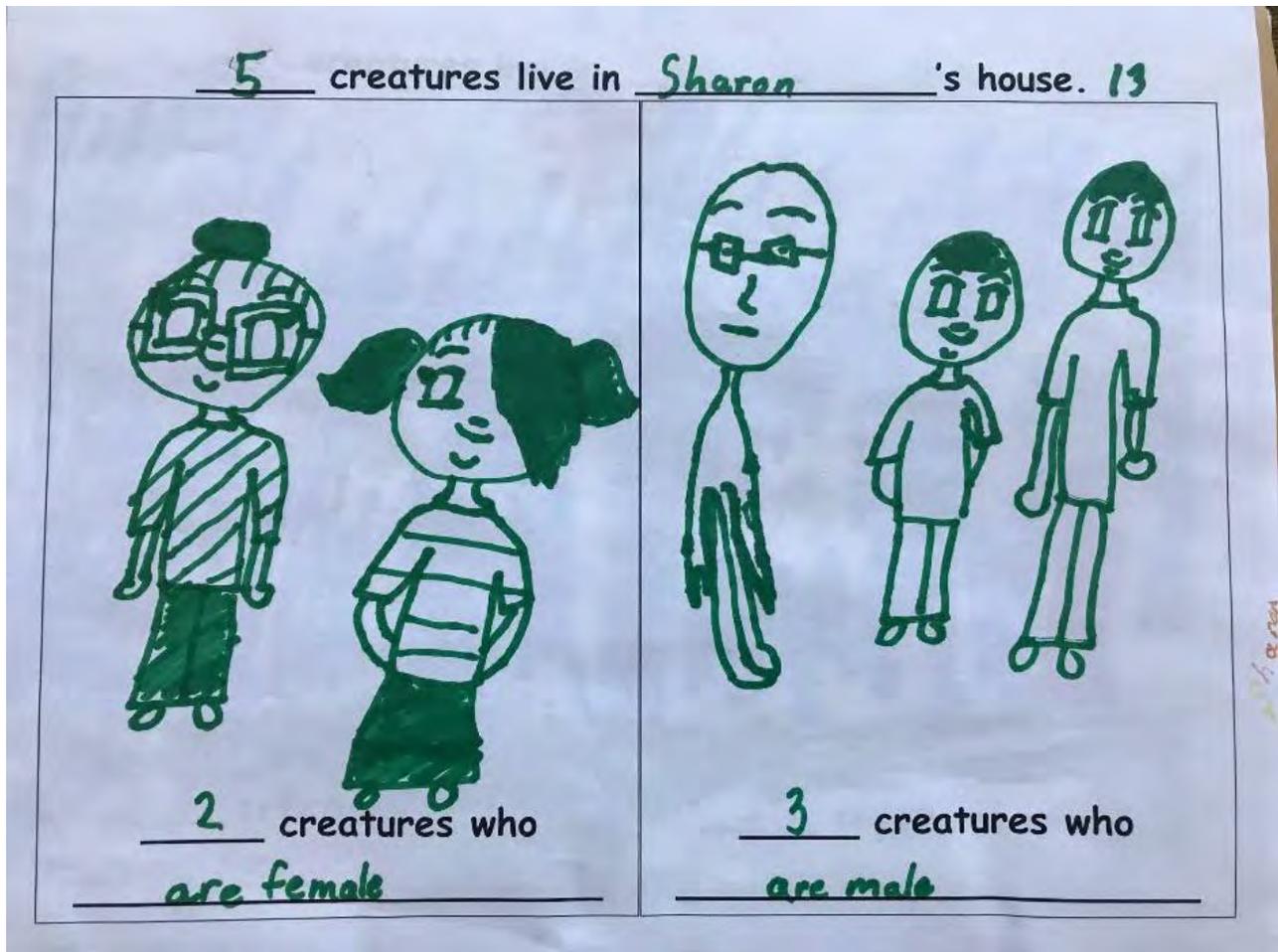
Day 2: "Creatures in our Family"

After breakfast, we asked the parents and their children to reflect on the story we had read the night before. We talked about what they remembered from the story and how it related to their own lives. Some families identified with the family portrayed in the story and talked about how some of their family members share certain characteristics (e.g., a dislike of coffee). We sat together as a group and had a conversation about the similarities and differences that they observed in their own families. Following this collective conversation, we asked parents and their children to think about and discuss ways that their immediate family members were similar and different. Once they completed their conversations, we asked them to illustrate two ways to sort the "creatures" in their home by using the template we provided (see Figure 1).

This activity helps us build a bridge between mathematics at school and mathematics at home, while encouraging families to share what makes them unique. Finding different sets among family

Figure 1

Creatures in Sharon's family

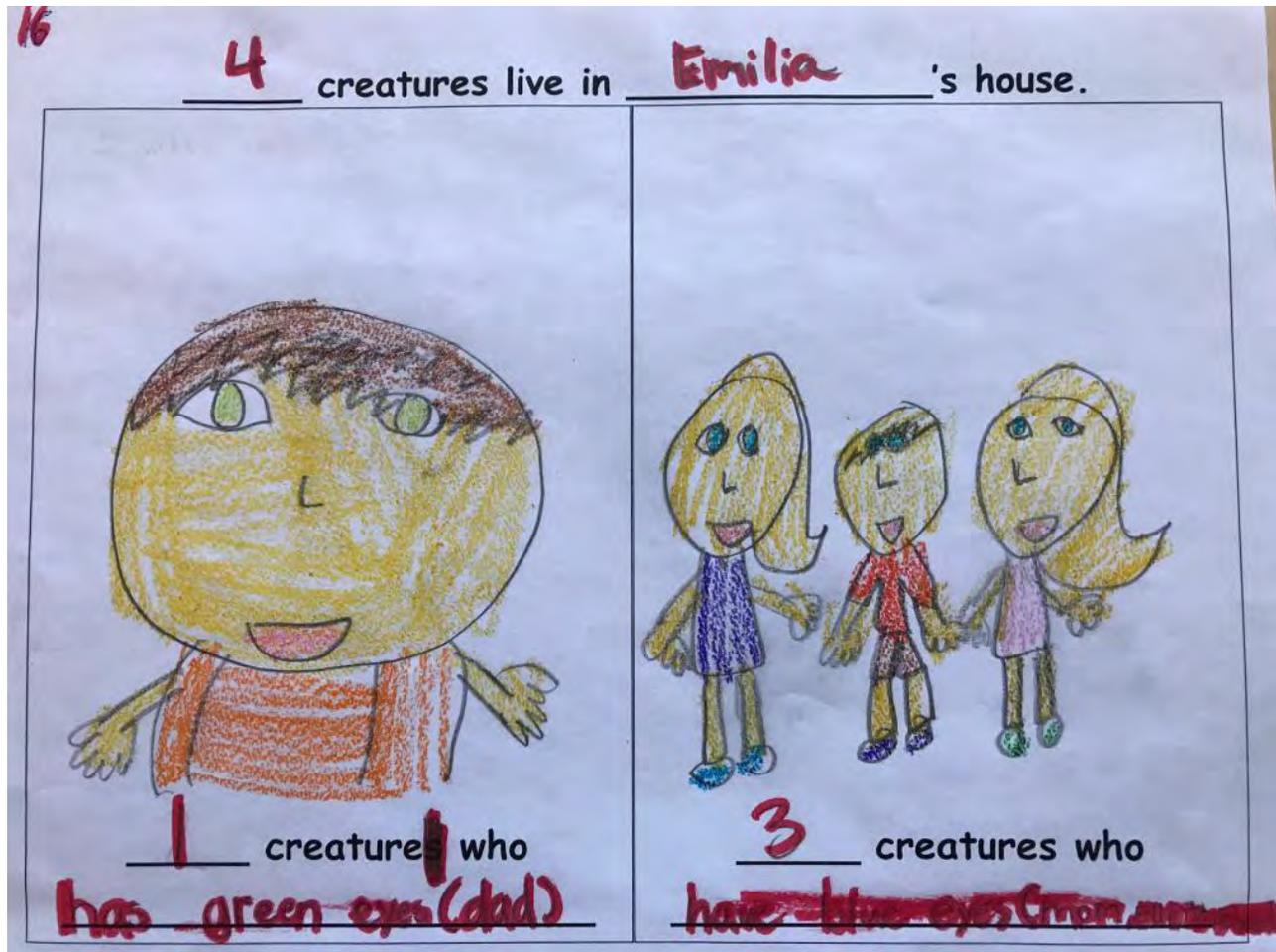


members is a way to celebrate what makes us special and what makes us similar. For example, Sharon and her family used gender as an attribute to sort the members of her family. Similar to the family in the story, she indicated that there were five “creatures” in her family. While two of the creatures were female, the rest were male (see Figure 1). Emilia, on the other hand, used eye color as an attribute to sort her family members, and indicated that only one creature in her family had green eyes, while the other three had blue eyes (see Figure 2).

Once each family completed their sorting and illustration, we asked the families to sit together in groups of 5 to 10 people, and to share their illustrations with their cabin-mates before they went to bed that night. This allowed us to give the families time and space to get to know one another, but it also enabled us to have these mathematical conversations within a larger community.

Figure 2

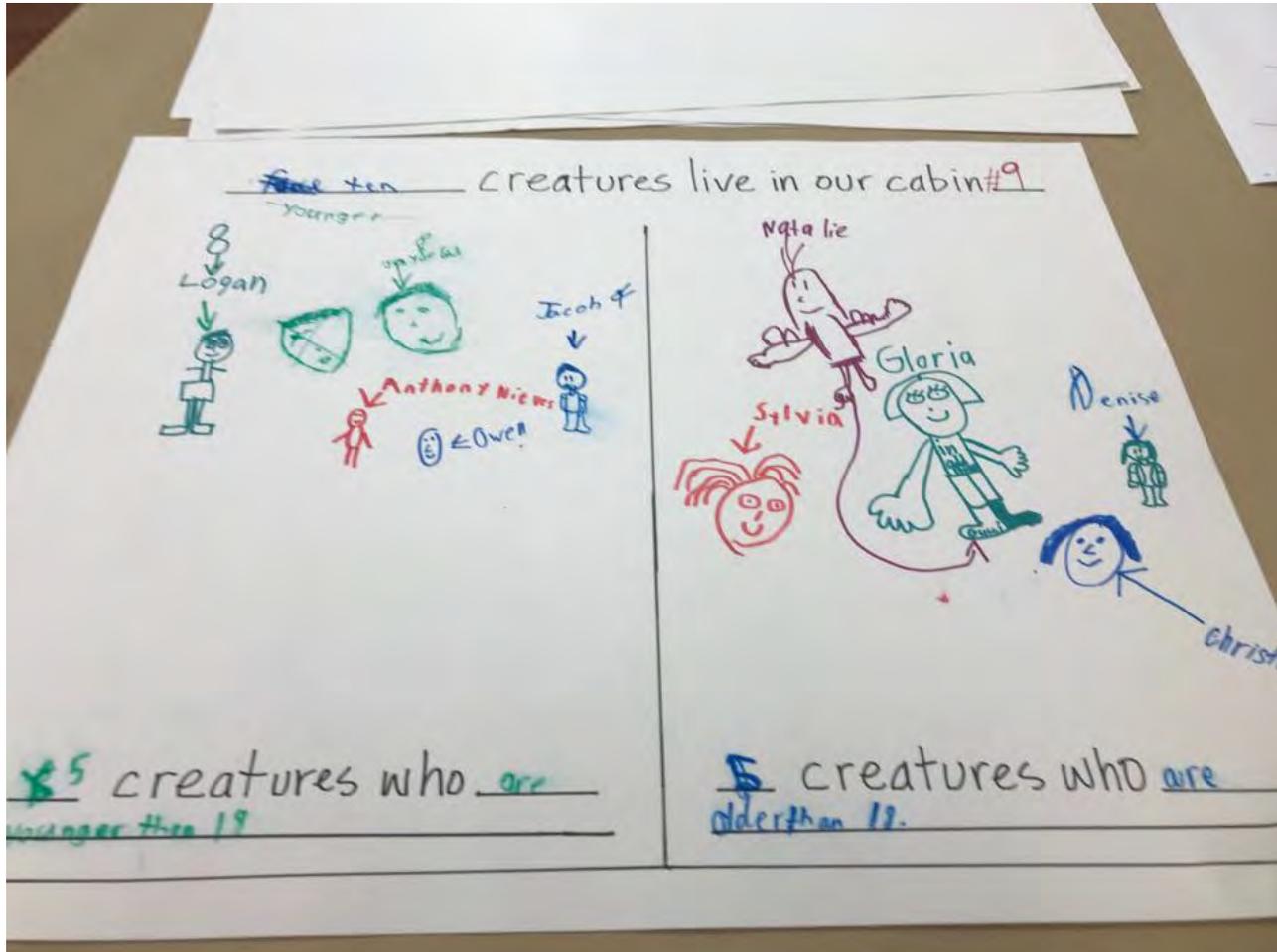
Creatures in Emilia's family

**Day 3: "Creatures of In Addition"**

On the final day of the camping trip, we asked members of each group to sit together and reflect on the conversations that they had had the day before. We requested that they think about the characteristics they had in common and the characteristics that made them unique. After giving each group enough time to reflect on these conversations, we asked them to come up with a way to sort their group members using an attribute, and illustrate two ways to sort the "creatures" in their group using the same template we had provided earlier.

After each group finalized their discussions and illustrations, we came together as a larger group and sat in a circle. One by one, we asked members of each group to sort themselves again into two sets and then stand in the middle of the circle, without telling the rest of the larger group the

Figure 3
Creatures in Group 9



attribute with which they had grouped themselves. Each In Addition member sitting in the larger circle was encouraged to observe how the group members in the middle had sorted themselves, to see if they could detect a pattern. After a few seconds, several hands shot into the air, with many eager to share their observations. However, while these observations were often accurate, they were not always correct. For example, one of the groups had used age as an attribute to sort themselves. While one sub-group consisted of people who were younger than 18 years, the other sub-group consisted of those older than 18 (see Figure 3). Some of the observers thought this group of parents and children had sorted themselves by height because members of the one sub-group happened to be shorter than the members of the other sub-group. Even though this attribute was indeed applicable to the grouping, it was not the attribute the members had used to sort themselves. The

parents and children soon realized that, even if an observation was accurate and applicable to the grouping in front of them, it may not necessarily be the attribute with which the “creatures” in the middle had sorted themselves. Examples such as these led us to have richer conversations about the flexibility of mathematics, and how there can be multiple ways to reach the same answer. We also talked about the importance of observing, noticing, and wondering about mathematics. Some of the parents even mentioned how surprised they were when they realized how much mathematical thinking they engaged in as they were doing these sets of activities. Others noted that they were pleasantly surprised to see that mathematics could be fun and meaningful.

Concluding Remarks

Negative attitudes toward mathematics are unfortunately far more common than they should be. Empirical evidence has consistently documented the connection between parents’ own mathematics anxiety and their child’s mathematics performance, and how mathematics anxiety can greatly influence a student’s learning environment and their overall achievement in mathematics. In response, we designed the In Addition Afterschool Mathematics Program. This program is built around supporting mathematics thinking and discoveries by engaging the whole family, as families are seen as partners. The aim is to create an environment in which math is part of everyday life, to allow us to serve those in need while helping families realize that math is a subject for curiosity, discussion, and growth. This paper describes one way in which we can support family engagement with mathematics through children’s literature. By engaging a sorting activity that encourages families to share what makes them unique, we were able to build a bridge between mathematics at school and mathematics at home and have interactive and engaging mathematical conversations within a larger community.

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