MATH BELIEFS STUDY MEMO

STUDY CONTEXT AND LEARNING QUESTIONS

Given the role that teachers, principals, and caregivers play in the lives of students, existing literature suggests that teachers and caregivers that show positive attitudes and higher levels of support towards their students, benefit from higher engagement in math fundamentals across all grade levels.[1]

Some teachers propose that fostering positive attitudes towards math fundamentals are vital, and prior studies reveal significant correlations when analyzing adult math beliefs about the ability of a child to learn math.[2] Additionally, parents holding positive attitudes about math early in childhood tend to have more mathematical activities provided in the home.[3]

The Bill and Melinda Gates Foundation (BMGF) is eager to learn from the community on how elementary teachers, parents, and caregivers perceive the fundamentals of math relative to their middle and high school counterparts. This study will explore how perceptions of math fundamentals may implicitly and/or explicitly reshape the perceived value of building mathematical concepts.[4]

Learning Question 1:

How do elementary teachers, principals, and caregivers (TPCs) think about math in relation to their middle and high school counterparts?

Learning Question 2:

How do elementary teachers, principals, and caregivers (TPCs) perceive math fundamentals relative to their middle and high school counterparts?

[1] Michelle Hurst and Sara Cordes, When Being Good at Math Is Not Good Enough: How Students' Beliefs About the Nature of Mathematics Impact Decisions to Pursue Optional Math Education, Emotions in the Learning and Teaching of Mathematics, Chapter 8, 221 – 241.

[2] Kristen Missall, Robin L. Hojnoski, Grace I. L. Caskie and Patrick Repasky, Home Numeracy Environments of Preschoolers: Examining Relations Among Mathematical Activities, Parent Mathematical Beliefs, and Early Mathematical Skills, Early Education and Development, 356 – 375, DOI: 10.1080/10409289.2015.968243

[3] Ibid.

[4] Ibid.

METHODOLOGY

In late October, ResultsLab invited a total of nine individuals to participate in 30-minute Microsoft Teams interviews. To stratify principals, teachers, and caregivers across the K-12 grades, we recruited the following individuals to discuss their perceptions of math:

- Three (3) Principals who oversee an elementary school (which may either be K-5 or K-6 grades), Middle School (either 6th – 8th grades or 7th and 8th grades) or high school (9th-12th grades)
- Three (3) Teachers who are instructors in an elementary school (which may either be K-5 or K-6 grades), Middle School (either 6th – 8th grades or 7th and 8th grades) or high school (9th-12th grades)
- Three (3) Caregivers who provide care to student in elementary school (which may either be K-5 or K-6 grades), Middle School (either 6th – 8th grades or 7th and 8th grades) or high school (9th-12th grades)

All the participants worked at a Title 1 school. Additionally, the majority (83%) of these principals and teachers work at a school that where at least half of the children identify as a person of color (i.e., African American/Black or Hispanic/Latino). Once the screening survey was sent to the prospective interviewees, ResultsLab selected participants based on geography, the number of years of dedicated teaching, and their personal experience learning math. Of the principals and teachers that participated in the study, 66% identified as a person of color (3 African American/Black and 1 Hispanic/Latino).

Three caregivers participated in this study with students in elementary, middle, and high school. To participate in the study, each caregiver must have a student in one of these grades, and in two instances caregivers had multiple children in each grade level or multiple grades. Two of the caregivers identified as White and another as African American/Black. All caregivers were women whose children did not attend Title 1 schools. While an attempt was made to recruit caregivers from Title 1 schools, these individuals did not respond to interview requests. The caregivers resided in Maryland and New York. Table 1 provides insight into the number of students for the caretakers.

Table 1. Number of Students

	2nd Grade	5th Grade	12th Grade
Number of Students	4	1	1

INSIGHTS

As mentioned above, this study explored perceptions of math amongst principals, teachers, and caregivers. The study stratified the participants amongst all grade levels. Based on the experiences of each of the participants, it is clear some cross-cutting themes such as the **divisiveness of math** and the **importance of math** exist amongst each group. Principals and teachers explicitly mentioned both the divisiveness and importance of math, whereas caregivers mentioned the importance of math throughout the study. Other themes that arose during the math beliefs study when discussing beliefs and perceptions of relative to their middle and high school counterparts included the student needs such as **differentiated learning** and **effort-based** grading. The following sections provide more detailed analysis of the perceptions of the math beliefs amongst study participants.

Overall Thoughts of Math

Learning Question:

How do elementary teachers, principals, and caregivers (TPCs) think about math in relation to their middle and high school counterparts?

A recurring theme present throughout all participants in this study was **the importance of math fundamentals**, and there was a universal understanding of how **critical the subject is in one's lifetime**. The importance of math cannot be understated due to the fact that many of the fundamental skills acquired in elementary school math are building blocks for long term success. Both teachers and principals spoke about the initial steps of learning math fundamentals in elementary school. The initial math fundamentals referred to by educators are addition and subtraction, and then as the student advances, multiplication, and division. Teachers, principals, and caregivers believe in the importance of applying these fundamentals throughout a student's life, whether they are aware or not of when they apply these math fundamentals.

In addition to teachers' and principals' agreement on the importance of math fundamentals, their experiences as educators revealed how **inherently divisive** math is and continues to be throughout all grade levels. At least one teacher pinpointed specific grades where middle school math (either 5th or the 6th grades depending on geographic location) creates sharp divisions. Those divisions occur when students begin to divide amongst themselves into those who either enjoy math or have a natural ability towards performing math fundamentals and those who do not.

In addition to the above themes such as the importance of math along with the divisiveness of math in schools today, educators also think that their **greatest assets are math teachers**. In addition to teachers and principals, caregivers share this belief that math teachers have a large influence on students' perception and attitudes towards math throughout elementary, middle, and high school. Where the two groups diverge in their thinking is when principals and teachers believe that parents *also* have a significant influence on a student's approach and overall behavior towards learning math fundamentals. In other words, for principals and teachers, they acknowledge that they are assets to students learning math and likewise have a considerable influence. However, they believe that parents also greatly influence a student in math. On the other hand, caregivers did not speak of their influence on their student learning math, but rather the teachers influence on how a student approaches math fundamentals.

Teachers, principals, and caregivers emphasized the importance of the method of instruction when teaching key mathematical concepts to their students. All of the participants that took part in the math beliefs study stressed the importance of having their students receive math instruction that is robust and one that provides them with multiple opportunities to not learn from a variety of different tools such as visuals and exercises, but a math teacher that has a deep understanding of the concepts so that one is able to provide support for a variety of learning styles (i.e., auditory, visual,). It became increasingly evident that while some caregivers had great experiences with their students, this was not reflected amongst all caregivers. A key differentiator was whether the math teacher was using a variety of tools whether auditory or visual to **ensure that math students in elementary, middle, and high school** understood the mathematical concepts presented to them.

> "So, I started supporting him at home and that meant I had to learn. And you know, I did that once again because I'm his mom... He had the benefit of someone who will sit and work with someone when I felt like his teacher did not do that.
>
> If I could teach him math from there, he should be [able to learn] in class."
>
> - High School Caregiver

Perceptions of Math

Learning Question:

How do elementary teachers, principals, and caregivers (TPCs) perceive math fundamentals relative to their middle and high school counterparts?

We asked participants to describe their perceptions of math fundamentals relative to their high school counterparts. Throughout the study, a variety of perceptions both similar and distinct arose amongst principals, teachers, and caregivers. First, both teachers, principals, and caregivers discussed the evolving perception of math over time and in this way, there are similarities and agreement about math evolving amongst participants. However, the perception of math instruction provided to students has positively evolved for both teachers and caregivers. Specific examples involved how mathematical fundamentals and concepts were being taught, and the grading of students work when applying those mathematical fundamentals for assignments.

Principals solely discussed that from their oversight role they believe that the perception of how math is taught continues to evolve. They stated that in their role they ensure that teachers and students know that math fundamentals are important, and repetition of these skills is the best way to improve one's abilities. From a teacher's perspective, the evolving perception of math involves prior methods of instruction based off the ability to understand the mathematical concept from the moment it was being taught. Also, the student must perform the steps on a timeline according to core standards of each state whereas that state timeline may be too accelerated for some students. Ultimately, this contributes to a student's negative perception of math. Now, teachers work towards changing the perception of math by allowing math to be seen as a subject that can be relatable, understandable, and applicable to real life. Some teachers include effort-based grading into their curriculum, which allows students to be able to continue practicing their mathematical concepts to achieve the grade they want even if it is after numerous efforts at repeating the mathematical concepts for homework they have. There is acknowledgment amongst teachers that by showing students that math fundamentals can be learned and can be inclusive to those students that require differentiated learning that the perceptions of math can also change based on their individual experiences.

Vertical articulation arose throughout some of the discussions with teachers. Math teachers believe that part of the difficulties that some students may face is due to some teachers who are not fully

aware of the math fundamentals that are being taught in grade levels above and below. Teachers perceive that math is becoming more difficult for students because they are not adequately prepared for more advanced concepts or students do not have a solid foundation of prior grade levels thereby complicating their efforts to understand key math concepts. Some examples involved some teachers stating negative numbers do not exist, and students arrive in classes believing that some numbers do not exist thereby making the instruction of existing teachers difficult. There is a greater need for math teachers to work together and align on mathematical concepts that they must teach according to state regulations but also being aware of potential challenges some students may face by progressing to the next grade under false assumptions.

Principals and teachers acknowledge that their math perceptions do vary depending on their level and tasks and responsibilities at a school. That said, it is important to note that principals and teachers believe that there are areas of math that are not evolving and that remain constant throughout their experiences as educators. Some of the perceptions that remain include that math is perceived as a mystery, as something difficult to overcome, and that the perception of being tested for math brings anxiety, fear, and outright adverse reactions to math. Principals and at least some teachers explicitly mentioned that the standardized testing and high stakes system of math contributes to the negative sentiments they observe from their students. On the other hand, caregivers experience math concepts as evolving, but limit this to the instruction and multiple methods used such as visuals and other activities. In some ways, differentiated learning may contribute to the method of instruction being beneficial if it is used for the caregiver's student and may make positive contributions to math perceptions. Those that experienced differentiated learning often benefit from additional methods of instruction whereas those who are unable to utilize the services do not benefit from differentiated learning. As a result, those students who can take part in the math instruction that has evolved (differentiated learning), the students may shift their attitudes and perspectives towards a subject that has been historically proved to be difficult and more complex relative to other school subjects.