

Math is for Girls: The Unequal Effects of Text Messaging to Help Parents Support Early Math Development

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OVERVIEW

This study assesses the effects of two programs for parents aimed at supporting math development in pre-kindergarten students. Both programs use text-messaging to deliver content. One program focuses purely on math (the “pure math” program), while the other focuses on a combination of math, literacy, and social-emotional skills (the “combination” program). We find no evidence that the math-only program benefits children’s math development. However, the combination program shows greater promise, particularly for girls. When girls’ parents receive the combination program, their daughters — even those who start off the year behind boys in math — make learning gains in math that, on average, allow them to catch up to and even surpass the achievement level of their male counterparts.

BACKGROUND

Starting math instruction early benefits children’s development of math skills. Mastering more advanced concepts such as addition and subtraction is dependent on knowledge of earlier concepts such as number recognition and counting. In fact, math achievement in pre-kindergarten and kindergarten predicts math achievement throughout elementary and middle school. Yet, while parents tend to endorse the notion of supporting early math concepts at home, they focus far more on literacy development than on math development; with some evidence that this preference for building literacy rather than skills is greater in under-resourced and racial/ethnic minority families.

Parents benefit from reinforcement, encouragement, and advice for establishing productive parenting practices. However, most parenting programs have shown only

KEY FINDINGS

- The pure math program had no detectable effects on students’ early math development.
- The combination program had meaningful positive effects on girls. Girls in the lower half of the distribution had particularly large and significant benefits.
- While girls started off the year behind boys in math, the magnitude of the effect of the combination program led them to catch up to and even surpass boys by the end of the program.
- We hypothesize and show some evidence for three potential explanations of differences between outcomes for boys and girls:
 1. Parents of boys may be overconfident in boys’ ability to do math and see less need to practice math with boys.
 2. Parents may respond to a greater perceived interest of girls in math-related activities, although that perception may not correspond to a real difference between boys’ and girls’ interest in math.
 3. While parents may not engage differently based on their child’s gender, girls may be more receptive to math activities because they can regulate emotions and impulses better than boys.
- The structure of behavioral interventions can interact with participants in sometimes unexpected ways to produce meaningful differences in outcomes.
- More research is needed to understand why only girls benefitted from this intervention and how to support boys’ math development.

limited success in helping parents overcome behavioral and informational barriers to supporting their children's growth. Issues of cost and access also make many of the better parenting programs unavailable to those that need them.

Encouragingly, text-messaging interventions for parents have proven to promote behaviors that improve educational outcomes. Most relevant, text-messaging curricula including information, activities, and ongoing encouragement have helped parents support the literacy development of their pre-kindergarteners in the home. These low-cost and scalable programs have been most effective for students with lower pre-intervention literacy skills. We know of no prior study that has assessed the effects of text-messaging programs – or similar low-touch programs – for parents on children's math development.

The effects of math-focused interventions may differ from those of literacy-focused interventions for a number of reasons. First, parents are primed to focus on early literacy, with numerous well-established programs encouraging parents to build their children's early literacy skills. Conversely, parents receive little advice to focus on math. Second, parents may be more comfortable thinking of themselves as teachers of literacy than teachers of math. While early math is likely no more difficult for parents — only requiring a basic understanding of elementary concepts — parents may be more hesitant to engage in math-building exercises. This hesitancy may be due to their own negative experiences with math in school, which may have led to math anxiety. Finally, how parents engage with their children in building math skills may be gender-specific focused more on one gender than the other, because they believe that either the importance of math or the importance of effort for learning math differs by gender.

This study builds on the results of two small pilot studies in California that looked separately at the effects of the math program and the combination program on children's math development. The study investigates whether text-messaging-based programs can help parents improve the early math outcomes of their pre-kindergarteners, and whether there are gender differences in program effects. We compare a pure math program with a combination program, asking whether the pure program will be more successful because it spends more time on math, or, alternatively, whether the combination program will be more effective because it includes both literacy-building activities— which may enhance parental comfort and engagement — and social-emotional learning (SEL)

activities which may enable children to more readily acquire math skills.

THE PROGRAM

Both the pure math program and the combination program were created by our research team and based on the literacy-focused text-messaging program that we first fielded in San Francisco in the 2013-14 school year. Beginning with that initial study, our work has shown that texting interventions show considerable promise, but also that program design matters and impacts results for children. Thus, in our subsequent work — including this study — we have sought to refine our interventions and to understand the mechanisms underlying our results.

Both the pure math and combination programs send three text messages per week to parents over the course of eight months. As in the original literacy-focused program, both programs follow a three-text-per-week "FACT," "TIP," and "GROWTH" approach. A "FACT" text sent on Mondays explains to parents the skill of the week and why it is important. A "TIP" text on Wednesdays provides an easy-to-achieve activity using everyday props and routines to build the skill of the week. Finally, a "GROWTH" text on Friday provides encouragement and reinforcement, and an additional skill-building activity.

SAMPLE WEEK OF TEXTS

FACT: Shapes are all around us. You can help build your child's math skills by pointing out shapes and asking questions about them.

TIP: Look for shapes on the go. Point & say: That house's windows are rectangles. Ask: What shape are the wheels on that car?

GROWTH: Keep pointing out shapes. You're preparing for K! Make it a game. Who can find a circle, square, rectangle, and triangle (like a slice of pizza)?

The contents of the text messages differ between the programs. The pure math program focuses exclusively on building math-related skills. These skills include counting, number recognition, shapes, sorting, patterns, addition, subtraction, and comparisons of size. The combination program covers literacy and social-emotional learning in addition to the math topics, with the topic rotating each week from literacy to math to SEL. Literacy texts build

skills including letter recognition, letter-sound awareness, rhyme-awareness, name-writing, story comprehension, vocabulary development, and establishing high-quality parent-child book reading routines. SEL texts concentrate on identifying emotions, identifying their causes and consequences, and building emotion regulation, perseverance, sharing, and turn-taking. Both programs employ a spiral curriculum — as children grow older and develop, the activities become increasingly more advanced and topics are repeated for reinforcement.

When designing the programs, we drew on the California Preschool Learning Foundation age-specific standards, Common Core standards, and research in academic development and academic-related parenting practices. In each program, our texts aim to support positive parenting practices beyond focusing on specific skills.

THE STUDY

We fielded the eight-month intervention during the 2017–18 school year among parents of preschoolers in three California school districts — San Francisco Unified School District, Oakland Unified School District, and Fresno Unified School District. We asked parents to participate in the program during the pre-kindergarten enrollment process and parents could choose to receive texts in English, Spanish, or Cantonese. Program participants were racially and linguistically diverse, had a range of educational attainment, and reported an average annual household income of approximately \$31,000.

In this randomized controlled trial (RCT), we assigned parents into three equally-sized groups, each with approximately 450 participants. One treatment group received the pure math program, the other treatment group received the combination program, and the control group received a placebo program unrelated to child development or parenting practices — one text message every two weeks containing school-related information such as upcoming events.

We drew on three main data sources for this study. To measure math development, we conducted one-on-one math assessments of each participant in the spring of 2018 covering tasks related to the skills covered by the text messaging programs. We also drew on administrative student records from the participating districts. These records provided data on student gender, ethnicity, and age, as well as fall 2017 scores for each student on a teacher observational assessment that focused on five domains of child development: (1) approaches to learning,

(2) social and emotional development, (3) language and literacy development, (4) math and science, and (5) physical development and health. Finally, we collected parent-specific information on the enrollment forms. These forms include demographic information such as parental education, income, and hours worked, as well as questions about parenting practices.

CONCLUSION

This study confirms earlier findings in our work: texting interventions for parents of young children can produce positive effects on academic development. However, these effects can depend on participant parent and student characteristics. Perhaps, in part because of parents' views of math, math programs do not necessarily lead to benefits for children. In this case, program effects differed depending on student gender, with girls' math development benefitting from the combination program but boys' math development not benefiting from either a pure math or a combination program.

Our hypothesis is that child-parent interactions may differ by gender and cause parents to implement the programs differently. Parents' fidelity to the program may hinge on their perceptions and preconceptions about the academic ability and interest of girls and boys. Boys and girls may also react differently to a prompt to engage in skill-building activities, possibly due to differences in the maturation of executive function capabilities such as self-regulation.

The greater effectiveness of the combination program than the pure math program offers lessons about in-home math learning that may inform how best to design parenting support beyond text-messaging programs. Programs that solely provide math-related information and activities may not be as effective as those that cycle through literacy, math, and SEL topics. Combination programs may keep parents more engaged and build their confidence, allowing those who struggle in one domain to find success in another. Moreover, these domains are not mutually exclusive and may be complementary.

Overall, this intervention was successful in improving the mathematics outcomes for a portion of the sample, confirming that sustained light-touch interventions can help parents change behavior and meaningfully impact child learning. However, more research is needed to understand why only girls benefited from this intervention and how math development of boys can be supported.

Our nuanced results provide some evidence that researchers may benefit from going beyond the application of broad principles about how to impact adult behavior. Attempting to understand heterogeneity in behavioral barriers and then incorporating appropriate responses to this heterogeneity in interventions may yield the best results.

RELATED PUBLICATIONS

York, B. Loeb, S. & Doss, C. (2019). "One Step at a Time: The Effects of an Early Literacy Text Messaging Program for Parents of Preschoolers." *Journal of Human Resources*, 54(3), 537-566.

For a summary brief on research related to our texting programs, please visit:

https://annenberg.brown.edu/sites/default/files/Tbt_Support_Parents_and_Caregivers.pdf