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Intergenerational effects of parents' math anxiety on children's math achievement and  
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**Title: Intergenerational effects of parents' math anxiety on children's math achievement  
and anxiety**

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**Abstract:** A large field study of children in 1<sup>st</sup> and 2<sup>nd</sup> grade explored how parents' anxiety about math relates to their children's math achievement with the goal of better understanding why some students perform lower in math than others. We tested whether parents' math anxiety predicts their children's math achievement across the school year. We found that when parents are math anxious, their children learn significantly less math over the school year and have more math anxiety by the school year's-end – but only if math-anxious parents reported providing frequent math homework help. Importantly, when higher-math-anxious parents reported helping with math homework less often, their children's math achievement and attitudes were not related to parent math anxiety. Parents' math anxiety did not predict children's reading achievement. These findings provide a mechanism for intergenerational transmission of low math achievement and high math anxiety.

**Main Text:** A core goal of the education system is to help students achieve at high levels, both while they are in school and later when they are in the workforce. Although the classroom is usually viewed as the primary vehicle for advancing academic achievement, parents also play an important role in students' academic success.<sup>1</sup> Parents are their children's first and most sustained teachers. But what if parents are themselves anxious about the material their children are learning, as is often the case with math?

Many people have a fear of math, termed *math anxiety*.<sup>2,3</sup> Worldwide, math anxiety is associated with decreased math achievement.<sup>4</sup> Classroom and laboratory studies have revealed a great deal about the bidirectional link between an individual's math anxiety and his/her math performance. Yet, very little is known about how one person's negative emotional responses towards math might relate to someone else's math achievement and attitudes – for example, how

having a math-anxious parent or teacher might affect a child's mathematical success and math anxiety.<sup>5</sup> Here we demonstrate that parents' math anxiety is linked to their children's math achievement and math anxiety, and show how intergenerational effects of low math achievement and high math anxiety may develop.

Parents of young children widely believe that math education is primarily the function of schooling, and that their role in their children's math achievement is not as important as their role in other subjects such as reading.<sup>6</sup> Nonetheless, children may turn to their parents for math help, and/or teachers may ask parents to work with their children on their homework. We reasoned that if parents are math-anxious, their help could backfire, negatively impacting their children's math learning and attitudes. This is a somewhat counterintuitive idea given that parent involvement in homework is generally believed to have positive effects on children's academic achievement. However, this positive relation holds more for verbal subject matter than for mathematics.<sup>8</sup> Indeed, parent math homework help is sometimes negatively linked with students' math achievement.<sup>7,8</sup> Here we consider the possibility that it is specifically parents with high math anxiety whose homework help is negatively related to their children's math achievement. These parents may have inadequate helping skills or rigidly use instructional strategies that conflict with those that teachers use in the classroom, which could confuse children and negatively affect their math learning. Frequent involvement of higher-math-anxious parents with math homework could also create opportunities to communicate their fears about math to their children.

To uncover the relation between parents' math anxiety and children's mathematical knowledge and attitudes, we assessed parents reported math anxiety and frequency of math homework help as well as the math achievement and math anxiety of their 1<sup>st</sup> and 2<sup>nd</sup> grade

children at both the beginning and end of the school year. As a control, we also assessed children's reading achievement. Each child was tested individually within the first three months and the last two months of the school year, with measures of math achievement and math anxiety administered on separate days. We focus on early elementary school because children as early as 1<sup>st</sup> grade experience math anxiety, which is negatively related to their math achievement,<sup>9</sup> and those students who start behind their peers in math skills tend to stay behind throughout schooling.<sup>10,11</sup>

## **Method**

Child Participants. We started with 868 children (469 girls, 399 boys), all of whom participated in a larger study assessing the relation between academic-related affective factors and school achievement. The sample was a convenience sample in which we contacted schools during the fall and recruited as many schools as was feasible. We then tested every child with parental consent who was present at school on the days in which we tested. The first round of data collection ended after the first 12 weeks of the school-year. Of the children tested, we had parent math anxiety and homework help data from 529 (289 girls, 240 boys), and thus considered 529 to be our starting sample for this study. This subsample did not significantly differ from the full starting sample in terms of age, gender, or grade. Further, this sample is representative of the state of Illinois with respect to SES; of the children for whom we have parent data (and thus were included in the analyses in this study), these children came from schools where, on average, 52% of children were on free or reduced lunch and this is on par with what is typical for the state of Illinois.<sup>12</sup> However, as is often the case in studies such as ours,<sup>13</sup> the children whose parents

chose to participate in the study came from higher SES schools (school SES was calculated as the percentage of children who were on free or reduced lunch with a higher percentage corresponding to lower SES). Children whose parents participated came from schools with a mean of 52% of children on free or reduced lunch, children whose parents did not participate came from schools with a mean of 67% free or reduced lunch. While our sample of children with participating parents was statistically higher in SES relative to all of the children that we tested, we nonetheless had a large range of SES schools. Looking solely at the sample for whom parents responded, the SES-level of their children's schools ranged from 0% of the children receiving free or reduced lunch to 97% of the children receiving free or reduced lunch. Given this wide range of SES in our sample and the fact that the SES for our sample is on par with statistics for the State of Illinois, we feel we have captured a representative sample of children.

We removed children who were uncooperative and did not complete tasks as asked (N=21; 4.0 %). We also removed students due to experimenter error during the administration of the Woodcock–Johnson (i.e., basal was not administered properly or children did not get six problems in a row wrong; N=43; an additional 8.1 %).<sup>1</sup> We further removed children who had not completed the assessment of math anxiety in both the Fall and the Spring (N=27). This left us with 438 children (243 girls, 195 boys), mean age=7.21 years, SD=0.62 years. The 438 children whose data were analyzed came from 90 separate classrooms in 29 different schools

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<sup>1</sup> Furthermore, for 3% of included children, ceiling was not properly administered. Proper administration of ceiling is to stop after the child has incorrectly answered 6 problems and has completed the page. For these 3% of children, testing stopped after they incorrectly answered 6 problems but did not continue until page completion. The likelihood that children would have answered any questions correctly after failing 6 is extremely low (2.2%) given our examination of the protocols that were correctly administered. Thus, we chose to include the data from these children in our analyses.

including public (both charter and non-charter) and private schools in three states in the Midwest.

Parent Participants. The primary caregivers of the children that were entered into our analyses all completed the relevant tasks. For simplicity we use the word “parents” to refer to primary caregivers. Of those who identified their relation to the child (N=133), 97% were parents. The others were foster parents (0.8%), grandparents (1.5%), or legal guardians (0.8%). Of those who answered the optional question about their gender (N=127), 89.0% were female.

Teacher Participants. To examine whether parents’ math anxiety and math homework helping behavior were related to children’s learning above and beyond their classroom and schooling environment, we also assessed teachers’ math knowledge and math anxiety and gathered information about school-level socioeconomic status (SES; operationalized as the percentage of children who qualified for free or reduced lunch). The 438 children whose data were analyzed came from 90 classrooms in 29 schools; however, for all analyses involving teacher factors (i.e., teachers’ math anxiety or teachers’ math knowledge) we excluded 14 teachers (and their students) for the following reasons: 2 teachers did not teach their students math, 4 teachers only taught a subset of their students math and this subset changed throughout the school year, 5 teachers did not complete the relevant measures or dropped out of the study, and 3 teachers co-taught their students. This left us with 76 teachers (3 males) and 379 children (211 girls; 168 boys) from 27 different schools for analyses involving teachers. The subset of 379 children who were included in the analyses in which we control for teacher factors did not differ in SES from

our starting sample of 529 children for whom we have parent math anxiety and homework helping data.

### **Materials and Procedure.**

Child tasks. Children completed measures of math achievement, reading achievement, and math anxiety as part of a larger study. All tasks were administered within the first 12 weeks of the school year and again within the final 8 weeks of the school year. Students were assessed at school during one-on-one sessions with an experimenter. The achievement and anxiety sessions were conducted on separate days, typically no more than a week apart, with the achievement test session always administered first.

Math achievement was measured using the Applied Problems subtest of the Woodcock–Johnson III Tests of Achievement.<sup>14</sup> The Applied Problems subtest consists of orally- and visually-presented word problems involving arithmetic calculations of increasing difficulty. A different version of the Woodcock–Johnson test was used for the fall and spring assessments (Version A and Version B, respectively). Reading Achievement was measured using the Letter-Word Identification subtest of the Woodcock–Johnson III Tests of Achievement.<sup>14</sup> The Letter-Word Identification subtest consists of visually-presented letters and words of increasing difficulty. Children are asked to identify the letters and read the words aloud. A different version of the Woodcock–Johnson test was used for the fall and spring assessments (Version A and Version B, respectively). Each child was assessed at school during a one-on-one session with an experimenter. All analyses were performed on students' W scores, a transformation of the students' raw score into a Rasch-scaled score with equal intervals (a score of 500 is the

approximate average performance of a 10-year-old). Because of its properties as an interval scale with a constant metric, the *W* score is recommended for use in studies of individual growth.<sup>15</sup>

Math Anxiety was assessed using a revised version of the child math anxiety questionnaire (C-MAQ).<sup>16,17</sup> The CMAQ-R was designed to be appropriate for 1<sup>st</sup> and 2<sup>nd</sup> grade children and involves 16 items that ask children how nervous they would feel during various math-related situations. Some items directly addressed children's feelings of nervousness while solving particular math problems (e.g., "There are 13 ducks in the water, there are 6 ducks in the grass, how many ducks are there in all?"), while other items addressed their nervousness using more general situations they would experience in the classroom during math lessons (e.g., "being called on by a teacher to explain a math problem on the board"). Children responded by pointing to one of five faces that displayed an emotional gradient. Options included (1) not nervous at all, (2) a little nervous, (3) somewhat nervous, (4) very nervous, and (5) very, very nervous. Scores were averaged across the 16 questions. This scale had good reliability; Cronbach's alpha for the scale was .84 in the fall and .82 in the spring.

Parent Tasks. Parents were sent questionnaire packets, which they completed and returned by mail during the middle of the school year. As part of a larger battery of assessments, math anxiety was assessed using the short Mathematics Anxiety Rating Scale (sMARS),<sup>18</sup> which is a 25-item version of the widely-used 98-item MARS.<sup>19</sup> Parents responded to questions about how anxious different situations would make them feel (e.g., "reading a cash register receipt after you buy something," "studying for a math test") on a scale of (1) not at all, (2) a little, (3) a fair amount, (4) much, and (5) very much. All analyses were performed on the average of the 25 items. Parents also completed an assessment of their homework helping behavior using the

question, “How often do you help your child with their math homework?” and options included (1) never, (2) once a month, (3) less than once a week, (4) once a week, (5) 2-3 times a week, (6) every day, and (7) more than once a day. To obtain a proxy for math achievement, parents were also asked to indicate their highest level of education obtained and to indicate the number of high school and college-level math courses they had taken.

Teacher Tasks. Teachers’ math anxiety and math knowledge were assessed during the middle of the school year. As was the case with the parents, math anxiety was assessed using the sMARS,<sup>18</sup> described above. All analyses were performed on the average of the 25 items. Teachers’ math knowledge was assessed using the Elementary Number Concepts and Operations subtest of the Content Knowledge for Teaching Mathematics measure (CKT-M).<sup>20</sup> This task measures teachers’ facility in using mathematics knowledge for classroom teaching, including the ability to explain mathematical rules, assess the validity of unusual algorithms produced by students, and illustrate mathematical equations using diagrams or word problems. The content areas included addition, subtraction, multiplication, and division with whole numbers and fractions. The task consists of 26 multiple-choice questions. Items that were left blank were considered incorrect. All analyses were performed on raw scores (the number of items correct of the 26 questions).

## **Results**

Child Descriptives: Of the 438 children (243 girls, 195 boys) whose data were included in the analyses, 185 were in 1<sup>st</sup> grade and 253 were in 2<sup>nd</sup> grade. *Math Achievement:* all 438 children completed the assessment of math achievement at both the beginning and end of the year. W scores on the Applied Problems subtest at the beginning of the year for the children in 1<sup>st</sup> grade

ranged from 415 to 501 ( $M=456$ ;  $SD=16$ ) and at the end of the year ranged from 424 to 515 ( $M=469$ ;  $SD=20$ ). W scores on the Applied Problems subtest at the beginning of the year for the children in 2<sup>nd</sup> grade ranged from 411 to 542 ( $M=476$ ;  $SD=19$ ) and at the end of the year ranged from 439 to 581 ( $M=488$ ;  $SD=21$ ). *Reading Achievement*: 437 children completed the reading assessment in both the beginning and end of the year. W scores on the Letter-Word Identification subtest at the beginning of the year for children in the 1<sup>st</sup> grade ranged from 354 to 511 ( $M=434$ ;  $SD=32$ ) and at the end of the year ranged from 389 to 533 ( $M=463$ ;  $SD=27$ ). W scores on the Letter-Word Identification subtest at the beginning of the year for children in the 2<sup>nd</sup> grade ranged from 384 to 539 ( $M=472$ ;  $SD=27$ ) and at the end of the year ranged from 401 to 533 ( $M=486$ ;  $SD=24$ ). *Math Anxiety*: all 438 children completed the assessment of math anxiety in both the beginning and end of the year. Scores on the math anxiety scale at the beginning of the year ranged from 1 to 5 ( $M=2.6$ ;  $SD=0.8$ ), with “1” being “not nervous at all” and “5” being “very, very nervous.” Scores on the math anxiety scale at the end of the year ranged from 1 to 4 ( $M=2.4$ ;  $SD=0.8$ ). The correlation between beginning-of-year math anxiety and end-of-year math anxiety was  $r(438)=.48$ .

Parent Descriptives: *Math Anxiety*: scores on the math anxiety scale ranged from 1 to 5 of a possible 5 ( $M=2.1$ ;  $SD=0.9$ ). *Parent Homework Help*: scores on this scale ranged from 1 to 7 ( $M=5.3$ ,  $SD=1.3$ ). The median level of parent math help did not differ by grade (6.0 for 1<sup>st</sup> graders; 6.0 for 2<sup>nd</sup> graders). Parents ( $N=438$ ) indicated their highest level of education obtained with levels ranging from “Less than high school” to “Graduate degree,” with parents, on average, having completed “An associate's degree or equivalent 2-year undergraduate degree.” A subset

of parents (N=130)<sup>ii</sup> also indicated the number of high school or college-level math courses they had completed, ranging in number from 0 to 9 (M=4.4, SD=2.0). In all analyses, all scale variables were left as continuous variables. Because responses on the parent help question were left-skewed, we transformed the responses by squaring them to normalize the distribution.<sup>21</sup>

The effect of parents' math anxiety at varying levels of parents' homework help

We first asked whether parent's math anxiety related to students' end-of-year math achievement and if, importantly, this relation varied as a function of how frequently parents helped with math homework. Using PROCESS,<sup>22</sup> we tested the interaction between parents' math anxiety and parents' homework help, while controlling for students' grade, gender, beginning-of-year math achievement and beginning-of-year math anxiety.<sup>iii</sup> Overall, the frequency of parents' homework help did moderate the relation between parents' math anxiety and children's end-of-year math achievement as the interaction term was significant [ $f(1,430)=4.59, p=.033$ ]. See Table 1 for the full model.

Table 1:

	Unstandardized Coefficient	Lower CI	Upper CI
Parent Help	-0.16 *	-0.29	-0.03
Parent Math Anxiety	-1.18	-2.57	0.21
Parent Help x Parent Math Anxiety	-0.16 *	-0.30	-0.01
Gender (Girl = 0, Boy = 1)	2.18	-0.30	4.66

<sup>ii</sup> Note that the course information question was only given to 130 parents, as it was added to the end of the parent demographic questionnaire after some parents had already completed the material.

<sup>iii</sup> While it is true that our data are nested within classrooms and schools and that the use of multi-level modelling techniques such as hierarchical linear modelling can address the nested nature of data such as these, in this particular case, our main analysis of interest – the moderated mediation – is conducted using a bootstrapping approach and, to the best of our knowledge, using HLM is not an optimal means of conducting such analyses.

Grade (Grade 1=0, Grade 2=1)	1.56	-1.25	4.36
Beginning-of-year Math Achievement	0.84 ***	0.77	0.92
Beginning-of-year Math Anxiety	-0.86	-2.51	0.79
<hr/>			
df's (7,430)			
$R^2 = .68$			
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Note: \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

At 1 standard deviation below the mean of parents' homework help, there was no relation between parents' math anxiety and children's end-of-year math achievement [95% CI: -1.82 to 2.77] as the confidence intervals crossed zero. In contrast, at 1 standard deviation above the mean of parents' homework help there was a significant relation between parents' math anxiety and children's end-of-year math achievement [95% CI: -4.62 to -1.05] as the confidence intervals did not cross zero. See Figure 1. For ease of interpretation, the DV in Figure 1 is grade equivalent change (end-of-year grade equivalent minus beginning-of-year grade equivalent). A grade equivalent change of 1 unit represents the amount that an average child is expected to grow over the course of an academic year. Further note that the figure plots model estimated growth. Given the continuous nature of our variables, we do not plot specific data points but growth estimates as a function of +/- 1 SD in parent math anxiety and homework help, respectively.

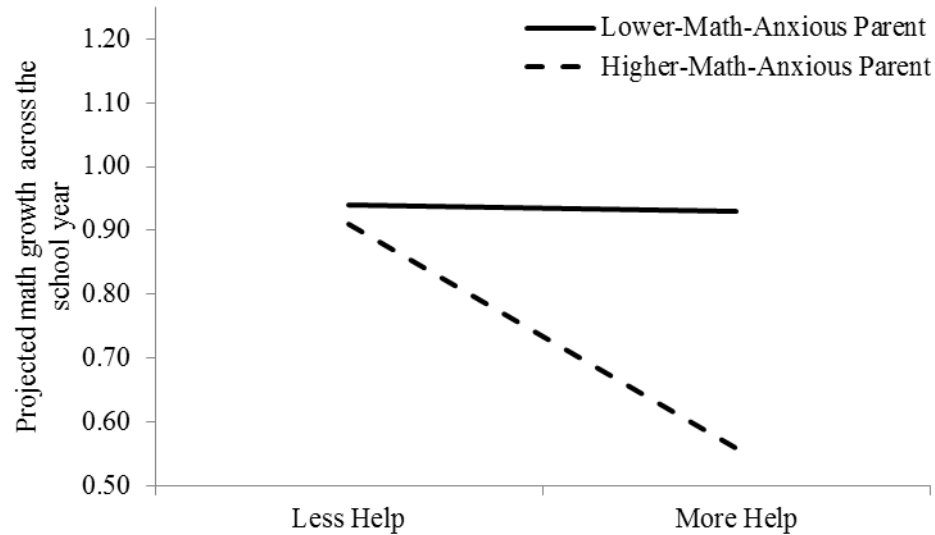


Figure 1: Children's model estimated growth across the school year (grade equivalent change score; end-of-year minus beginning-of-year) as a function of parents' math anxiety and frequency of homework help. Lower- and higher-math-anxiety refer to values at -1SD and +1SD from the mean of parent math anxiety respectively. Less homework help and more homework help refer to values at -1SD and +1SD from the mean of parent homework help respectively. Predicted end-of-year math achievement is controlling for beginning-of-year math achievement and math anxiety, as well as grade and gender. Although analyses were conducted using the W score, for ease of interpretation we present grade equivalent scores in the figure. One grade equivalent unit represents the amount that the average child is expected to learn across a school year.

Importantly, the moderation of the effect of parents' math anxiety on children's end-of-year math achievement by the frequency of parent's homework help is not driven by parents' level of math knowledge. Even after controlling for parents' highest level of education (which we used as a proxy for parents' math knowledge), the pattern remains the same. At 1 standard deviation below the mean of parents' homework help, the relation between parents' math anxiety and children's end-of-year math achievement is not significant [95% CI: -2.61 to 2.41] as the confidence intervals cross zero. However, at 1 standard deviation above the mean of parents' homework help, the relation between parents' math anxiety and children's end-of-year math achievement is significant [95% CI: -3.90 to -.022] as the confidence intervals do not cross zero.

Furthermore, even after controlling for teacher and classroom factors (i.e., teachers' math anxiety and math knowledge as well as school-level SES), the pattern remains the same. The relation between parents' math anxiety and children's end-of-year math achievement is not significant at 1 standard deviation below the mean of parents' math help [95% CI: -1.642 to 3.776] but is significant at 1 standard deviation above the mean of parents' math help [95% CI: -4.874 to -.952].

Also important is the fact that we do not see the same parent math anxiety by math helping behavior interaction when the dependent variable is end-of-year reading W score (rather than the end-of-year math W score). We tested the interaction between parents' math anxiety and parents' homework helping behavior while controlling for students' grade, gender, beginning-of-year reading achievement and beginning-of-year reading anxiety. Overall, the frequency of parents' math homework help did not moderate the relation between parents' math anxiety and children's end-of-year reading achievement [ $F(1,425)=.114, p=.736$ ], indicating that this relation is specific to math achievement.

#### The relation of parents' math anxiety to children's math anxiety

Above we demonstrated that when parents frequently help with their children's math homework, increased parent math anxiety leads to decreased end-of-year math achievement. We further hypothesized that this, in turn, would lead to increased math anxiety in the children. To test this hypothesis, we conducted a moderated mediation analysis using a bootstrapping approach<sup>22</sup>. Specifically, we tested the strength of the indirect path from parents' math anxiety to children's end-of-year math achievement to children's end-of-year math anxiety at three levels of parents' homework helping (1 standard deviation below the mean, the mean, and 1 standard

deviation above the mean) using 5000 bootstrap samples. Overall the mediation of parents' math anxiety and children's end-of-year math anxiety by children's end-of-year math achievement was moderated by parents' math homework helping behavior [95% CI: 0.000 to 0.003] as the confidence intervals did not cross zero. The mediation was not significant at 1 standard deviation below the mean of parents' helping [95% CI: -.021 to .009] as the confidence intervals crossed zero, but it was significant at both the mean of parents' helping [95% CI: -0.001 to 0.021] and at 1 standard deviation above the mean [95% CI: 0.002 to 0.038], as the confidence intervals did not cross zero. In other words, when parents frequently helped their children with their math homework, parents' math anxiety was related to their children's end-of-year math anxiety, and this relation was mediated by the children's end-of-year math achievement. See Figure 2 for the moderated mediation model.

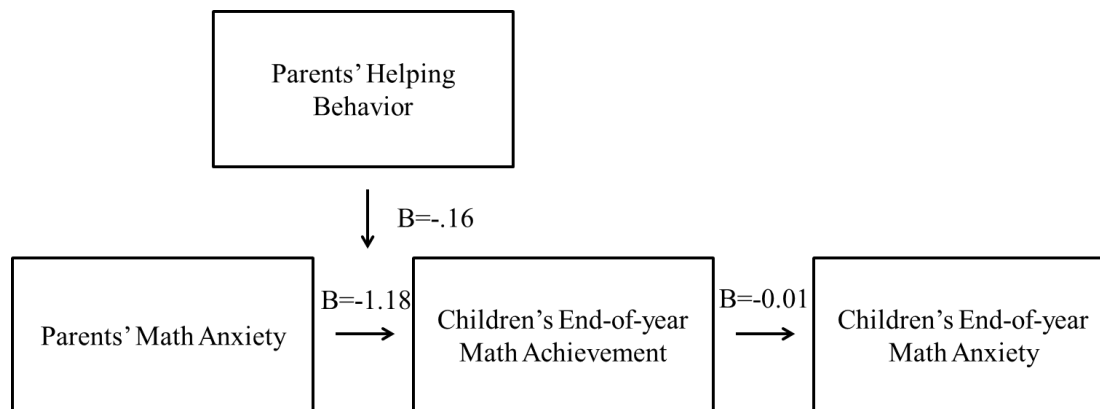


Figure 2: Visual depiction of the moderated mediation model. Values are the unstandardized coefficients for the mean value of parents' helping behavior. Overall the mediation of parents' math anxiety and children's end-of-year math anxiety by children's end-of-year math achievement was moderated by parents' math homework helping behavior [95% CI: 0.000 to 0.003]. The mediation was not significant at 1 standard deviation below the mean of parents' helping [95% CI: -.021 to .009], but it was significant at both the mean of parents' helping [95% CI: -0.001 to 0.021] and at 1 standard deviation above the mean [95% CI: 0.002 to 0.038].

## Discussion

In this large-scale field study we demonstrate that parents' math anxiety is negatively related to their children's math learning across the school year - but only when parents frequently help their child with math homework. The negative impact of homework help by higher-math-anxious parents was specific to children's math achievement, as there was no relation between higher-math-anxious parents' homework help and children's reading achievement. We further showed that this effect persists even after controlling for parents' math knowledge and for school-level factors (i.e., teachers' math anxiety and math knowledge, and school-SES). The fact that parents' math knowledge does not explain our effects is perhaps not surprising given that the math children learn in early elementary school is relatively easy (e.g., adding and subtracting under 20, working with basic shapes, time, and money). Most parents are likely competent in these basic skills and concepts. Nonetheless, even if parents' math ability is playing some role, our main point remains intact: When parents have a poor relation with math and frequently help their children with their homework, their children learn less math.

Importantly, even if parents are competent in the type of basic math 1<sup>st</sup> and 2<sup>nd</sup> grade children encounter, this does not preclude them from having feelings of anxiety when faced with their children's math homework. A case in point is that even reading aloud simple math problems can cause anxiety in higher-math-anxious adults.<sup>23</sup>

How might parents' math anxiety negatively relate to their children's math achievement across the school year? Previous research has shown that higher-math-anxious individuals often express a variety of poor attitudes about math. They tend to believe that math is not useful and have low math self-efficacy and low motivation to succeed in math.<sup>24</sup> Expressing these beliefs could be demotivating to children, likely reducing the amount of effort they invest in math and

reducing the amount of math they learn and remember. As a result of learning less math, these children may then become more math anxious.

Future studies are needed to investigate differences in the homework environment that is created by higher- vs lower-math-anxious parents. It is possible that higher-math-anxious parents convey a great deal of negativity when they help their child with math homework. For example higher-math-anxious parents may express frustration with their child for answering questions incorrectly or for struggling to learn a mathematical concept, and this frustration could be perceived by the child as punishment. Indeed, if the parents themselves have a high fear of failure in mathematics, then they may be more likely to express negativity upon their child's struggling which, in turn, could cause their children to also learn to fear failing in mathematics and to avoid engaging in challenging situations.<sup>25</sup> It is also possible that high-math-anxious parents may be inflexible in the problem-solving strategies that they use. If the strategies taught in the classroom are different from those that parents were taught, then these parents may insist that the child use the strategies they learned long ago, leading to confusion and negative affect in the child. Though understanding the precise behaviors that account for the relation between parent math anxiety and children's math learning across the school year is an important avenue for future research, the first step is to establish that a relation between parents' math anxiety and children's math achievement exists in the first place. To our knowledge, this study is the first to establish this relation.

Given that the large majority of the responding parents in this study were female, as were the majority of the teachers, these data do not afford us the statistical power needed to explore the role of parent/teacher gender in the reported effects. It is possible that the gender of the parent may play a role in the relation between parents' math anxiety and their child's math

achievement when parents frequently help with math homework. While more work is needed to explore this issue, it is important to note that the majority of early elementary teachers (>90%) are female<sup>26</sup> and mothers are more likely than fathers to help with homework.<sup>27, 28</sup> As such, while it is an empirical question as to whether the gender of the teachers and parents play a role, we believe that the pattern reported here applies to the majority of children in this age range.

A consistent message that parents receive from teachers and schools is that their involvement in their children's academics is an important factor predicting their children's school success. However, in the absence of positive math attitudes, parent homework involvement, though well-intentioned, may backfire, negatively impacting children's math growth across the school year and, in turn, children's math anxiety. The fact that this relation is present during the early elementary school grades is consistent with the possibility that the math homework help provided by math anxious parents may play an important but negative role in children's early math achievement, math anxiety, and their long-term academic achievement trajectories. **Error! Bookmark not defined.**

While it is possible that there is a genetic component to math anxiety,<sup>29</sup> the fact that parents' math anxiety only negatively impacted children when they frequently helped them with math homework points to the need for interventions focused on both decreasing parent math anxiety and scaffolding their homework help. Fortunately, adults' math anxiety can be changed.<sup>30,31</sup> Past work demonstrates that adults are able to put aside their math fears to improve their own math achievement.<sup>32</sup> If decreasing parent math anxiety can also translate into more effective homework help, then this help could increase math achievement and decrease math anxiety in their children.<sup>33</sup> While a conservative interpretation of these data would be to suggest that parents' who are anxious about math simply should not help their children with math

homework, another approach is to provide parents with tools to successfully help their children with math homework. These might include structured activities that allow parents to interact with their children around math in positive ways, which could be delivered in the form of math books, computer and traditional board games, or web apps. Parents' homework help could also be facilitated by the provision of tip sheets that provide general guidelines for math homework help and through video models of effective math homework help.<sup>7</sup> With support, higher-math-anxious parents may be less anxious while helping their children with math and be more equipped to positively impact their children's math achievement and math attitudes.<sup>34</sup>

In sum, enhancing students' math performance will not be accomplished by solely focusing on teachers or curricula or simply urging parents to be involved in their children's math homework. Indeed, though well-intentioned, when parents are math anxious, their homework help may backfire, decreasing children's math learning and increasing their math anxiety across the school year. These results shed new light on the importance of parents' math attitudes in their children's mathematical achievement and suggest that many parents need support to effectively help their children succeed in math.

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