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MATH TALK BETWEEN PRESCHOOLERS AND THEIR MOTHERS
DURING A HOME COOKING ACTIVITY

by

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Parenting practices tend to influence young children's cognitive and academic skills development (Gregory and Rimm-Kaufman, 2008). Early forms of academic skills have been thought to be a result from everyday interactions and activities with parents at home, and this is true for early mathematics skills (Anderson, 1997; Tudge and Doucet, 2004). Unfortunately, a gap has been reported in the quality of stimulating interactions in home environments and parenting strategies between low-income children and their more affluent peers which seems to link to the gap in the level of early academic skills (Denton & West, 2002).

The development of mathematical concepts starts to emerge during early childhood from birth to age 5 (Ginsberg & Papas, 2004; Slaughter, Kamppi, & Paynter, 2006; Swanson, 2006). While available studies suggested the importance of parent-child interactions for children's early mathematical skills (Anderson, 1997; Tudge and Doucet, 2004), overall limited number of studies exists on math-related activities between parent and child; moreover, the available studies did not examine specific types of interactions or verbal behaviors that contributed to children's early mathematical skills; rather, they used the frequency of activities as a predictor.

Studies illustrate that American children are less likely to be engaged in mathematical activities compared to literacy-related ones (Graham, Nash, and Paul, 2007; Tudge and Doucet, 2004), and to experience less math activities compared to children from other countries (Pan, Gauvin, Liu, & Cheng, 2006). However, research indicated that children have higher mathematical skills when they had more opportunities to be involved in math-related activities with parents at home (Anderson, 2007; Melhuish, Phan, Sylva, Sammons, Siraj-Blatchford, and Taggart, 2008; Starkey and Klein, 2007). While they demonstrated that the parent and the child often tend to play with mathematics-related objects, or roles, which

contribute to children's math learning (Anderson, 1997), these studies focused on math activities in middle-income families, thus, not much information is available about math activities in low-income families. Further, these studies did not extensively investigate the nature of specific parent-child interactions during a math activity and the relative importance of different types of interactions to children's math development, which may suggest important mechanisms through which parents contribute to early mathematical development. Thus, the current study intends to examine specific types of math-related linguistic inputs from parents to their child and their links to mathematical development of children in low-income families in order to explain learning pathways to early mathematical development of at-risk low-income children.

Variability of Early Mathematical Knowledge Development: The Role of SES

Young children start to develop mathematical knowledge nearly from birth to age 5. As children interact with the world around them, they start to develop everyday mathematics including informal ideas of more and less, taking away, shape, size, location, patterns and position (Ginsburg, Lee & Boyd, 2008). Given the fact that the early skills predict later academic achievement (Duncan et al., 2007), it is important to support children's early mathematical experiences.

Individual variability in young children's mathematical development has been associated with their socio-economic status. A study done by Ginsburg and Pappas (2004) investigated SES differences in children's performance on addition and subtraction and strategies that they utilized in order to complete the tasks. Results show that the upper SES group solved significantly more problems correctly without adult guidance than children in lower or middle SES groups. In terms of strategies that children utilized to solve the problems, in contrast to the performance result, there were rather similarities in the use of strategies among three SES groups. Similar SES gap was found in Jordan et al.'s study (2006) where

researchers investigated growth of children's mathematical knowledge for four times during the kindergarten school year. The results showed that both low-income children and middle-income children progressed at similar rates in all areas other than story problems, but the level of low-income children's mathematical skills were lower compared to that of their middle-income peers. While these studies demonstrated SES differences in math skills, they were not able to present differences in mathematical experiences that contribute to math skills.

Stimulating Mathematical Knowledge

Children's mathematical knowledge can be promoted by the environmental support. Some studies examined the effect of parental support on children's math learning. Research done by Melhuish, Phan, Sylva, Sammons, Siraj-Blatchford, and Taggart (2008) investigated how home environment and preschool settings influence British children's literacy and numeracy development. Children's home and school experiences were measured for those who were underachieving or overachieving; unexpectedly overachieving five-year-old children seemed to have clear learning opportunities (frequency read to, going to the library, playing with numbers, painting and drawing, being taught letters, being taught numbers, songs/poems/rhymes) at both environments.

An intervention created by Starkey and Klein (2000) found effects of parental support for early mathematical development on children's informal mathematical knowledge. The intervention was provided for low-income families whose children were enrolled in Head Start, primarily African-American families and Latino families. Families were offered a family mathematics curriculum through eight biweekly classes and a lending library of math kits for families to use at home. Results showed that children who received intervention developed mathematical knowledge significantly more than those who did not.

Despite the importance of math-related activities for children's mathematical knowledge, young children do not seem to receive enough supports from adults. Tudge and

Doucet (2004) illustrated how young children are engaged in mathematical activities in typical settings and routines. Children were observed for one day to identify the extent to which children were engaged in math-related activities at home and to examine the differences of the extent across ethnicities (White and Black) and social classes. The researchers found that there was a gap between amounts of time children engaged in literacy-related activities and math-related activities. These trends were consistent across ethnic groups and social classes. Similar findings of the literacy versus mathematical experiences were reported in the preschool/childcare studies which examined young children's exposure to mathematics in the child care context and explored activities and interactions that would facilitate children's understanding of mathematics (Graham, Nash, and Paul, 1997).

What counts is not just the frequency of math activities, but also the types of interactions during the activity. Parents can stimulate early math skills everyday from early on by engaging more in math-related interactions with their children at home. Anderson (1997) was interested in parent-child interactions during various activities that support children's understanding of mathematical learning and how parents address mathematical concept to children. Middle-class parents were recruited and provided with materials; but, did not receive any instruction on how to utilize the materials. Parents seemed to employ various types of behavioral and verbal communication strategies that support children's understanding of math. Such strategies included naming the shapes of blocks, naming and counting numbers, or comparing sizes with their children. The author suggested that parents add a significant element in children's mathematical learning experiences considering the variability across homes in the mathematical interactions during the math activity. Similarly, a study done by Klivanoff, Levine, Huttenlocher, Vailjeva, and Hedges (2006) investigated math talk from preschool teachers by audiotaping during the circle time to obtain information on how teachers provide mathematical input to children. This study found the relationship

between the amount of preschool teachers' math talk (not just the number of math activities) and the growth of young children's math knowledge over the course of the school year.

Overall, previous research has shown the importance of quality as well as the quantity of math activities. However, limited studies have addressed which specific types of math talk positively influence children's understanding of numeracy especially for low-income children. It is possible that some types of math-related interactions are more likely to stimulate numeracy development than others. Research of specific math interactions could contribute to designing of research-based intervention of parenting practices for early math skills of at-risk children. Thus, this study attempts to observe existence of various mathematics-related comments of parents during everyday home interactions and examine specific parents' verbal behaviors that predict children's mathematical development in low-income families. For everyday home activities, we will observe home cooking which may include interactions around measuring and counting. The hypothesis is that low-income mothers may provide math talk during home baking although not often and that maternal math talk will be positively associated with children's math skills.

Method

Participants

Current study includes 32 preschool child-mother dyads. The participating children were four-to-five year olds who were attending the Head Start program in Lafayette, Indiana in the fall of 2007-2008 and 2008-2009 academic years. We contacted the potential participants' parents by sending out flyers and meeting them at the Head Start center in Lafayette. The participants were in the low socioeconomic status with various ethnic backgrounds including Latino, White, and African American families. Current analysis used data from English-speaking families.

Procedure

We tested the children's mathematical skills with standardized assessment of Woodcock Johnson test of achievement III (Woodcock, McGrew, & Mather, 2001) at school at the beginning of the school year. At the beginning of the school year, home visits were conducted to observe how parents interact with children on the daily basis in respect to mathematical learning. Parent-child dyads were asked to engage in a baking activity and the interactions between parents and children were video recorded. The recorded videos were coded using the Noldus Observer program following the specific coding scheme created by the research team (Son, Tineo, & Hur, 2009). We coded verbal behaviors of parents and children for task management, behavioral regulation, literacy and math stimulation.

Measures

Child's early mathematical skills. Children's math skills were assessed using a subtest of Applied Problems of Woodcock-Johnson III Tests of Achievement (Woodcock, McGrew, & Mather, 2001). Applied Problems include oral math problem measuring mathematical analysis and practical problem-solving.

Parents' math-related talk. We coded math talk of parents to their preschoolers. The math codes are based on the kinds of informal math concepts found to develop during preschool age including number representation, operation, measurement, and pattern/shape, as reported in the previous research (Ginsburg, Lee & Boyd, 2008). Number representation code consists of math-related conversations particularly related to number symbols and counting objects. Operation code includes verbal interactions that parents or children engage in adding or subtracting activity. Any measuring activities including temperature, time, or amount were coded as measurement. Conversations related to geometry were coded as pattern/shape. See table 1 for more details about the codes.

Table 1. *Definition and examples of math-related code*

Codes	Definition	Examples
Number representation	Identifying number symbols, number symbol to object correspondence (one-to-one correspondence), counting quantity, and rote counting	<i>“Let’s read this. How many is it?” “One, two, three, four, five. Five!” “Bring three cookies”</i>
Operation	Adding or subtracting; identifying which is more or less	<i>“It’s been 5 minutes since we started. We need to bake 15 minutes. How many more minutes we need to bake?”</i>
Measurement	Concept of measurement referring to the amount/time/temperature; measuring amount of ingredients needed, reading or talking about the concept or amount of ingredients	<i>“We need to pour ¼ of cup of water” “You need to pour more until you reach where it says 1” (while pointing to the line on the measuring cup)</i>
Pattern/Shape	Talking about shapes, patterns, positions, direction, distance in space; visual/spatial	<i>“What’s the shape of egg?”</i>

Analysis

I ran descriptive statistics including mean, range, and standard deviation to examine the nature of math talk of low-income parents as part of home interactions. Then, to examine types of math talk that influences children’s mathematical skills, children’s mathematical knowledge was associated with the parent practices using correlation analysis.

Results

The nature of parent math talk

Figure 1 shows the mean frequency of mother and child of total talk, math talk, and each type of math talk. Results showed that out of 128 total utterances ($M=128.47$, $SD=80.49$), parents provided 7 math-related utterances ($M=7.31$, $SD=10.92$). This illustrates that parents use comparatively low amount of math talk during cupcake baking activity.

Among different types of math talk, parents talked most often about numbers ($M= 4.9, SD= 7.34$) and operation ($M= 0.09, SD= 0.30$) than measurement or pattern /shape. Children provided most often about number representation ($M= 5.47, SD=10.00$) and measurement ($M= .60, SD= .98$). The figure demonstrates that both mother and child did not differ greatly in regards to the frequency of math talk as well as each type of math talk. However, child did not engage in any of operation related talk; whereas, mother participated in a few operation talk. Figure1 also shows that mother talked almost twice as much as child talked during the cupcake baking activity.

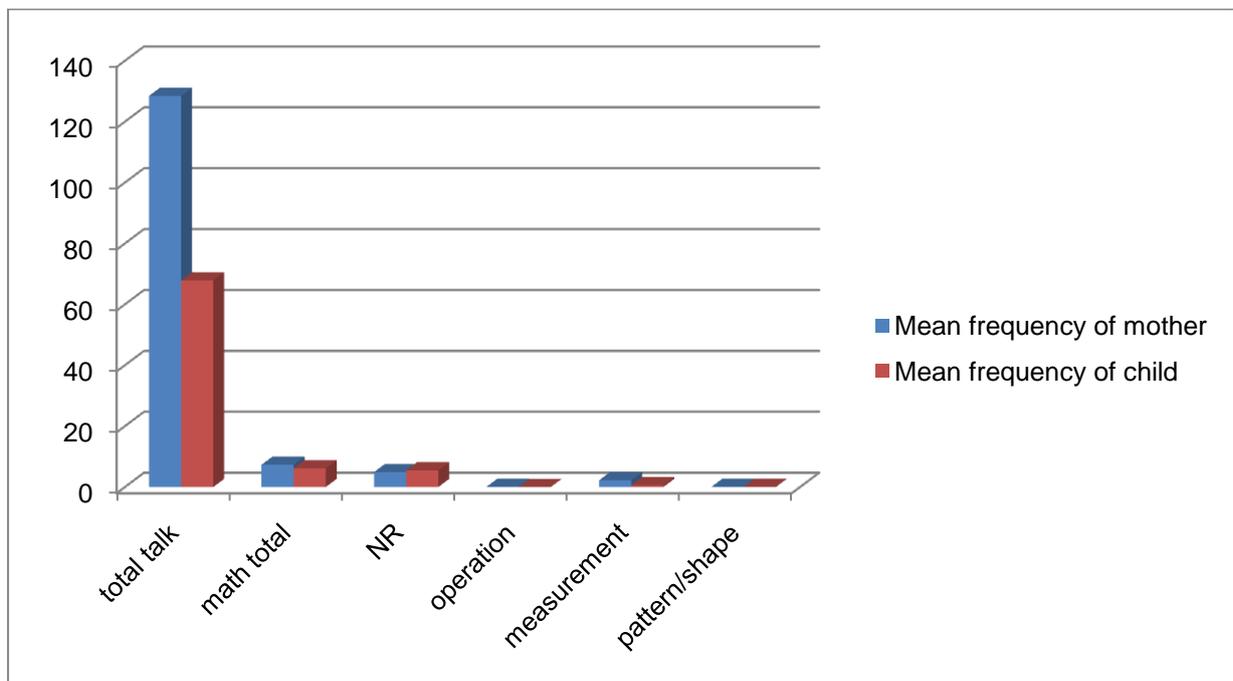


Figure 1 *Frequency of maternal talk, maternal math talk, and child math talk*

Association between math talk and math skills

The results did not support my hypothesis that mothers' math talk will positively correlate with children's math scores. Table 2 shows the correlation coefficients between mothers' math talk and children's math scores. It is interesting to note that mothers' operation

math talk and children's math score was negatively correlated ($r=-.39$ $p<.05$).

Table 2 *Correlations between mother math talk and child's math score*

Variable	1	2	3	4	5	6
1. WJ applied prob	-					
2. Mother total math talk	-.04	-				
3. Mother NR	-.19	.97**	-			
4. Mother operation	-.39*	.54**	.61**	-		
5. Mother measurement	-.24	.89**	.76**	.28	-	
6. Mother pattern/shape	-.19	.03	-.03	-.10	.06	-

Note. * $p<.05$, ** $p<.01$, *** $p<.001$

The correlation between child's math score and each type of child's math talk was run to see if there is association between the two. However, table 3 illustrates that significant association did not exist.

Table 3 *Correlations between child math score and child math talk*

Variable	1	2	3	4	5
1. WJ applied prob	-				
2. Child math total talk	-.10	-			
3. Child NR	-.09	.10**	-		
4. Child measurement	-.12	.56**	.48**	-	
5. Child pattern/shape	-.08	.57**	.51**	.70	-

Note. * $p<.05$, ** $p<.01$, *** $p<.001$

The correlation analysis of maternal math talk and child math talk was run to see if there is association between child math talk and mother math talk. As table 4 shows, each type of math talk was significantly correlated between the mother and the child other than talk about pattern/shape. Interestingly, however, mother total math talk and each type of math talk was not associated with child operation talk. Since children did not provide any operation talk, no correlation coefficients were calculated with this type of talk.

Table 4 *Correlations between child's math talk and mother's math talk*

	Child math talk	Child NR	Child operation	Child measurement	Child pattern/shape
Mother math talk	.84**	.84**	NA	.46**	.39*
Mother NR	.86**	.87**	NA	.39*	.33
Mother operation	.60**	.58**	NA	.47*	.26
Mother measurement	.67**	.65**	NA	.47**	.43*
Mother pattern/shape	-.05	-.07	NA	.25	-.10

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Discussion

Conclusions

According to the results in this study, mother math talk did not positively contributed to child's math scores. However, mother operation talk and child's math scores were negatively significantly associated. This could have resulted because mothers may be more likely to engage in operation talk since their child's math score was low; mothers could have

realized that their child needed support in math that they talked more about operation (addition and subtraction) during the activity.

The results demonstrated that mother math talk and child math talk were significantly correlated. Each type of math talk from mother and child were associated. This suggests that the type of talk that mothers use influenced children's use of math talk.

Implications

This is one of the first research study examining specific types of parental math talk that contribute to low-income children's math skills. Math activities are not as much frequent or ritual as reading activities such as home book reading this it is relatively difficult to observe and measure. This study has shown that mothers' use of math talk has impact on their child's use of math talk; and mothers' use of math talk tended to be depending on child's math skills level.

This study highlights the importance of providing appropriate instruction for parents to better support their child's math development; if parents provide more math talk, this will increase child engagement in math talking which may ultimately help their math learning longitudinally. By providing opportunities for low SES parents to learn about ways to promote their child's math development, the gap between low SES children and their middle class peers may be reduced.

Limitations

There were some limitations on this study. First, there were only thirty two participants, which might have been too small to find significant findings. If there were a bigger sample, there could have been other findings as well as significant correlations between other types of mother's math talk and child math score with more sample power. Second, the cupcake baking activity and testing children's math scores were both done during the fall semester as a cross sectional study. This might have limited the study by not being

able to find causal relations such as children's progress of math skills followed by the cupcake baking activity. If children's math scores during spring semester were used to see the correlation between mother math talk and child math score, the result might have been different; it might be the case that mothers' math talk during cupcake baking activity improved children's math score in the following semester.

Future Research

Future research could further explore longitudinally using children's later math scores to be predicted from maternal math talk, which may make causal inference a little easier. Future research in general can help design an intervention program for parents to better support their child's math development on a daily basis with everyday activities.

References

- Anderson, A. (1997). Families and mathematics: a study of parent-child interactions. *Journal for Research in Mathematics Education*, 28(4), 484-511.
- Duncan, G. J., Dowsett, C. J., Claessens, A., Magnusson, K., Huston, A. C., Klebanov, P., et al. (2007). School readiness and later achievement. *Developmental Psychology*, 43(6), 1428-1446.
- Ginsburg, H.P., Lee, J.S., & Boyd, J.S. (2008). Mathematics education for young children. *Social Policy Report*, 22(1), 3-23.
- Ginsburg, H., & Pappas, S. (2004). SES, ethnic, and gender differences in young children's informal addition and subtraction: A clinical interview investigation. *Journal of Applied Developmental Psychology*, 25, 171-192.
- Graham, A., Nash, C., & Paul, K. (1997). Young children's exposure to mathematics: the child care. *Early Childhood Education Journal*, 25(1), 31-38.
- Gregory, A., & Rimm-Kaufman, S. (2008). Positive mother-child interactions in kindergarten: predictors of school success in high school. *School Psychology Review*, 37(4), 499-515.
- Jordan, N.C., Kaplan, D., Olah, L.N., & Locuniak, M.N. (2006). Number sense growth in kindergarten: a longitudinal investigation of. *Child Development*, 77(1), 153-175.
- Klibanoff, R.S., Levine, S.C., Huttenlocher, J., Vasilyeva, M., & Hedges, L.V. Preschool children's mathematical knowledge. *Developmental Psychology*, 42(1), 59-69.
- Melhuish, E., Phan, M., Sylva, K., Sammons, P., & Siraj-Blatchford, I., Taggart, B. (2008). Effects of the home learning environment and preschool center experience upon literacy and numeracy development in early primary school. *Journal of Social Issues*, 64(1), 95-114.

- Son, S.-H., Tineo, M., & Hur, J. H. (2009). *Measuring everyday learning interactions for school readiness*. West Lafayette, IN: Purdue University.
- Starkey, P., & Klein, A. (2000). Fostering parental support for children's mathematical development: an. *Early Education & Development*, 11(5), 659-680.
- Tudge, J.R.H., & Doucet, F. (2004). Early mathematical experiences: observing young black. *Early Childhood Research Quarterly*, 19, 21-39.
- Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). *Woodcock-Johnson III Tests of Achievement*. Itasca, IL: Riverside Publishing.