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Recommended Citation
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To link to this article: http://dx.doi.org/10.1080/02568543.2015.1073816

Published online: 23 Sep 2015.
A Window Into Mathematical Support: How Parents’ Perceptions Change Following Observations of Mathematics Tutoring

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This research study examined the perceptions of 24 parents of rising 5th-grade students with mathematics learning difficulties as part of a 10-week summer mathematics tutoring experience. During the summer tutoring program, parents observed their children participating in mathematics learning experiences during one-to-one tutoring sessions. At the conclusion of the summer tutoring services, parents reflected on observations of their own children in surveys and interviews. Results indicated that parents’ observations of the tutoring impacted their perceptions and changed the support they provided to their children during and after the tutoring program. Parents reported changes in attitudes and beliefs about mathematics, gaining insights into their child’s mathematical understanding, and changes in their methods and practices as mathematics supporters outside of the tutoring sessions.

Keywords: parents, mathematics, intervention, tutoring

Many parents take an active role in the mathematics education of their children. Parents are involved in monitoring homework, facilitating basic fact practice, providing learning resources, discussing mathematical concepts, providing encouragement, and promoting the application of mathematics in daily living (Abreu & Cline, 2005). Although parents’ influence in the mathematical development of their children is important, many parents express feelings of inadequacy and frustration when doing mathematics with their children (Hoover-Dempsey, Bassler, & Burow, 1995). The difficulties and frustration are even more intense for parents of children with mathematical learning difficulties (Abreu & Cline, 2005).

To date, there has been little research describing methods of providing mathematics support and education for parents of children who struggle with mathematics. Therefore, this study took a unique approach to improving children’s mathematics learning by involving parents more directly in their child’s mathematics learning process. Few parents have the opportunity to watch their children as they struggle to learn mathematics concepts. This study provided such an opportunity. Children with mathematics learning difficulties participated in mathematics tutoring provided by a university-based elementary mathematics tutoring clinic. The purpose of this study was to involve parents in their child’s tutoring by providing parents with opportunities to observe the
tutoring over a sustained period of time (10 weeks). We were particularly interested in gathering information about parents’ observations of their child’s learning, what parents learned about mathematics, what parents observed about the instructional strategies used by the tutor to help the child overcome learning difficulties, and how parents used their observations in mathematics interactions with their child outside of the tutoring sessions.

Parental Involvement

Results of parent surveys indicate that most parents (approximately 90%) believe that success in homework is necessary for success in school and that parents have the responsibility to monitor and assist with mathematics homework (Hoover-Dempsey et al., 1995; Remillard & Jackson, 2006; Van Voorhis, 2011b). Cai, Moyer, and Wang (1999) identified five roles for parents helping with homework: motivator, resource provider, monitor, content advisor, and learning counselor. Additionally, parents are the child’s most frequent model of mathematics in daily life and often use everyday situations to help children understand the mathematics they are learning in school (Civil, Diez-Palomar, Menendez, & Acosta-Iriqui, 2008; Remillard & Jackson, 2006).

The methods parents use to help children with mathematics homework are strongly influenced by the types of experiences parents, themselves, had when learning mathematics (Civil et al., 2008). Research shows that, for most parents, memories of their own mathematics learning focus primarily on the development of procedural skills. As a result, parents tend to focus more on procedural skills than on conceptual understanding when helping their children (Lehrer & Shumow, 1997; Remillard & Jackson, 2006). Parents who believe that schools do not emphasize sufficiently the traditional algorithm often provide additional practice for their child, especially for learning basic mathematics facts (Abreu & Cline, 2005; Civil et al., 2008; Hawighorst, 2005). Research also suggests that students tend to mirror the mathematics values of their parents and that the social value given by parents to specific practices often determines whether the child will accept or resist the way that mathematics is taught in school (Abreu & Cline, 2005). Mathematical experiences and parental values influence the mathematical learning of the child.

Frustrations of Parents

Based on parent surveys, Abreu and Cline (2005) reported that parents find it difficult to teach mathematics at home. Parents’ strong feelings of stress and frustration are themes that emerge in a number of studies (Civil et al., 2008; Ginsburg, Rashid, & English-Clark, 2008; Lange & Meaney, 2011). This research identifies two main causes of frustration: (1) parents’ lack of mathematical abilities and (2) differences between instructional methods parents experienced when learning mathematics and methods used by their children’s schools for teaching mathematics.

Parents who lack the mathematical understanding necessary to help their children may feel their role as parents is threatened by their inability. In one study, researchers reported that parents felt embarrassment and that they had failed in their parental role as providers when they had to ask others to help their child (Ginsburg et al., 2008). As a result, a number of the parents sought to improve their skills by studying their children’s textbooks, observing in the classrooms, and participating in parent education classes.
The second main source of frustration stems from gaps between “new” and “old” ways of learning mathematics (Abreu & Cline, 2005; Civil et al., 2008; Ginsburg et al., 2008; Remillard & Jackson, 2006). Reforms in mathematics education support theoretical perspectives such as constructivism and conceptual development, philosophies that are very different from focusing on rote learning of skills and procedures (Abreu & Cline, 2005; Remillard & Jackson, 2006). Parents who are weak in mathematics encounter difficulty when their child’s homework is different than the homework they experienced during their own schooling (Ginsburg et al., 2008), and when the mathematical terminology used by teachers is different from the language they learned (Abreu & Cline, 2005; Hoover-Dempsey et al., 1995; Remillard & Jackson, 2006). Parents struggling with these differences report feelings of disempowerment in their child’s mathematics understanding development (Remillard & Jackson, 2006).

Parents of Students With Mathematical Learning Difficulties

Parents of low-achieving students have more difficulty than parents of high-achieving students in bridging the gap between new and old ways of learning mathematics (Abreu & Cline, 2005). This is because high-achieving students may be able to work on mathematics independently, whereas low-achieving students struggle and need help from a parent. When a child explains basic concepts, new language, and new strategies to the parent, the differences between reform and traditional mathematics instruction put the child in the negotiator position between home and school. When the child is not able to negotiate due to low achievement, it is much more difficult for parents to learn the new language and strategies needed to support their child’s mathematical development. The parents have only their own learning to act upon and therefore tend to take on actions similar to those of their past teachers. The result may be mathematical trauma, which occurs when (1) the child is unable to do the homework, (2) there is conflict between parent support and what the student learned in school, and (3) parent support is “beyond what the child is capable of following” (Abreu & Cline, 2005).

Research Projects Designed to Support Parental Growth and Understanding

Although educators advocate parents’ involvement in the mathematics education of their children, research describing this involvement is limited (Abreu & Cline, 2005; Ginsburg et al., 2008; Remillard & Jackson, 2006). Some suggest that parents have been ignored in mathematics reform efforts and were even considered by some to be a “stumbling block” to reform (Peressini, 1998; Remillard & Jackson, 2006). However, this trend recently has begun to shift, and the vital role parents play in the development of their children’s mathematical learning has begun to be acknowledged. There have been calls for research describing the attitudes of parents and the development of effective methods of supporting parents in this role (Peressini, 1998; Remillard & Jackson, 2006). Research has focused on two types of programs: interactive homework and parenting classes.

Interactive homework typically contains detailed and informational instruction to parents and involves the parents and children in interactive activities and games. Muir (2012) surveyed parents who had participated in an early childhood numeracy program consisting of weekly packets focusing on numeracy. Survey responses indicated that parents developed understanding about
the reform methods being used for mathematics instruction. In a 2-year study of the effects of interactive homework, VanVoorhis (2011a) found that parents became more involved in and more positive about their children’s homework and students scored higher on standardized tests than they had previously. Similarly, Lehrer and Shumow (1997) found that the use of weekly newsletters containing ideas for practice activities positively affected student achievement.

Other studies have focused on educating parents through parental classes, observations, and school parent partnerships. Approximately 170 parents participated in the Math and Parent Partnerships in the Southwest (MAPPS) Project on leadership teams. As part of the leadership teams, parents participated in a series of mathematics workshops, observed classrooms, and assisted in teaching Math for Parents workshops at their schools (Civil & Bernier, 2006; Civil et al., 2008). Although their own learning had been more traditional, parents valued the development of conceptual understanding, the use of manipulatives, and inquiry-based pedagogy (Civil, Bernier, & Quintos, 2003). Muir (2011) used a “Maths Club” model to offer three 1-hour workshops for parents addressing current mathematical practices and pedagogy used in teaching numeracy, algorithms, tables, and mental computation. These recent research projects show that supporting parents results in positive effects on parental involvement, attitudes, and knowledge, and improved student gains (Sheldon, Epstein, & Galindo, 2010).

This Study

In this study, we took a different approach to involving parents in their child’s mathematics learning by providing parents with opportunities to observe their child learning mathematics during one-to-one tutoring sessions over a sustained period of time (10 weeks). Parents had the opportunity to observe mathematics instruction based on reform methods and practices, discuss the instruction and progress of their child with the intervention instructor, and observe the development of their child’s mathematics understanding in response to the intervention activities. The main areas of interest in the study were parents’ observations of their child’s learning, what parents learned about mathematics, what parents observed about the instructional strategies used by the tutor to help the child overcome learning difficulties, and how parents used their observations in mathematics interactions with their child outside of the tutoring sessions. The research questions that guided this study were:

1. What did parents observe concerning how their child learns mathematics?
2. What did parents learn about mathematics and about how individuals learn mathematics?
3. What did parents observe about the instructional strategies used by the tutor to help the child overcome learning difficulties?
4. How did parents use their observations in mathematics interactions with their child outside of the tutoring sessions?

METHOD

Participants

The 24 participants in this study were the parents of 25 children participating in free summer mathematics tutoring sessions provided by a university-based mathematics education tutoring
clinic that specialized in mathematics intervention and enrichment. Mothers and fathers regularly brought their children to participate in the mathematics tutoring sessions and observed the tutoring sessions. These participants were all the legal parents of the children (not their guardians). Among the parents, 41.7% reported high school as their highest level of education, 50% reported having obtained undergraduate degrees, and 8.3% held a graduate degree.

The children of these parents were rising 5th-graders and were referred to the mathematics clinic by classroom teachers who identified the students as having mathematical learning difficulties. Of the children participating in the tutoring, 43% were female and 56% qualified for school free-lunch programs. Seven of the children had received special education services for mathematics during the prior school year.

Instruments

There were two instruments used to collect data during the study: an anonymous open-response parent survey and parent phone interviews. The survey instrument contained 18 items designed to collect four types of data: (1) parents’ background and academic experiences in mathematics, (2) observed methods and practices, (3) parent and perceived child attitudes and beliefs about mathematics, and (4) insights about the child’s mathematical understanding. One example of a survey question in the second category was, “How has the observation of your child during tutoring affected how you think about mathematics?” (Q 11). One example of a survey question in that fourth category was, “What insights have you gained through your observations about the manner in which your child learns?” (Q 15). The entire survey appears in the Appendix. Questions on the survey were developed by researchers and were guided by the comments and questions from parents to the tutor during the first 5 weeks of the tutoring sessions. Mothers and fathers of the children being tutored completed the surveys.

The phone interviews were guided by a five-question protocol that asked follow-up questions based on the survey responses. These questions asked parents about the short- and long-term benefits of the tutoring, parents’ attitudes toward mathematics, and characteristics of the tutoring program that would make parents more likely to continue tutoring services for their child during the school year. Questions for the interview protocol were developed by researchers based on results from the surveys, and unscripted follow-up questions were used by the interviewer to probe for detailed information and examples based on parents’ responses.

Setting

All tutoring sessions were conducted in a clinical setting by an instructor with a PhD in mathematics education, more than 25 years of elementary teaching experience, and research experience in working with mathematics intervention and students with mathematical learning difficulties. The clinical setting was housed in an early childhood education research center located on a university campus. The research center was a state-of-the-art facility built in 2010 with resources that reflected the current education research methods. The clinical teaching laboratory rooms used in this study were equipped with two-way mirrors, audio observer booths, and built-in video cameras. The audio observer booths allowed parents to observe and listen to all of the tutoring
sessions without being in the room with the child. This allowed the instructor to focus on teaching, the child to focus on learning, and the parent to focus on the teaching and learning interaction between the tutor and their child. The clinical teaching labs had wall-mounted video cameras that allowed all tutoring sessions to be recorded and digitized. Videotapes of the tutoring sessions were electronically protected and accessible only by approved researchers. The videos captured by the wall-mounted cameras were available through a password-protected website accessible only from researcher computers housed in the research center building.

Procedures

A total of 41 rising 5th-grade students were recruited and participated in a free summer tutoring program provided by the university’s mathematics clinic. Twenty-four adults, parents of 25 children participating in tutoring, agreed to participate in this study. During the summer tutoring, each parent observed one preassessment session, seven to eight 1-hour tutoring sessions, and one postassessment session (an average of 9.6 hours of mathematics tutoring and assessment).

During the sessions, the children were in the clinical teaching lab room learning mathematics with the instructional tutor. Parents were in the clinical observation room observing the interactions of the tutor and their child and wearing headphones so that they could hear all of the auditory interactions during the sessions. Parents observed mathematics tutoring sessions focused on the procedural and conceptual understanding of basic operations (e.g., subtraction, multiplication, and division), fractions, and number sense.

During the final week of the tutoring sessions, in which the children were completing postassessments, parents who had agreed to participate in the study completed a 19-item written survey. Most of the parents completed the survey while their child was completing the postassessment (21 parents), whereas a few other parents completed the survey at home (three parents) and returned it to the researchers.

After the parent surveys were collected, researchers conducted an initial review of parents’ responses. Based on this initial review, questions were constructed to gather follow-up information based on the survey findings. Researchers created five main questions to ask parents during in-depth phone interviews with four parents. The phone interviews were conducted 2 weeks following the final tutoring session by a member of the research team who had not met the parents and who was not a mathematics instructor during the summer mathematics tutoring experience. Four mothers participated in the phone interviews. Parent phone interviews were used to add detail and clarity to the responses on the surveys. The interviews were open ended using a set of structured questions to guide the discussion between the interviewer and the parents. Based on the interview responses, the interviewer asked follow-up questions asking for clarification and extension of parents’ responses. Each interview lasted between 8 and 13 minutes.

Data Analysis

The written survey and telephone interview data were analyzed using qualitative methods, including thematic analysis (Patton, 1990) and open and axial coding (Strauss & Corbin, 1990). Data were examined for common themes, central phenomenon, and variations in parents’ responses.
The open-ended survey responses where digitized and then examined initially using open coding methods (Charmaz, 2006; Strauss & Corbin, 1990). Researchers began by looking for and coding emerging salient themes within responses to each individual question. Some survey questions elicited direct and similar responses from parents that were easily grouped and coded by simply deciding if the response was of one type or another. Other survey questions produced complicated responses that were coded multiple times for varying layers of complexity (Strauss & Corbin, 1990). Axial coding was then used to examine the relationship of individual question coding systems to one another. This stage revealed that several survey questions (Qs 6, 7, 8, & 11) had produced very similar responses that pointed to key phenomena of the study. Causal conditions between responses were also examined to determine if a participant’s response on one question was likely to produce a predicted response on another question.

Central phenomena that emerged from the written survey data informed the development of the analysis protocol for the telephone interview data. Telephone interviews focused on parents’ perceptions and were used to add detail and clarity to the survey themes. A formal analysis of the interview data was conducted using the practices of thematic analysis (Patton, 1990) appropriate for use with transcription analysis suggested by Burke and Miller (2001). These stages included (1) the review and generation of initial pattern coding by individual researchers and (2) theme naming and defining performed by the researchers together, which compared interviewee responses and individual researcher codes with the goal of organizing the data into systematic categories.

During the first stage, two researchers reviewed the interview transcripts separately seeking recurring themes. When two similar comments were found, a matching numerical code was given to the comments. Any comments with a similar theme found later in the documents received the same code. During this stage, data reduction occurred as the data were reduced to segments of text identified by theme (Patton, 1990). Stage 2 occurred after the transcripts had been coded by theme and involved both researchers comparing their transcript codes. During this stage, researchers engaged in data complication as they reconceptualized the data and made inferences about how the comments were connected (Patton, 1990). All but two of the coded transcript sections had been assigned similar codes by the researchers. After discussion, the two comments that had been coded differently were recoded as agreed upon by both researchers. After interviewing 15% of the participants and coding their interviews, it was determined that a level of saturation had been reached; all interviews seemed to produce similar responses supportive of survey findings, and it was likely that additional interviews would provide no further insight into the themes being studied (Strauss & Corbin, 1990).

RESULTS

Responses from the telephone interviews and the written surveys were found to directly inform three central themes concerning the influence observing their child’s tutoring sessions had on the mathematical support parents provided to their children. A thematic analysis of the data is presented below based on these three observation influences: (1) changes in parental attitudes and beliefs, (2) parental insights concerning their child’s mathematical understanding, and (3) changes in parental methods and practices (see Figure 1).
When asked about their feelings toward mathematics, 58% of the parents expressed negative feelings. Of these parents, 48% specifically stated that mathematics was their “least favorite” subject, and 30% described the difficulties they had doing mathematics even when not prompted for an explanation. One parent’s response illustrates parents’ overall negative feelings toward mathematics, “It stressed me out—Horrible experience” (SP 7). However, a surprising number (30%) of the parents who reported disliking mathematics also reported now successfully using it every day to complete job responsibilities or in daily family activities. One parent reported, “Not one of my favorite subjects! I do use it a lot now—running a household. [I’ve] used more math than I thought” (SP19).

When asked why they believed so many parents have negative feelings toward mathematics, parents gave two explanations: (1) the perceived inherent difficulty of mathematics and (2) the way in which they were taught mathematics:

I think that it’s because people tend not (to) like things that they find difficult. . . . I think that most people find math a little bit more difficult. It’s more rigid and I think that math teachers get into one set way of teaching something and it doesn’t necessarily translate to all or even most of the kids. (IP 3)

Only 25% of the parents reported that they enjoyed doing mathematics. One parent reported, “[I] love it!! We paint parking lots and use math A LOT for measuring of 9 ft stalls, how many in 500 ft., 90 degree angles, angled parking. Use math daily” (SP 21).

Interestingly, overall 50% of the parents reported they frequently use mathematics even if it wasn’t something they enjoyed studying academically. “It was a least favorite subject, but I use it a lot now and believe I would now have the foundation to learn more” (SP 1).

When asked during the interviews if they felt their attitudes toward mathematics affected their child, parents were mixed in their opinions. Some parents indicated that students reflect the parents’ attitudes and that those attitudes can have a positive or negative influence. One mother explained:

I have a sister-in-law that likes math. (Her) kids like math as well. You don’t ever hear them say, “I hate math” because their mom is always saying, “I’m good at math. I love math and you use it all the
"... time." Then I’ve got another sister-in-law [that says,] “Ugh . . . I hate math . . . you don’t ever need to use it.” I see their attitudes in their kids. I hear them say it and then I hear their kids say it. It’s so frustrating that they don’t understand what a big deal it is. (IP 1)

Other parents explained that their attitudes, negative and positive, did not seem to have influenced their children significantly. Several parents explained how some of their children loved mathematics whereas others did not. Others explained how opposite their child’s attitude was from the parents’ attitudes. One mother commented:

It’s hard to convey that [attitude] to our kids. It’s hard to tell them why we think math is great and why we think it’s cool. They just think we’re nerds. When I think of our kids, I think, “Gosh, come on. Genetically [they had] to pick up something!” (IP 4)

From this parent’s explanation, it can be observed that some parents have an underlying belief that attitudes toward mathematics are inherent within the child—that children are genetically born with mathematics abilities and a predisposition to either hate or love mathematics. Perhaps partially because of this belief, parents’ observations of their children having fun and positive experiences during mathematics tutoring activities were their most notable observations. This insight, reported by 50% of all parents in 22 separate comments across multiple questions, was the most often identified tutoring characteristic by parents. Another insight reported by 23% of parents focused on changes in parents’ beliefs that mathematics could be understandable and meaningful for their child. Three parents’ comments illustrate these changes, “It not easy for everyone but there is always a way to do math and to understand it” (SP 7), “[I realized that] when you break down the concept [as the tutor did] it is not that overwhelming” (SP 15), and “Math and games never seemed to go together, but the tutor showed how almost any game could teach a math concept!” (SP 24).

Other attitude changes described by parents were that they themselves developed a greater appreciation for mathematics, a stronger understanding that children learn differently, and a desire to improve their own understanding of mathematics.

When asked what changes they observed in their child’s attitude towards mathematics, 37% of parents responded during the written survey (on 30 occasions) that their child was more confident. A parent of twins commented during a phone interview that the enjoyment and confidence her children felt during the tutoring sessions has carried over into some of their mathematics during the school year, “I’ve seen a couple of times when they’ve figured it out and I’ve said, ‘See you can do it!’ and they’ve smiled, which is usually unheard of when we’re working with math” (IP 2).

Parents also reported that their child had learned to enjoy doing mathematics more (27%) and had developed more positive attitudes toward mathematics (7%), were more willing to work on mathematics problems (17%), and would work harder to find solutions to mathematics problems (13%). In a follow-up interview, one parent described the change she had observed:

In fifth grade she seems to be doing . . . she seems to be approaching her math homework a lot better. She has not burst into tears telling me how difficult it is even once this year. I think that a lot of that is because of the help over the summer. (IP 3)

The results of parents’ responses concerning attitudes toward mathematics points to the need for a tutoring experience to be a positive experience for the parent and the child. Many of these parents, presumably because of their own experience in learning mathematics, had developed negative attitudes toward mathematics. Yet as a group, these parents acknowledged the importance of
mathematics in daily life. And, as demonstrated by their action of scheduling, transporting, and observing their child during tutoring sessions, the parents wanted their children to be successful in mathematics. Observing the positive changes in their child’s attitude appeared, for some parents, to be a catalyst that changed their attitudes, specifically their belief that learning mathematics can be positive and even enjoyable.

Insights Gained Concerning Their Child’s Mathematical Understanding

When asked what they learned about their individual child’s level of mathematics knowledge by observing the tutoring sessions, 54% of parents reported learning their child was really behind in mathematics. All students who attended the summer tutoring were referred by classroom teachers because they were falling behind their peers in mathematics, yet prior to tutoring parents seemed to have no idea how far behind their children were or what “being behind” meant: “[I learned that] she was struggling and not confident in her abilities more than I knew” (SP10), “I didn’t realize she really didn’t understand some very basic concepts” (SP17), and “They had some earlier gaps, I was not aware of” (SP 18).

Parents also reported becoming aware for the first time of mathematical difficulties their children encountered such as a lack of confidence (17%) and confusion or frustration (26%). When asked to report what they observed as their child’s typical behavior during the tutoring sessions, parents reported an overall lack of confidence in this way, “She hesitates and looks to the tutor for confidence, once she gets it she’s happier” (SP 11) and “She is very quiet—she doesn’t want to say the wrong answer. She likes to be given clues or help solving” (SP 10). Parents also recognized several other difficulties their child experienced during mathematics, such as getting easily side-tracked (9%), guessing when they didn’t know (9%), and an inability to do simple problems (17%).

However revealing the tutoring sessions were concerning children’s current ability, parents did not feel that being behind was something that their child couldn’t overcome. More than 42% of parents were surprised at how much their children progressed during the sessions and that their child exhibited more ability than they had assumed possible while working with the tutor. One parent commented that her son had made so much progress that he’s “not mad at mom anymore” (SP 2). Another parent expressed, “He has a long way to go, but he’s making tremendous progress” (SP 6). A third commented, “She had fun and didn’t cry” (SP 13). The renewed hope for their children’s mathematical success was evident in parents’ responses.

When asked what insights they gained concerning how their child learns mathematics, 52% of parents reported coming to understand how important physical and pictorial representations were as a support for children’s mathematical thinking, “He does better with hands-on, tactile examples of methods for performing math operations” (SP 14), “She is a hands-on learner—when she can see it and manipulate it—she learns it” (SP19), and “They learn more easy through objects, seeing, touching” (SP 4).

The insight that learning mathematics could be enjoyable for their child was identified in 38% of parents’ responses. In a parent interview, one mother commented that prior to the summer tutoring, her daughter “was very adamant about the fact that she did not like math.” However, after she met the tutor and engaged in some of the games and activities, the mother found that within minutes “she had fun with it, which I think is amazing!” (IP 1). Another parent commented on the survey that her son “typically hated working on his math homework, but [during tutoring] he was engaged the whole time” (SP 14).
Changes in Methods and Practice

To determine their involvement level, parents were asked how often they typically helped their child with mathematics at home. Fifty percent of the parents reported helping their child daily, 25% helped weekly, 13% only occasionally, and 12% did not respond to the question. Parents also reported that, during the school year, they engaged in three types of mathematics activities at home: assisting their child with homework assignments, checking their homework when completed, and flash card practice.

The activities parents did during summer tutoring were different than what they did during the school year. There were 39 responses written by parents that described types of activities parents did to help their child during the summer months. These activities included computer support (16%), discussion of mathematics concepts (18%), fact practice (15%), playing mathematics games (15%), supervision of homework (18%), and additional practice of concepts learned in the tutoring sessions (18%). The addition of computer support and playing mathematics games can be attributed to homework suggestions given by the tutor. Students were introduced to websites (see, e.g., nlvm.usu.edu) and games (see, e.g., Moyer & Bolyard, 2003) during the summer tutoring sessions and were encouraged to engage in these activities throughout the week. Parents had observed the games and website activities, already knew the rules and procedures, and could easily replicate the activities at home.

Parents also reported engaging in two additional activities not directly encouraged by the tutor: discussion of mathematics concepts and providing additional practice of concepts. Unlike school-assigned homework when parents are typically dependent on their child to communicate what was taught in the classroom, parents observing the tutoring sessions knew which concepts had been addressed and which strategies their child had been successful in using. These observations made it possible for parents to initiate discussions about the concepts being studied and to extend the learning of concepts into other settings. Survey results suggest that observation of the child’s tutoring tended to broaden parents’ involvement in their child’s mathematical learning.

Similar to participants in other studies (Civil et al., 2008; Ginsburg et al., 2008; Lange & Meaney, 2011), many of the study participants described frustrations experienced during the daily routines of working with their child, when practicing mathematics facts, and when completing homework. How parents teach and assist their child is typically a reflection of their own school experiences. When those methods fail, parents who do not have alternative methods may either give up helping the child or repeat unsuccessful methods over again. This causes frustration for the child and the parent. Observing their child in the tutoring sessions allowed parents to step back from what can be an emotional situation and to focus on how their child responds to instruction and recognize new mathematical approaches. Responses related to how observing tutoring influenced parents’ teaching methods at home were aggregated into two themes: learning environment and effective methods.

Learning environment. Many of the parents who commented about homework (62% of those) described their desire to make homework experiences more positive for their child. One parent stated, the tutor’s “patience, guidance, and positive encouragement of our child reminded me of the importance of keeping it positive” (SP1). Parents observed that when students were having fun, they were more engaged in the activities (SP 19); and 62% of participants used the word fun to describe the tutoring environment they found so effective. In a positive environment,
“The mathematics concepts didn’t seem to be so hard for [one student] to learn” (SP 3) and engaging in mathematics was no longer “scary” for another (SP 10). Other parents indicated they had become more patient with their child’s mistakes. One parent explained, “I don’t get angry with my child any more for not getting it right off the bat” (SP 2). Another wrote that in the tutoring sessions, “He’ll let his guard down and be okay about making mistakes and not feel like he is stupid” (SP 6). The expressed desire to make learning experiences more positive suggests that observing the tutoring sessions gave parents the opportunity to evaluate their homework interactions and to plan changes for improvement based on the successes they witnessed.

Effective methods. Parents made 31 comments describing five different methods or approaches they felt would be helpful as they worked with their children. Even though these parents were not specifically told that the tutor was using reformed methods of mathematics instruction, the methods parents identified are important components of reform practices. Parents also described the importance of these methods for learning and expressed a desire to incorporate the practices when working with their child.

The method most commonly mentioned was using multiple strategies (39% of the 31 comments related to strategies). These comments referred to trying different approaches when their child didn’t understand (SP 14) and encouraging children to use a variety of strategies when problem solving (SP 1). One parent said she learned “to approach things with more than one method, especially if he (her son) is having a hard time grasping the concept” (SP 24).

The benefits of using visual representations and physical manipulatives were described in 23% of the methods responses. Money, base-10 blocks, and fraction circles were the concrete manipulatives most commonly used in the lessons. During telephone interviews, 50% of parents stated they had begun using more physical and visual representations as a result of their observations and had found this approach to be successful. Comments describing the use of representations were found in responses to a number of the survey questions; it appeared to be a new and powerful idea to many parents. One parent said, “Math is not as difficult if you can see the problem visually. It makes more sense” (SP 22). Another lamented about her own education, indicating that if she had been taught using representations, she “may have done better with that too” (SP 7).

Using games and engaging activities was a method described in 19% of the methods-based comments. One parent (SP 19) expressed that she or he had never thought of games and mathematics as going together and was surprised to discover that games could be used to teach almost any concept. Another parent (SP 3) observed that the mathematics didn’t seem as hard for the child when it was presented in game format. Also described by parents (13% of methods-based comments) was the effectiveness of breaking difficult concepts into smaller subconcepts. Parents observed that their child was not as overwhelmed when the new ideas were presented in small amounts (SP 10). One parent explained:

She (the tutor) broke down the math problems into pieces and worked with her on each piece. We took that approach. We focused on her rounding or estimating [when dividing] instead of just sitting her down in front of a whole huge problem and saying, “OK. Do this.” (IP 3)

The final method identified by parents was encouraging their child to talk through their thinking (6% of methods comments). One parent reported she liked seeing how the tutor taught by dialoguing with children about their thinking (SP 19). Another parent explained, “I need to have
them dialogue what they are thinking. I need to sit back and let them think more before I jump in” (SP 18).

In summary, as was observed in other studies (Abreu & Cline, 2005), the parents involved in this study took an active role in the mathematical education of their children by helping them with homework and fact practice. Parents participating in the observations did additional activities, such as providing computer support, discussing concepts studied, playing mathematics games, and providing additional practice opportunities. Parents developed a greater appreciation for the benefits of positive learning environments and observed the effectiveness of using multiple strategies, engaging activities, dialogue, and physical and pictorial representations (see, e.g., Moyer, 2001). They observed that when their child struggled with difficult concepts, breaking the concepts into sub concepts made it possible for the child to master the larger concept.

DISCUSSION

This study provided a unique opportunity to identify and describe the changes that occurred in parents’ attitudes and beliefs, the mathematical insights parents gained concerning their child’s mathematical understanding, and the changes that took place in parents’ methods and practices as they observed the tutoring of their child. Although the importance of parent support is generally acknowledged, to date there has been little research as to how that influence can be strengthened. However, there has been limited research describing the possible influence of parents observing their children’s learning. A search of the literature produced no studies in which parents had the opportunity to observe tutoring sessions involving their own children. Analyses of parents’ responses in this study suggests observation opportunities prompted changes in parents’ perceptions after observing their child in one-on-one mathematics tutoring.

Changes in Attitudes and Beliefs

First, watching the tutoring sessions gave parents the opportunity to observe their child’s learning without being encumbered with the need to monitor or direct the learning. They were able to study their child’s interactions, learning styles, and abilities. The parents expressed surprise at the mathematics with which their child was capable and with which their child struggled. Parents also observed the limiting effect of learning difficulties on their child’s learning, such as lack of confidence, attention problems, and excessive guessing. Seeing their child make progress during the tutoring sessions gave parents hope that their child was capable of learning and enjoying mathematics. Studying their child’s learning from an observer’s perspective broadened parents’ understanding of the child’s learning abilities, styles, and habits.

Observing their child working with the tutor also encouraged parents to reflect on and evaluate their own interactions with the child. The frustration and stress parents experience when providing mathematics support can be intense for parents of children with mathematical learning difficulties (Abreu & Cline, 2005). Parents were surprised that “math could be fun,” indicating that their interactions with mathematics in the past had not always been positive. Observing their children confidently and enthusiastically constructing mathematical thinking during the tutoring activities
made explicit for parents the connection between a positive learning climate and increased learning. Parents expressed the desire to be more positive and more patient in their interactions and identified specific changes they could make.

Insights Gained Concerning Their Child’s Mathematical Understanding

The tutoring observations provided an opportunity for parents to observe reform practices and to evaluate its impact on their child’s learning. The observations provided parents with a bridge between the “old” and “new” ways of learning mathematics. The childhood mathematics learning experiences of the parents in this study were mostly procedurally focused, with a strong emphasis on drill and practice of mathematics facts. Observing the tutoring sessions made it possible for parents to contrast the differences between their own learning experiences and the reform methods used in the tutoring sessions. In the survey responses, parents acknowledged the importance of learners developing conceptual and procedural understanding, they identified the benefits of learning multiple strategies, and they saw the importance of using physical manipulatives. A picture is said to be worth a thousand words. The mathematics tutoring observations provided parents a picture of reform mathematics teaching and learning that affected their beliefs about mathematics and influenced the ways they interacted with their children in mathematics activities at home.

Changes in Methods and Practice

The observations provided parents with the opportunity to learn new methods they could later employ when their child struggled with mathematics concepts. Methods the parents reported learning were the use of manipulatives and pictorial representations, breaking down difficult concepts into subconcepts, using multiple strategies, use of games, and teaching through discussion. Parents were able to observe how and when the tutor employed the methods and to observe how the method influenced their child’s learning. Rather than reading or hearing about the methods, parents observed in real-time concrete examples of the tutoring method and its effectiveness. This process equipped parents with multiple strategies they could employ when their child struggled with a mathematics concept at home.

Parents of children with mathematical learning difficulties need strong support. One form of support is a strong partnership between parents and educators. Although we often talk of the importance of this partnership, relatively little is typically done to support parents in their role of the partnership. Parents’ knowledge is typically limited to practices and methods they experienced in their own educational experiences. Therefore, an important aspect in supporting parents is to provide them with opportunities to learn more about how children learn mathematics, about the learning styles and abilities of their own child, and multiple methods they can employ when doing mathematics with their children. The results of this study suggest that providing opportunities for parents to observe their child’s learning of mathematics can be an effective method of providing support. Analyses of the survey responses indicate that, as a result of their observation experience, parents’ attitudes toward and beliefs about mathematics changed, they gained insights into their child’s mathematical understanding, and they broadened their knowledge of successful mathematics methods and practices.
Although this study identified benefits of the parent observations, further research is needed to determine how to optimize observation experiences for all parents. The fact that these parents rearranged their schedules and invested time and financial resources to bring their children to the mathematics tutoring clinic indicates they were concerned about their children’s mathematics learning difficulties and that they did not feel they could solve the problem themselves. Data need to be collected to determine how different elements of the observation affected parents’ development of confidence, motivation, empowerment, and positive attitudes and beliefs, and how those elements can be enhanced. Future research also needs to be conducted in other settings, such as classrooms, special education sessions, and after school programs, to determine if these parental effects can occur there.

REFERENCES


**APPENDIX: TUTORING INTERVENTION AND MATHEMATICS ENRICHMENT (TIME) CLINIC PARENT SURVEY**

**Background Information**

1. How many times did you observe your child during the mathematics tutoring sessions?

2. In general, did you listen to the tutoring activities during your observations, or did you occupy your time in other ways (e.g., sending emails/texts, reading a book, etc.)?

3. What is your own background in mathematics (e.g., high school education, undergraduate, or graduate classes)?

4. What is your feeling toward doing mathematics (e.g., it was always a favorite or least favorite subject, you use it daily in your work, etc.)?

**Methods and Practices**

5. Do you usually help your child with mathematics at home? __________________________
How often do you help your child with mathematics at home?

6. What did you learn overall about mathematics during the tutoring sessions?

7. What did you learn about mathematics teaching and learning during your observations?

8. Did you learn about any specific mathematics content or concepts yourself during the tutoring session? _____________________________________________________________________
What were they?
9. What did you do with your child to encourage mathematics learning after the tutoring sessions?
____________________________________________________________________________
____________________________________________________________________________

10. Did you use any ideas or teaching practices that you observed of the tutor to encourage your child’s mathematics learning after the tutoring sessions? ___________________________
What were these?
____________________________________________________________________________
____________________________________________________________________________

Attitudes and Beliefs

11. How has the observation of your child during tutoring affected how you think about mathematics?
____________________________________________________________________________
____________________________________________________________________________

12. How have your attitudes or feelings toward mathematics changed after watching your child during the tutoring sessions?
____________________________________________________________________________
____________________________________________________________________________

13. Have you observed any change in your child’s attitudes or feelings toward mathematics during the tutoring sessions? ___________________________
What were these changes?
____________________________________________________________________________
____________________________________________________________________________

Insights About the Child’s Understanding

14. What did you learn about your child’s level of mathematics knowledge during your observations?
____________________________________________________________________________
____________________________________________________________________________

15. What insights have you gained through your observations about the manner in which your child learns?
____________________________________________________________________________
____________________________________________________________________________

16. What did you observe that was a typical behavior of your child when doing mathematics?
____________________________________________________________________________
____________________________________________________________________________

17. What did you observe that surprised you when your child was doing mathematics?
____________________________________________________________________________
____________________________________________________________________________
18. Was there a particular example where your child thought about mathematics in a way that was very different to you? ________________________________________________________________
What was it?
_____________________________________________________________________
_____________________________________________________________________

Final Thoughts

19. What suggestions do you have to make the mathematics tutoring experience more meaningful for you and your child?
_____________________________________________________________________
_____________________________________________________________________