

PARENTS' SUPPORT OF MATHEMATICS LEARNING DURING A PANDEMIC: A FOLLOW-UP STUDY

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Abstract

This qualitative study examined roles of parents a year after the pandemic effected instructional delivery and is a follow up to a previous study that examined the roles parents played in their children's mathematics learning two months into remote instruction. Seventeen participants completed demographic, open-ended, and Likert scale survey items regarding their roles and the challenges they faced. Parents promoted conceptual understanding, valued the use of manipulatives and tools, and recognized the need for flexible procedural skills. Parents reported teacher availability, changes in mathematics problems solving, instructional weaknesses, and students falling behind as challenges during the pandemic.

Keywords: *parents, families, mathematics learning, pandemic*

In the spring of 2020, schools across the United States closed due to the COVID - 19 pandemic. Teachers and families scrambled to adjust to remote learning, causing numerous challenges and barriers for families. In a previous study, we explored how parents supported mathematics learning during remote instruction at the beginning of the pandemic. We examined the roles parents played in their children's mathematics learning as well as the challenges and successes they faced during the first couple months of emergency remote instruction (Williams Mills et al., 2021). A year later, we reached out to the same parents to explore how their roles in their children's mathematics learning had changed during the pandemic.

This study was guided by the following research questions:

1. How do parents support mathematics learning during a pandemic?
2. How has their children's mathematics learning changed due to the pandemic?
3. What success and challenges do parents and their children face during the pandemic?

Theoretical Framework

Like our first study, Vygotsky's sociocultural theory served as the theoretical framework. Vygotsky (1978) emphasized the important role adults play in children's learning. Acknowledging that culture influences learning, Vygotsky explained knowledge is co-constructed among children and their

peers and/or more knowledgeable others, like parents or teachers. As the pandemic began, parents quickly took on new roles in their children's learning due to remote instruction. We recognize the valuable role parents play and sought to explore those roles. Therefore, sociocultural theory was used as the lens to examine the research questions in this study.

Literature Review

Recommendations for family involvement were perpetuated during the pandemic. Williams Mills et al. (2021) initial study highlighted the mathematics learning challenges and successes of parents and families early in the pandemic. Parents reported a variety of feelings about helping their children with mathematics during remote instruction. The overarching theme across the study was that parents have a strong desire to be a part of their child's education, even in mathematics. The research from the pandemic encourages educators to consider families as a vital component of teaching (Panoura, 2021; Ribeiro, et.al, 2021). In fact, the authors argued that we involve parents more intentionally through preparation using technology and learning tools. Parents should be viewed as important educational social capital. While there are studies for family involvement during Covid-19, very few studies have surfaced considering the roles of family involvement after students returned to school or continued in a hybrid model. Yet, one study by Rahardjo et al. (2022) noted that the roles before and after the pandemic have not changed, rather parents need to be encouraged to continue as an extension of the classroom. In their study, parents were identified as mentors and motivators during and after the pandemic.

Methods

This qualitative study explored the roles parents played a year after the COVID - 19 pandemic began. More specifically, we examined their role in their children's mathematics learning and how it had changed throughout the pandemic. A year before, we surveyed parents at the start of remote learning due to the pandemic (Williams Mills et al., 2021), and this current study serves as a follow up. Participants completed online surveys that were composed of demographic, open response, and Likert scale items.

Eighty-one participants from the previous year's study were emailed and asked to complete a new survey. Seventeen parents chose to participate by completing the survey. All seventeen participants identified as women. Eighty-two percent of participants identified as White (n=14). The remaining three participants identified as Latinx (n=1), Black/African American (n=1), and Asian (n=1). Participants resided in six states across the United States. For the 2020 - 2021 school year, over half of the participants' children were learning face to face on a school campus (n=9), while some reported their children learned via remote instruction (n=4) or in a hybrid format (n=4).

For this current study, an elemental method of descriptive coding (Saldaña, 2013) was used for the first round of data analysis. After the initial round of coding, elaborate coding was used to find themes within each code from the first round. One member of the research team completed the data analysis, and another member reviewed the analysis to establish group consensus (Saldaña, 2013).

Results

The codes roles, changes, resources, challenges, and successes were identified in the first round of coding. During the second round of coding, sub themes were identified within each of the initial codes.

This section is organized by those initial codes and followed with the analysis of the Likert scale data from the survey. The themes and their coded frequencies are shown in Table 1 and followed by the narrative of the results in more detail.

Table 1

Parental Roles of Mathematics Learning During the Pandemic

Theme	N	%
Roles of Parent		
Facilitator	20	57.1
Supervisor	4	11.4
Teacher	7	20.0
Hands-off	4	11.4
Changes in Role of Parent		
Less Involved	4	19.0
No Change	6	28.6
More Involved	11	52.4

Roles

During the 2020 - 2021 school year, parents took on a variety of roles - facilitator, supervisor, teacher, and sometimes a less involved role. Roles were not exclusive, one parent may have taken on several roles, like “I became a support to their online learning. I was the link between the teacher and the student. I made photocopies of assignments, made sure kids were logged on when they needed to be, made sure things were completed and turned in and also taught supplement assignments.”

Facilitator

A facilitator role was coded twenty times, and included checking homework, providing moral support and suggestions, and keeping up with academic progress. An elementary parent described, I was the encourager, the affirmer, the supporter. Initially they would come to me repeatedly to check their work before they would submit it. I tried to return the responsibility for checking their work back to them. I would ask if they were certain of their work. They eventually would just come to me with questions they had. I encouraged them to ask their teachers the questions; often giving them the words to say in the message. It is very important that students learn HOW to ask questions.

Supervisor

The role of supervisor was coded four times in the data. Parents in this category described checking on their students, providing “constant reminders,” and enforcing rules. One mother said, “I became principal [or] nagger of [my] child. I had to remind him to stay focused during zoom classes, be respectful etc. None of which I would have to do if he went in person.”

Teacher

Participants also mentioned taking on the role of teacher, and this was coded seven times. Parents expressed the need to teach difficult concepts, reteach lessons, and provide face to face instruction. One mother described her need to be more involved in teaching because of the instructional format, “he really struggled with remote learning, so I had to find other ways to teach whatever he was learning. He was really starting to fall behind in math and math was previously a strength of his.” Challenging advanced students was another reason for parents to take on a teacher role, “I was able to make sure my son understood concepts completely and was able to move at his accelerated pace.”

Hands Off

Four times in the survey data, parents noted a more hands-off approach to mathematics instruction. The reasons included parents’ difficulties understanding the “new math,” children not asking for help, or unnecessary. Because her children were in school, one mother relied on the teachers to help with misunderstanding, “my children go to school and receive instruction from their teachers. They return home in the afternoon to do their homework. If they don’t understand their assignments, they have to try to catch their teacher before class to get additional help.”

Changes

Participants in this study were asked if and how their roles in their children’s mathematics learning had changed a year after the pandemic began. Parents ranged from describing themselves as being involved less to about the same to more involved.

Less Involved

Being less involved in their children’s learning was coded four times in the data. Less involvement was mentioned only by parents whose children were attending traditional face to face or hybrid learning formats. One parent described less involvement due to school safety policies, “2020- 2021 I haven't set foot in the school. No school parties. Don't know what my kids' classrooms look like. I only assist with schoolwork on homework and extra reading.” Another parent mentioned helping even less at home:

This school year I have not had to really be hands on since they were able to attend in person. I feel like the rigor of the classes at the public school was diminished though. My middle schooler never once had homework when that was not the case when my son attended the same school two years prior.

No Change

Six responses were coded as neutral in regard to how their role changed in their children’s mathematics learning. Parents who described little to no change also reported their children attended school in a traditional face to face environment for the 20-21 school year. Changes like wearing masks and social distancing were mentioned, but still described as “mostly normal.” One parent described her willingness to abide by rules so that her children could return to school:

After having to do remote instruction Spring 2020, I was determined to do whatever we had to do for both of my kids to stay in the classroom on campus. I can't say that I agreed with the measures

implemented for the 2020-2021 school year, but we followed them because I knew that is where my kids needed to be.

More Involved

Describing themselves as more involved occurred eleven times in the survey data. Parents expressed being more concerned with learning and not just grades, “I became much more focused on how both of my children were progressing academically as individuals irrespective of what their school grade indicated. I wanted to be sure they were still progressing as they would have if the pandemic had not happened.” Participants also described recognizing challenges, “I am also much more aware of my students’ academic struggles and able to help guide where assistance or clarification is needed.” Parents reported their children as more likely to ask for help, “I think they are more willing to ask me for help than they were before the pandemic.” One mother emphasized the benefits of the increased uses of technology:

Because of the pandemic, the school provided laptops to all kids. I can now see what assignments are due on each day, and I can see specifically what the assignment is. I took this opportunity to stay on top of the school situation and worked closer with my kids. Their grades have improved because of this.

Resources

Parents described computer hardware and software, non-digital tools, and supplemental instruction as various resources used to enhance their children’s mathematics learning. Based on the survey data, students relied heavily on electronic devices to learn mathematics.

Computer Hardware

Computer hardware, like laptops and tablets, was only specifically mentioned three times in the survey data, but the use of computer software was mentioned eight times. One mother, whose child was learning face to face on campus, found school issued computers valuable, “I think because of the heavy use of laptop instruction in math, I could now be a resource to my child after school hours because I can see the assignments, as well as watch the videos linked to teach us how to do each assignment.”

Computer Software

Parents mentioned specific types of computer software - web conferencing tools, learning management systems, apps, and websites when discussing their children’s school day schedule. According to the participants, web conferencing was a frequently used tool used by teachers and students during remote and hybrid instruction. Some parents reported children meeting with teachers synchronously multiple times a day, while others reported just a few times a week during remote instruction. A few parents supplemented mathematics instruction with websites and apps. One parent mentioned the value of digital videos when assisting her child with school work,

If we ever get stumped, I've always been able to ‘refresh’ my memory with a quick video tutorial. It would be great to have a reliable source to turn to for help. We don't need apps that just give you the answer, we need more lessons online so that parents can be confident to help their kids!

Non-digital Tools

While digital tools were frequently mentioned and used, four parents also discussed non-digital household instructional tools like manipulatives, paper and pencil, and workbooks. One parent, an academic consultant, shared various tools she used to help her daughter learn mathematics, including a deck of cards, yardstick, measuring cups, multiplication puzzles, and “we also obtained some old wristwatches that my father no longer wanted, and I would have my daughter manipulate the hands on a watch when she was answering a homework problem dealing with telling time.”

Challenges

Throughout their survey responses, participants mentioned particular challenges, coded 32 times, they faced in regard to learning during the pandemic. The themes that emerged when coding this section included, changes in mathematics problem solving, falling behind, limited help from teachers, instructional weaknesses, disengagement/frustration, time management, and no challenges.

Solving Differently

A few parents noted their children learn to solve mathematics problems differently than they did, which caused challenges when helping with schoolwork. According to one mother, “we don’t communicate in the same manner, my approach to math doesn’t come across as easier for him. I’m trying to teach using methods that I learned as a kid but he’s just not understanding it.”

Falling Behind

Referring to the quick shift to remote learning in the Spring of 2020, some participants reported children falling behind in mathematics and not yet catching up. One participant pointed out the lack of rigor, “the year started out very slow as they had to review and reteach what all the kids missed last spring. I feel like they will be behind next year because everyone felt bad for the kids and didn’t push them as hard as they normally do.”

Limited Teacher Help

The code limited teacher help included difficulties receiving timely feedback from teachers, lack of instructional videos, and teacher unavailability. Parents shared, “online instruction needs teachers who are flexible and available,” and “there’s no substitute for face to face instruction with a certified teacher.” One parent felt she was left responsible for teaching, “my 1st grader didn’t have any video lessons for math. If I hadn’t taught her there would’ve been no instruction at all.”

Instructional Weaknesses

Parents also identified challenges related to instructional and curriculum weaknesses, like lack of mathematical tools, weak online teaching pedagogy, and difficulties of schools and teachers to adjust to new challenges. One parent described, “the schools were not prepared for remote instruction,” and another mentioned the differences from campus to campus, “the elementary didn’t seem as equipped as the junior high to deliver content remotely.” According to one mother, her child and their teacher “rarely

used virtual manipulatives...and focused more on rote memorization rather than problem solving.”

Another parent also found too much dependence on technology:

With the state’s decision to have everyone take STAAR [standardized test] online, teachers were forced to have students continue online mathematics work, so they might acclimate. My 4th grader felt pressured to not use paper and pencil while working, but needs to be able to do so. The pressure was not from his teacher, but other students that may not have needed that ability.

Student Disengagement

Student frustration and disengagement were also mentioned as challenges. Participants shared their children struggling “adjusting back to a traditional school day” after an extended break, difficulties in completing lessons, and “competing with video games.” One mother emphasized poor instruction as the cause of disengagement, “due to lack of “hands on learning from [the] teacher. Child was disengaged from virtual learning.”

Time Management

Time management was also discussed by a few participants. Parents felt overwhelmed, “I spent every minute of every day rushing from one activity to the next.” According to one participant, her child who was learning virtually had difficulty managing his time, “2nd grader usually finished work between 1:30 and 2 (initially he was working until 4:30 or 5). We were able to meet with the teacher to adjust the expectations and give him tips to be more efficient.”

No Challenges

When asked about challenges, a few participants reported having no challenges. One mother shared no current issues, but maybe in the future, “we really haven’t faced many obstacles. My son loves math and was eager to learn. I think going in person will face problems because he is so far ahead in math and above grade.”

Successes

Family success was coded 24 times in the survey data. Success codes included affective improvements, mastery of learning, strong instruction, parent help, and neutral or no successes.

Confidence

Parents mentioned the increase of student “confidence” and the “opportunity to ask questions with no fear of being ridiculed” as successes in mathematics learning. For one family, online learning proved a success.

My children THRIVED in the remote environment. Even with the struggles we had, they achieved more growth this year than in previous years. By finishing early, my 2nd grader was able to explore topics he was interested in. He read more books, created posters, completed projects, and grew based on his interests. My 4th grader has very high anxiety and was throwing up before school every day when going to in-person school...By moving to remote learning, she was no longer needing her medication, she wasn’t throwing up every day, she was happy and motivated to

learn. While we have had some struggles (the district kept trying to push us back to in-person; they changed the instructors multiple times during the first 12 weeks of school) the kiddos adjusted beautifully, stretched and grew. We will continue remote learning for the younger two in the next school year. Even though our district will no longer be supporting remote learning, we will use one of the other Texas public school remote options.

Instruction

Some parents referred to strong instruction as a success. This included comments about improved instruction from previous years and strategies modeled by parents and teachers to improve mathematics learning. One parent discussed a strategy she introduced to her son, “one major success that we’ve had is explaining the plug and chug method to him. Even if you don’t know an answer, you can always plug the possible options into the problem and see which one will work.” Another parent praised her child’s teacher, “[I] found all the different methodologies employed by his teacher fascinating, and I think they’re really good at teaching a child all the very many ways they can approach any problem. I never got that growing up.”

Student Mastery

Participants highlighted student mastery multiple times in their responses. They emphasized mastery of specific skills like “adding and subtracting large numbers,” and “my daughter transitioned to multiplication very easily.” Advanced learners were also mentioned by parents, “My first grader is testing at a 3rd grade math level.” Making progress was also celebrated, “he made significant leaps and bounds in his understanding.”

Likert Scale Results

Participants were asked how prepared they felt to support their children’s mathematics instruction after remote learning during the Spring of 2020 on a scale from one to five, with one being not prepared at all and five being very prepared. The data presented in Table 2 reflects more than half of the participants (n= 9) felt prepared or very prepared to support their children’s mathematics learning. Only two parents, who both had children learning in a face to face traditional environment, reported being not at all prepared to help their children learn mathematics. The participants were also asked to rate their children’s 2020 - 2021 mathematics instruction compared to previous school years, and the data is represented in Table 3. Parents of children who were learning face to face were more likely to report mathematics instruction as more effective (n=4) or similar (n=4) to previous years instruction.

Table 2*Level of Parent Perceived Preparation to Support Mathematics Learning*

School Format	Very Prepared (4-5)	Somewhat Prepared (2-3)	Not Prepared (1)
Fully Remote	2	2	0
Hybrid	3	1	0
Onsite (traditional face-to-face)	4	3	2

Table 3*Comparison of Mathematics Instruction to Previous Years*

School Format	More effective (4-5)	Neutral (3)	Less effective (1-2)
Fully Remote	1	1	2
Hybrid	0	2	2
Onsite (traditional face-to-face)	4	4	1

Discussion

Surveying the same parents, a year after the pandemic began provided additional insight into the roles parents played in their children's learning as families navigated the academic and social distancing changes brought on by the pandemic. We also identified new concerns and challenges held by parents a year later. Parents promote mathematics learning in a variety of ways and their support is not always easily recognizable or valued by teachers, students, and parents themselves. In this discussion, we align parents' support of their children's mathematics to the five strands of mathematical proficiency - conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition (National Research Council, 2001).

Similarities: Roles and Resources

In the initial study (Williams Mills et al., 2021), parents noted they had several roles such as facilitator and teacher. These self-actualizations did not change, in fact they were continually reinforced as they were able to help for the duration of the mixed instructional modes. However, in this study the participants and researchers recognized these roles were more dynamic and that parents often took on

multiple roles like facilitator, teacher, and supervisor throughout the school year. Similarly, Bansak & Starr (2021) noted that parents reported being highly involved across the pandemic, despite differences in economic status or race. Parent involvement was reported as necessary to ensure their students were learning.

Another significant similarity was with respect to the use of technology and manipulatives. The parents reported valuing technology in both studies (Williams Mills et al., 2021). Technology in the home was helpful to parents, as they saw themselves in the teacher or mentor roles even as the pandemic progressed, and students began to return to campus. Furthermore, both studies highlight parents are willing to go ahead with the more 'old-fashioned' practices such as paper and pencil, household items and homemade manipulatives for learning. Encouraging the use of manipulatives and tools reflects parent promotion of conceptual understanding, the first strand of mathematical proficiency (NRC, 2001). The use of manipulatives seems almost intuitive to parents as they help their children to use tools appropriately, such as using manipulatives or household items to make sense of mathematical problems.

When they did not understand how to solve a problem, parents sought out videos and learning resources to supplement instruction. Yet, even with technology, parents reported at both ends of the pandemic that they still struggle with how math is taught now, as opposed to the way they learned it. Parents recognized they struggled with being flexible in the use of various procedures to solve a problem, and reported being unsure of more innovative strategies, which reflected parents needed more help in promoting the mathematical proficiencies of procedural fluency and strategic competence (NRC, 2001). This is an ongoing issue that parents recognize despite the pandemic (Garbe, et. al, 2020).

Differences: New Concerns and Challenges

Several different concerns and challenges parents mentioned in this follow-up study do not come as a surprise. Parents were nervous about their students being behind in mathematics due to the lack of quality remote instruction in the Spring of 2020. Some research has provided insight that while students were not necessarily behind, the growth in learning was lower (Kujfeld, Soland, & Lewis, 2022). However, this study asserts we should be careful in assuming the children will not rebound as quickly as we think. Therefore, while the parents' beliefs are not unusual, they might not be well founded. Even though parents in this study were concerned with their children falling behind, only about a third of participants reported mathematics instruction as less effective than previous school years. Some families also reported how much their children enjoyed mathematics, demonstrating how parents encouraged and supported the mathematical proficiency productive disposition of mathematics (NRC, 2001). Bansak & Starr (2021) suggest we capitalize on parent interactions and at-home instruction to avoid gaps in learning.

Another concern parents voiced was the limited help by teachers. They felt their children need more instructional time, access to teachers, online manipulatives, and less dependence on software that assesses, but does not instruct students. The parents also reported feeling disengaged with schools because of the lack of school events such as parent lunches, school parties, and open houses. Parents were not able to go into the buildings for safety reasons. These challenges differed from our initial study, in which parents were worried about trying to be parent and teacher every day. This concern suggests we are getting back the more traditional roles of parents and teachers, parents are the at-home support, rather than having to be both.

Parents reported being more critical of what math was being taught and learned, over how their children were being graded. This shift likely aligns with parents seeing themselves as a facilitator of learning, in which they associate teaching the content with real-world connections and valuable resources as very important. These realizations have helped parents recognize the need for more than just grades to determine if their children are learning mathematics. Sharing the five strands of mathematical proficiency with parents may help them to better understand effective mathematics teaching practices and how they do and can better support mathematics learning.

Limitations

In the initial study, we had 81 responses, while in the current study, there were only 17. Although this qualitative study is small, it does provide information on how parents continued to support mathematics learning a year into the pandemic. The racial and ethnic diversity of the parents is not representative of the United State population, but is similar to the diversity of the initial study. No generalizations can be made, but teachers, teacher educators, and researchers may find “transferability” (Lincoln & Guba, 1985) when reading about the experiences of these 17 participants.

Conclusion & Implications

Parents should be viewed as educational capital, because they are a critical piece in the education of their children. Through this lens, if teachers purposefully include parents, perhaps we could bridge some of the pandemic lag in content and conceptual knowledge. While most parents in this study felt prepared to support mathematics learning at home, schools must provide opportunities for parents to understand the instructional strategies being used to support mathematics understanding, otherwise parents depend on traditional algorithms parents learned in school. Furthering parent education using the five strands of mathematical proficiency (NRC, 2001) by way of communication from school to home, would prove valuable.

Teacher preparation programs can help future educators encourage partnerships with families that are meaningful and focused on student learning. In preparing new teachers in STEM pedagogy, we need to be overt in the practices and how to help parents see that they play in an important role in helping students demonstrate the mathematical proficiencies (NRC, 2001).

Placing an importance on ongoing two-way communication with families will help parents feel involved, connected, and prepared to support students at home. Additionally, through the pandemic parents relied on school issued technology and software to stay engaged and aware of student learning progress, therefore we should continue to invest in maintaining this connection to parents. Future research may look deeper at trends in parent perspectives about learning mathematics either at home or in the classroom and using technology.

Parents found more autonomy in deciding what format their students learned best. They found they could choose the format more freely, rather than pressure to do traditional face-to-face public school. Some families chose to remain remote due to their students' success, while most families were happy for students to be back on campus and eager to be involved in activities in the school building. Teacher preparation programs should address online pedagogy and help preservice teachers transfer the use of

effective teaching practices to online learning. Regardless of the delivery of instruction, as teacher educators, we should place an emphasis on the importance of parents in a child's educational journey and model how to build classroom and home partnerships.

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