

Mathematics Curriculum Change: Identifying Parental Expectations

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Abstract: Parents' growing concerns about the current approaches to learning mathematics in elementary school have drawn public attention in Canada. Rather than dismiss such concerns, understanding parent perceptions and garnering their support is essential to ongoing curriculum transformation and students' success in mathematics learning. Using phenomenography, we examined parents' perceptions of the current mathematics curriculum and their children's experiences as expressed in community-based focus groups and individual interviews. Parents responded based on their past experiences, their views of children's current experiences and their future aspirations for their children. Our analysis of parents' perspectives revealed that their concerns and critiques were grounded in the expectations they held for their children's mathematics learning. In particular, parental expectations fell into three categories: students need the opportunity to reach expected goals of mathematics learning; essential supports must be in place to reach expected goals; and, home-school communication is necessary for parent understanding and engagement. We suggest that by understanding the specific expectations that underlie parents' concerns, teachers can engage in conversations that begin with affirming mutual expectations and respecting parents' personal experiences to lead to partnering with parents as they realize their agency in their children's learning.

Keywords: *Curriculum change; Elementary school; Mathematics education; Parental involvement.*

Introduction

Parents are critical partners in mathematics education (Remillard & Jackson, 2006). Their involvement in children's educational experiences increases achievement, improves motivation, and reduces anxiety (Patall et al., 2008). Yet, the differences between parents' experiences of learning mathematics and their perceptions of their children's learning may produce tension. This tension can be reinforced by media coverage which pits "back to basics" against "discovery learning" and presents these as opposing and dichotomous views of school mathematics. This perceived conflict, both personal and public, often leaves parents feeling frustrated and confused.

In order to address parental frustration and confusion, it is important to gain a deep understanding of their perceptions of their own mathematics learning in contrast to their perceptions of their children's learning. In doing so, we can identify where disgruntled parents see the source of difference and difficulty. Recognizing parent perceptions will assist in knowing how to empower parents to participate effectively in their children's learning and provide insight into how to communicate to parents about current reform-based curriculum and pedagogy. Parent concerns and expectations must be more clearly understood and addressed—rather than dismissed as naive and uninformed—if we wish to improve student success in mathematics.

In this study, phenomenography allowed us to develop an understanding of parent perceptions of their own learning as they are juxtaposed with their perceptions of their children's learning. In order to more productively engage with parents, we endeavored to understand their critiques of current approaches to mathematics and identify expectations they hold for their children's mathematical learning.

Although previous research has suggested that parental involvement in education, particularly in mathematics, can be ineffective and potentially detrimental to student learning (Bartlo & Sitomer, 2008), we seek to refrain from creating a deficit framework, perceiving parents as obstacles. Instead, we draw on a common theme in current literature that attempts to describe and shape parent perception and involvement (Civil & Bernier, 2006; Lightfoot, 2004) and views parents as intellectual resources and important partners in education. We aim to acknowledge parent experiences as essential for fruitful dialogue.

The initial research question which motivated our study was: *How can we understand parents' perceptions of current mathematics curricula and approaches to mathematics teaching and learning?* However, as the research process unfolded, we uncovered another question which demanded our attention: *What are the parental expectations which underlie concerns and criticism about current approaches to mathematics teaching and learning?*

This paper attempts to answer these questions by offering a framework of parental expectations through which to interpret parental unease and criticism. We believe this framework to be useful in shaping

mathematics educators' responses to the expressed concerns of parents. Reframing parental criticism of mathematics learning by identifying the expectations which underlie them, will allow teachers to engage in thoughtful conversations which respect parents' personal experiences and empower them to realize their agency in their children's learning.

Background

"Math Wars"

In 2012, the Programme for International Student Achievement (PISA) ranked Canadian students 13th in the world (OECD, 2013). Canadian media focused heavily on Canada dropping out of the top ten (e.g., Alphonso, 2013). Newspaper articles were framed as though mathematics education was a choice between two opposing methods "discovery learning" and "back to basics" (Barwell & Abtahi, 2017) and frequently targeted the "discovery learning" emphasis in curriculum as the direct cause of the lower PISA ranking (e.g., Hopper, 2014). Public concerns about the falling ranking lead to unprecedented outcry and fuelled the "Canadian Math Wars" (see Chernoff, n.d.). Parents took to online forums and social media to express their anxieties, they joined coalitions (e.g., WISE Math), and petitions were launched in three provinces demanding a "back to the basics" approach (Houle, 2013; Murray, 2013; Tran-Davies, 2013).

However, this is not the first iteration of the battle between "new math" and "back to basics." This tug-of-war has been replayed in North America and internationally for decades (Kilpatrick, 2012; Kline, 1973; Schoenfeld, 2004). During this time, decades of research demonstrate the advantages of conceptually-based approaches over traditional approaches to mathematics learning in nearly every area including

problem solving, mathematical modelling, disposition towards mathematics, inclusivity of Indigenous students, and equity for potentially disadvantaged students (e.g., Baroody, 1999; Boaler, 2002; Erlwanger, 1973/2004; Henry & Brown, 2008; Pesek & Kirshner, 2000; Russell & Chernoff, 2013; Thompson, et al., 2013). Despite this key research, efforts to communicate reforms and advantages to parents have largely failed. Thus, there is an ongoing debate between how parents learned mathematics and how it is taught to their children today (e.g., Civil & Bernier, 2006; Marshall & Swan, 2010; Peressini, 1998).

Parental Involvement in Mathematics Education

Parents play a role in their children's education both in and out of school. While general educational literature has identified possibilities for connections between home and school to support student learning (e.g., Epstein, 1987), mathematics educators have long been interested in deliberating the role and importance of parents (see Bright (1973) and Levine (1972) as early examples). We highlight here selected themes from within mathematics education research related to accessing parents' perspectives on their desires for their children's mathematics learning.

Parental Expectations: To date, little research has outlined specific expectations parents have for their children in mathematics education. Ntow and Tackie (2015) reported parents expected generally high grades in challenging high school mathematics courses and Deringol's (2019) quantitative analysis revealed high expectations overall. Aytekin et al. (2018) found parents' prior experiences with mathematics and educational attainment influenced how they expected mathematics to be taught and what

mathematics their children learned broadly. Given these general findings, many researchers have indicated the importance of high parental expectations in this subject area (e.g., Bleeker & Jacobs, 2004; Keith et al., 1993; Lazarides, et al., 2016). Froiland et al. (2013) suggest that parents' expectations for their children serve as strong predictors of children's own expectations to succeed and found that early parental expectations for children's post-secondary educational goals had a stronger effect on eighth grade achievement than did helping with homework. Bleeker and Jacobs (2004) found that parental expectations for their children's mathematics and science education were not only important for predicting school achievement, but also suggest "enduring links between mothers' early expectations for their children and the children's later career decisions" (p. 107). Since parental expectations have such a lasting impact on students, it follows that teachers and researchers should deepen their understanding of parental expectations and engage with parents to work alongside them in supporting their children's mathematics learning.

Parents Understanding Current Approaches in Mathematics Education: Although parents are important partners in their children's education, their involvement in their children's mathematics learning is not always effective (Bartlo & Sitomer, 2008). Parents may struggle to effectively engage their children in mathematics learning which supports classroom instruction. This is likely due to the difficulties created by differences between the mathematics instruction they experienced and those their children experience, and the feelings of disenfranchisement that accompany these differences (Remillard & Jackson, 2006). Parents may have little

understanding of current pedagogical approaches and curriculum requirements. However, as parents become more involved in their children's mathematics education, their understanding of the changes occurring in school mathematics increases (Peressini, 1997) as does parents' informal learning of mathematics through interactions with their children (Ginsburg et al., 2008). Additionally, Papadopoulus (2017) found that parents who participated in mathematics inquiry workshops not only enriched their understanding of elementary school mathematics and current instructional approaches but partnered with teachers to create new activities. Parents who are more informed about current pedagogical approaches and the rationale underlying them are better equipped to support their children's mathematics learning. We suggest that if parents and teachers work together to align parental support with classroom instruction and curricula expectations, parents can become essential supports in mathematics learning.

Communicating with Parents: A key step towards empowering parents to support their children in mathematics learning is effectively communicating with them about curriculum reform and the rationale, evidence and justification underlying curricular changes. On-going calls indicate that schools' communication about mathematics approaches to parents is under-researched (McMullen & de Abreu, 2011). However, when communicated to about curriculum, parents are often viewed as passive receivers of information, laymen outside of the teaching profession (Remillard & Jackson, 2006) or even obstacles to the curriculum innovation (Gellert, 2005). Furthermore, communication informing parents about school and student learning is often a one-directional flow of information and can be

criticized for having a "school centric" approach (Bartlo & Sitomer, 2008; Epstein, 1996). The School Level Study of Mathematics Reform found that schools tend to be slow in realizing the significance of parents and in acknowledging that parental concerns are legitimate (Peressini, 1997). Until we begin to recognize parents' concerns, we will have difficulty garnering their support in ongoing curriculum reform (Jackson & Remillard, 2006).

Methodology

In this study we build on previous work of reframing public opposition into collective concerns (McFeetors & McGarvey, 2019) by gaining more in depth understanding of the experiences, perceptions, concerns, and expectations of parents of elementary school-aged children. Understanding parent perspectives and how they are or are not aligned to research allows mathematics educators to refrain from dismissing criticisms as obstacles and reconsider the validity of parent perspectives—even if they are based on a small sample size: their own children.

Phenomenography

In order to adequately address the research questions which motivated our study we required a research methodology that allowed us to deeply delve into parent experiences, perceptions, and expectations. Phenomenography (Marton, 1986; Marton & Booth, 1997) is a research orientation developed within educational research that "investigates the qualitatively different ways in which people experience or think about various phenomena" (Marton, 1986, p. 31). Phenomenography provides a theoretical grounding to develop a framework of categories to illustrate the range of participants' perceptions of their experiences of a particular

phenomenon; in this case their experiences with mathematics learning. Phenomenographic researchers draw the phenomena into participants' awareness (Gurwitsch, 1964; Polanyi, 1964/1969) in order to characterize and understand participants' perspectives. The variation in participants' perceptions aids researchers in interpreting the phenomenon under study. As a conceptual framework, phenomenography is grounded in a nondualist ontology, where "the world we deal with is the world as experienced by people" (Marton & Booth, 1997, p. 13).

Within phenomenography's delineation of methodological guidelines, researchers develop a framework of related categories empirically, rather than applying extant theories. Qualitative data are collected which consist of participants' explanations of their views. Development of categories involves an iterative analysis of data relevant to the research question during which "selected quotes are grouped and regrouped according to perceived similarities and differences along varying criteria" (Akerlind, 2012, p. 118). Categories of description of collective experiences are generated and further substantiated through rich description of data excerpts. A premise of phenomenography is that there is a limited number of ways of experiencing a phenomenon. Therefore, the results of this study are useful in framing mathematics educators' responses to parents concerns about mathematics curriculum change, in an effort to engage parents in conversation, rather than debate.

Participants, Context and Research Methods

Participants for this study were recruited from ten urban, suburban and rural communities in a Western Canadian province. The 38 parents who participated

were representative of low, mid-range and high socioeconomic status. Table 1 reports demographic data collected from parent participants through a questionnaire at the beginning of the project.

Table 1

Participant Demographic Information (n = 38)

Question	Response	Count	Percentage
Parental role	Mother	30	79%
	Father	7	18%
	Grandmother	1	3%
Age range	30 - 39	15	39%
	40 - 49	18	47%
	50 - 59	4	11%
	60+	1	3%
Children's grade (n=95)	Pre-k and K	13	14%
	Gr. 1 - 3	29	30%
	Gr. 4 - 6	38	40%
	Gr. 7 - 12	15	16%
Highest education	High School	4	11%
	Vocational	7	18%
	Undergraduate	10	26%
	Graduate	12	32%
	Professional	5	13%
Occupation	Healthcare	12	32%
	Math/IT	7	18%
	Office/Admin	7	18%
	Education	4	11%
	Student	3	8%
	Unemployed	3	8%
	Science-related	2	5%

Parents were recruited through school council groups and parent networks. We anticipated that this recruitment process would likely yield parent participants with strong opinions about their children's mathematical learning. While using this method of recruitment could be criticized as participants may not be representative of all parents, it also enabled us to listen to parents who are active in their school communities. Thus, participants are more reflective of

vocal parents in the media, which allowed us to begin to understand the nature of parental concerns.

After completing the demographic questionnaire, all participants took part in one of ten focus group sessions. Focus group sessions were approximately two hours in length and included two to six parent participants. They were led by pairs of researchers and/or research assistants. Data collected during focus groups included field notes and full transcripts of the sessions. Focus groups were used as generative sites of data collection with the knowledge that differing parent perspectives required participants to explain their perspective to others, allowing us to notice differences in their personal experiences and in their concerns for their children's mathematical learning. We sought to develop a finely nuanced understanding of the dimension of variation within parents' perspectives. Therefore, focus groups were structured to prompt parents to address four key components:

1. Parents' observations and perceptions of their child's learning: *What is your child learning in math in school right now? Do you have idea of the topics they're learning?*
2. Parents' recollection of their own mathematics learning: *What sort of memories come to mind of you learning math in school, whether they were positive or negative? What do you remember doing? (e.g., class activities, homework, parent support)*
3. Parents' formal and informal efforts and interactions around mathematics at home: *What kinds of activities do you do at home with your children to support their learning of math, whether it is formal or informal? Are there mathematical activities that you do with your kids at home?*

4. Parents' expectations about their children's mathematics learning: *What are your expectations or what kind of goals do you have for your kids in learning math in elementary school? What do you want them to get out of their elementary math learning experience?*

Individual follow-up interviews were conducted with fourteen parents to elicit further clarification in understanding perspectives shared in the focus group conversations. The individual interviews were approximately one hour in length and were conducted by a single researcher or research assistant. Field notes and full transcripts of these sessions were also collected.

Data Analysis

We viewed the data from the focus groups and interviews as forming "a pool of meaning" (Marton & Booth, 1997, p. 133). Each statement made by a parent participant was reviewed for its meaning and an interpretation of the parent's concern and underlying expectation. We began our analysis using a pre-existing framework from our previous work reframing public opposition into collective concerns (McFeetors & McGarvey, 2019), but found these categories to be limiting and determined that many comments required expansion of previous categories, consolidation of several categories or the creation of new categories. Data was sorted and re-sorted several times to exhaust the range of different perspectives expressed by the parents. During the sorting process we developed and refined expectation statements which were intended to concisely and coherently assert the meaning of parental expectation underlying a comment. Multiple expectation statements were created if multiple concerns or expectations were included in a single

comment. Table 2 provides an example of expectation statements created from the data.

Table 2

Examples of Expectation Statements

Parent Comment	Expectation Statement
<p>“I think our last comments as a group sort of exemplify what our struggles are as parents; that we don’t know. We’re very supportive of what’s happening but we just don’t know how to be that support in the home environment. And there haven’t been directed interventions to bring us into the loop readily.”</p>	<p>Parents expect to help their children at home, but they tend to encounter difficulties in understanding current approaches to computation.</p>
<p>“As a parent if I go to look at the curriculum, I understand math but I don’t understand those words. The jargon and stuff like that.”</p>	<p>Parents expect curriculum and teaching resources to be clear to parents, and to be compatible with how children learn.</p>

Throughout the data analysis process, we used a constant comparative approach (Glaser & Strauss, 1967), moving among the parents’ comments and emerging categories fluidly. As analysis continued, we began to perceive connections between expectation statements and were able to identify three broad categories of parental expectations which could be used to frame our analysis.

In a recursive fashion, identification of these three broad categories further facilitated our ability to discern underlying parental expectations and thus create expectation statements to describe subcategories. For example, early on in the sorting process, we noticed many statements related to student confidence, abilities, skills, and learning goals. This led us to develop the parental expectation statement for category 1: Students need the opportunity to reach expected goals of mathematics learning. Reorganizing statements into this category, enabled us to more accurately identify three subcategories of parental expectations within expected goals: (1) those related to confidence and success, (2) those related to essential skills, and (3) those related to future careers. The third of these subcategories had not been considered prior to this reorganization. A similar cyclical sorting and identification process occurred with each of the categories of parental expectations.

Since we structured our study in such a way that parents were frequently comparing their own experiences learning mathematics with the experiences of their children, we expected to see comments which referenced past and present experiences. Again, within category 1 and expectation 1, Cynthia noticed a positive difference: “I think they get a lot more hands-on and I notice that they use a lot

more blocks ... I think when I went to school it was almost just lecturing.” However, we also found that parents often referred to the future of their children in their comments. For category 1 and expectation 3, we recognized Vincent’s comment “we want to make sure that you have solid mathematical grounds so that later if you decided ... you can go and be an engineer” was predicated on future aspirations. The parents’ comments were often framed by their past experiences, their current realities and/or their hopes for their children’s future, and this prompted us to overlay a temporal element on top of the expectation statements and categories. This multi-faceted analysis structure allowed us a deeper, multi-dimensional understanding of parental concerns and expectations.

Results

We identified three categories and nine subcategories of parental expectations which were expressed during the focus groups and individual interviews. The categories and subcategories represent a reduction of the concerns articulated by the parent participants. They characterize the range of parent perceptions and expectations of current approaches to mathematics learning. As described above, these categories were developed from the analysis of statements made by 38 participants during ten focus groups and fourteen individual interviews. The three categories of parental expectations are represented in Table 3 as numbered statements.

Students Need the Opportunity to Reach *Expected Goals* of Mathematics Learning

Parents believe their children need the opportunity to reach *expected goals* of mathematics learning. This closely aligns with elementary mathematics teachers’ goals for their students. However, while teacher

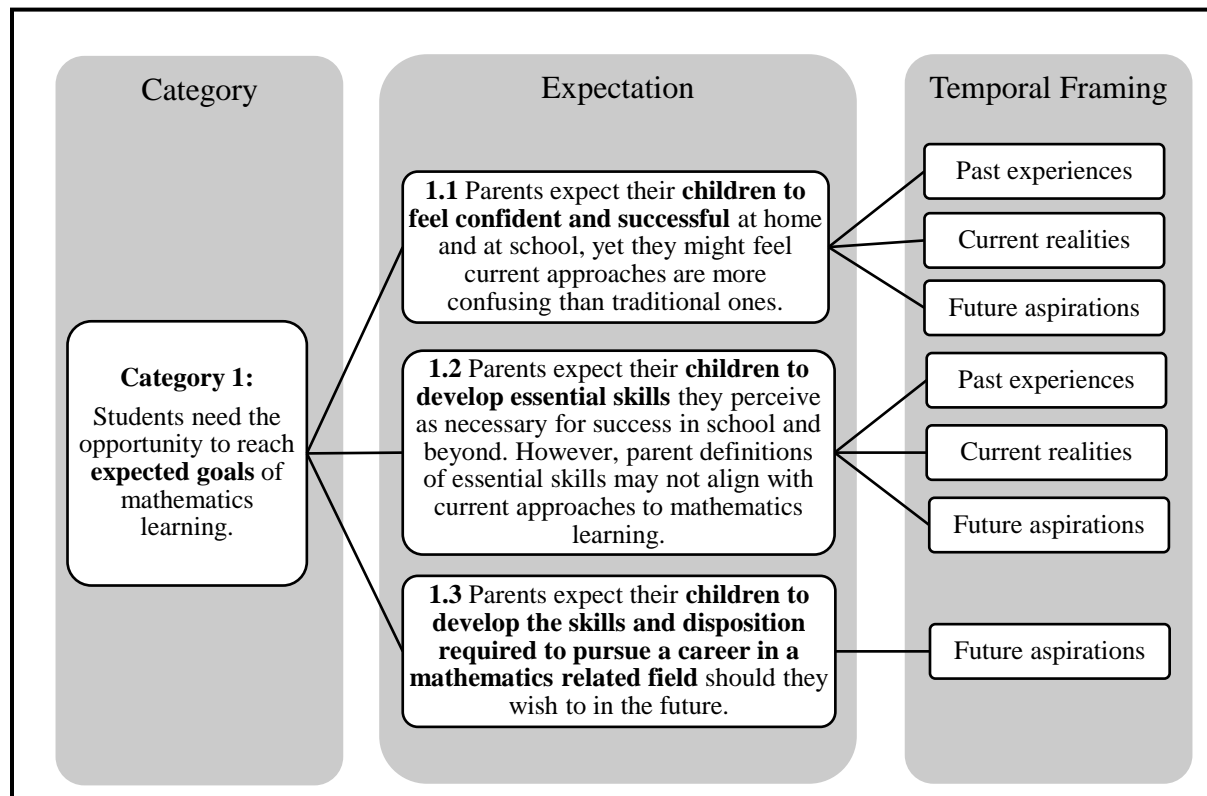
expected goals are often carefully outlined in curricula and pedagogical documents (e.g., district, state or provincial curricula; Common Core State Standards for Mathematics; Principles to Actions), parental goals have been less clearly delineated. In Figure 1, we map the category of *expected goals* as three parental expectations framed temporally.

Table 3

Categories of Parental Expectations

Category	Expectation for mathematics learning
1	Students need the opportunity to reach expected goals of mathematics learning.
2	Essential supports must be in place for students to reach goals of mathematics learning.
3	Communication between school and home is necessary for parent understanding and engagement.

Parents who expressed concerns about mathematics learning related to *expected goals* made statements framed by their past experiences learning mathematics, their current realities related to their children’s learning of mathematics and/or their future aspirations for their children. For example, Ashley’s statement demonstrating feeling confident and successful (expectation 1.1), “I don’t want them to be afraid of math class like I was. Math is such a building block for so many different things,” indicates that her concern for her children’s confidence in mathematics is connected to her past experiences as well as her hopes for their future and may not be related to current mathematical teaching approaches at all.

Figure 1*Parents' Expected Goals*

Conversely, Linh directly identifies current pedagogical approaches as the source of her daughter's struggles with confidence and success. She asserts, "My daughter felt that she wasn't great at math because she couldn't really understand what the question was asking." In the following excerpt, Linh expands on her perceptions of the causes of her daughter's lack of confidence:

If they're sitting and learning to double and all these additional steps and if you don't master the numbers and it doesn't become automatic for you, your mind gets more, you know, more complicated more, and they're confused from over learning, it's more overloaded with processing.

Here, Linh perceives multiple strategies for computation as overly complicated and confusing and does not see an advantage to approaching problems using different strategies. In fact, Linh identifies multiple strategies as the reason her daughter questions her mathematics ability. Linh's views were quite extreme when compared with other parents in our study. However, it is important to note that multiple strategies is a common discussion topic for parents. In the interviews, multiple strategies were referred to over 400 times. Although opinions of this teaching strategy were varied, several parents linked this teaching approach to low confidence and success. There is a need for improved teaching of multiple

computation strategies and clearer communication to parents about how to support their children's learning.

References to all three temporal domains were also included when parents expressed opinions related to essential skills (expectation 1.2). Past experiences learning mathematics were evident when parents asserted that the skills their children should learn were ones emphasized during their schooling, such as memorization of basic facts and timetables, quick computations and fluent use of standard algorithms. Elise pointed out:

I do think that there are some foundational skills, you know, being able to memorize and pull that out, [...]. And that's what I think is lacking. I think that being able to kind of read a bigger problem and go through some of those problem-solving steps. I think those are perhaps strengthened by some of the techniques that they're learning. But that sort of foundational very base skill that was certainly, I think, the main way we were taught, certainly in my experience as a student. I feel like that's what's really sort of been sacrificed in this new...[model].

In this excerpt, although Elise sees some benefit to current teaching methods, she returns to her own experiences learning mathematics to form her critique of current pedagogy and identify her expectation for "foundational skills." This notion of parents' more traditional mathematics learning experiences as representing "foundational," "fundamental," "core," "basic" or *essential skills* was one commonly expressed by participants in our study and represents a point of difference and difficulty.

However, not all parent felt that essential skills were found in the traditional methods they experienced. When recounting her current experiences problem solving with her grade two twin boys, Kelly stated that she did not remember problem solving herself in elementary school and that she sees great benefit to this teaching approach: "Overall I think that's very beneficial for a child's growth to be starting off with problem solving at an early age. I think that's very beneficial, and it gets their brains working in a different way, seeing that they can approach things differently." For Kelly, the ability to approach mathematical problems in different ways is an essential skill that she was not provided with. She felt that her sons' current experiences learning mathematics will help develop this skill.

Other parents framed essential skills by looking towards their child's future experiences. They suggested that essential skills might be those needed in higher grades, like Chloe explained:

I still think it's really important that you learn, memorize your times tables and all that. Because in the future when you're doing bigger math, I mean, you really need to know that stuff just off the top of your head.

Or those needed in daily life as an adult, like Tom described:

Algorithms are a life skill, actually. It's not just knowing how to long divide or something. You need it for filling out your taxes, you need it to construct IKEA furniture. You need to carefully follow a series of steps to do some of the things in life.

Parents mentioned activities such as shopping, baking, and driving, as future experiences that would require

their children to apply essential mathematical skills. As the previous excerpts illustrate, what parents perceive as essential skills for mathematics learning varies greatly and may be based on their past and present experiences, or goals for their children's future. However, recognizing essential skill attainment as a mutual expectation of both parents and educators allows for a common ground from which to discuss reform-based curricula.

Many parents moved beyond daily activities and maintained their future orientation to frame possible careers (expectation 1.3). Future career opportunities were mentioned over 60 times during the interviews and represent an important expectation for parents. While it may seem too early for an elementary school teacher to consider the possibility of her young students earning engineering or physics degrees, this may be a real concern for many parents. Rachel, whose daughters are in grade four and seven, states:

I want them to appreciate, respect math and to understand it and be able to use it in whatever. You know, whether it's your social sciences and they're using it in terms of statistics and doing research, or whether it's because they're an engineer.

Rachel's concerns about her daughters' possible careers may seem less far-fetched to the elementary school teacher if we consider that disposition towards mathematics and performance in lower grades plays an important role in determining which high school mathematics courses students will choose to take. Rose and Betts (2004) found that "the math courses that students take in high school are strongly related to students' earnings around 10 years later" (p. 510). Furthermore, scholarly research outlines how essential and pervasive mathematics has become in the

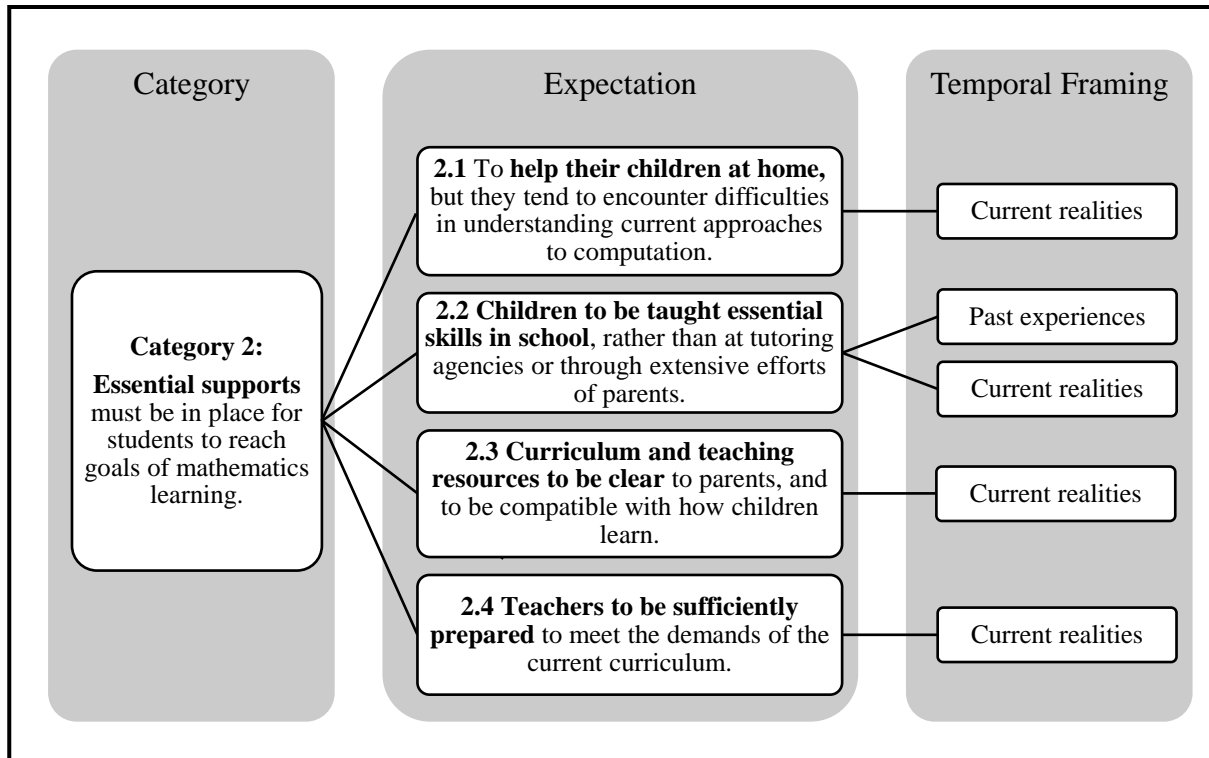
workforce and identifies rapidly expanding career sectors which require a high-level of mathematics education (National Research Council, 1990). When framed by this research, it is unsurprising that parents expressed fears related to their children's ability to pursue mathematics-related careers.

Both parents and teachers have expected goals for mathematics learning. Like parents, teachers wish to help children feel confident and successful learning mathematics and they also wish to teach them essential mathematics skills. Teacher understanding of these similarities between parent and teacher *expected goals* can create opportunities for working with parents. Additionally, teacher recognition of the gatekeeping role mathematics plays in their students' future academic and career opportunities and their potential earnings could allow for a deeper understanding of parents' expressed concerns.

Essential Supports must be in Place for Students to Reach Goals of Mathematics Learning

The second category of expectations we identified centered around the *essential supports* parents perceived as necessary for their children to attain the *expected goals*. Temporally, parents framed this expectation primarily referring to their current experiences with their own children. However, one parent did mention his perception that in his current reality, greater parent involvement was required to ensure academic success in all subject areas than had been required in the past when he was a student. Parents identified essential supports that they expected to provide themselves, as well as those they felt should be provided by the teacher, school, governing educational bodies or teacher preparation programmes.

Figure 2

Parent-identified Essential Supports

While many parents expressed concerns that these essential supports were not currently in place, others gave positive counter examples. In Figure 2, we map *essential supports* as four parental expectations.

In a study of parents of primary school-aged children, de Abreu and Cline (2005) found that “parents do not find it easy to teach their children school mathematics at home...Some parents may need support not just to learn how mathematics is taught at school but on strategies for bridging any home-school gap” (p. 720). While parents in our study expressed similar frustrations, their responses also highlight the fact that they still expected to help their children with mathematics even when providing that support is challenging (expectation 2.1).

Additionally, parents identified many activities beyond school homework that they engaged in to support mathematics learning. These included playing card and board games, encouraging children to calculate payment and change while shopping, practicing measurement, multiplication and fractions while baking, calculating angles while playing sports, analysing sports statistics, identifying patterns in their environment, calculating car speed during family trips, measuring fabric and many other informal conversations related to mathematics. This extensive list of activities emphasises how underutilised parental support in elementary school mathematics learning may be. Leslie’s comment clearly articulates parental willingness to support mathematics learning as well as frustration with not knowing how best to do so:

I think our last comments as a group sort of exemplify what our struggles are as parents; that we don't know. We're very supportive of what's happening but we just don't know how to be that support in the home environment. And there haven't been directed interventions to bring us into the loop readily.

As a parent if I go to look at the curriculum, I understand math, but I don't understand those words. The jargon and stuff like that. When we talk about regrouping, I had to figure out what that was. Oh, that's when you carry them on, that's regrouping. All these words and stuff, it's very new terminology.

Difficulty in providing support at home may, in part, be responsible for concerns about the need to pay tutoring agencies or provide extensive effort at home in order for children to be successful (expectation 2.2). Parents felt strongly that while they were willing to provide support at home, they did not want to assume primary responsibility for teaching mathematics. Parents who felt that current teaching practices did not sufficiently address what they perceived to be the essential skills, made assertions related to their undue need to take responsibility for teaching mathematics at home. As examples, Natalie mentioned, "I have to supplement at home" while Linh commented, "I had to work extra, devote extra time at the end of the day." This parental perception indicates a need for teachers to work with parents to identify common goals related to essential skills. In doing so, frustrated parents may be empowered to productively support their children's learning without feeling overburdened.

As mathematics education researchers and practicing teachers, we found that some of the vocabulary we took for granted posed difficulties for parents. In this example, the frustration felt by Meghan reflects a tension between vocabulary which supports a procedural approach to mathematics learning ("carrying") and that which supports a conceptual approach by identifying the underlying concept of "regrouping." This shift in vocabulary, reflects a larger shift towards conceptually-based teaching and learning. In order to address this, we believe that elementary mathematics teachers must make efforts to support parents by translating mathematical terms into language that is more easily understood by them and by making connections between conceptual understanding and procedural fluency (Kilpatrick et al., 2001). Indeed, we encourage all those working in the field of mathematics education to be cognizant of vocabulary usage, and particularly terms that indicate a conceptually-based approach to mathematics teaching and learning, when working with parent participants.

Parents not only expressed frustration and confusion with supporting their children at home. Additionally, they shared difficulties with deciphering textbooks, worksheets and curricular documents. They felt that these documents should be written more clearly (expectation 2.3). Some parents found the subject specific vocabulary particularly challenging. Meghan shared a personal frustration:

The final parental expectation we identify related to *essential supports* is the expectation that teachers should be sufficiently prepared to meet the demands of mathematics curriculum (expectation 2.4). A large body of research has shown that a significant number of elementary school teachers suffer from

mathematics anxiety (e.g., Bates et al., 2013; Bekdemir, 2010; Finlayson, 2014) and may not feel confident or well-prepared to teach mathematics. From our research it appears that, along with researchers, parents have also noticed this phenomenon. Mandy outlines her concerns about her son's grade four teacher:

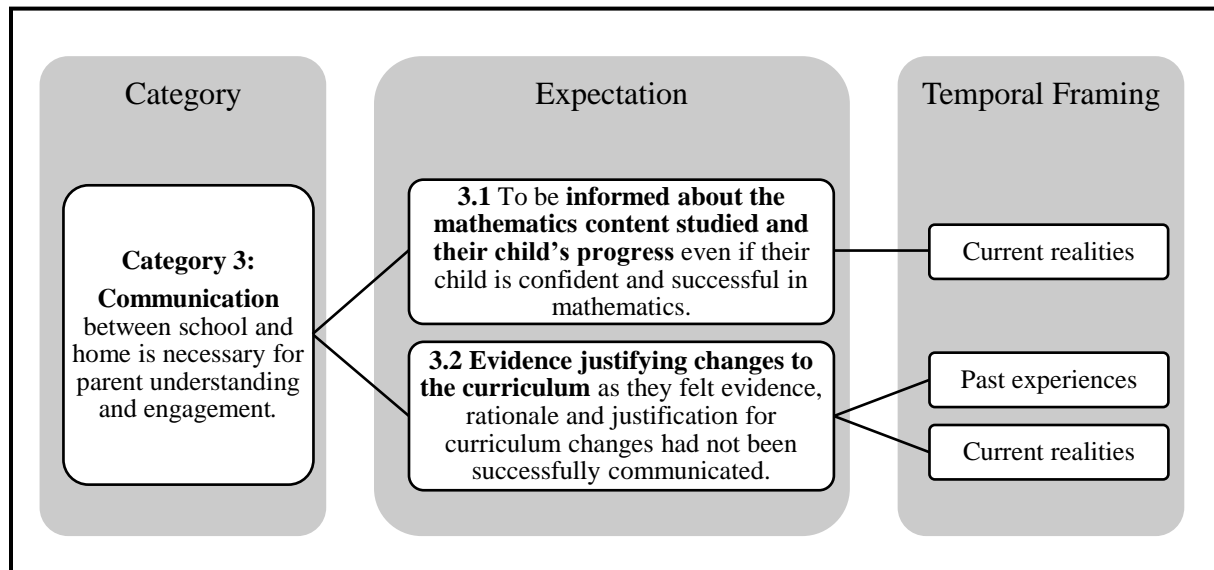
If you have a teacher that's weak in math – let's face it every teacher has a strength and a weakness. And if you get a weak teacher in a particular subject, in this case math, it's harder for the teacher to teach it to the kids. I'm finding that's what I'm suspecting this year we have.

Kilpatrick et al. (2001) believe that “it is critical that [students] encounter good mathematics teaching in the early grades” (p. 132). We believe that good teaching requires classroom teachers who are well-prepared and confident. Our research indicates that some parents believe their children are being taught mathematics by teachers who do not feel prepared, confident or comfortable teaching the subject. Previous research shows that these parents are likely correct. This suggests the need for steps to be taken at the individual teacher, school, district, state or provincial levels (through professional development opportunities) and at the university level (through increased mathematics requirements for teacher preparation programmes) to increase teacher capacity for mathematics teaching. Our belief is that increased teacher capacity could improve student learning and reduce parental concerns.

Communication between School and Home is Necessary for Parent Understanding and Engagement

The third category of expectations we identified related to the kinds of communication from school parents expressed desire for in order to understand and appreciate current approaches to learning mathematics. Rather than observing how children are learning in classrooms, parents rely on information provided directly by teachers and schools and indirectly through interactions with their children outside of school (McFeetors et al., 2016). Overall, parents voiced concerns regard the perceived inadequacies of home-school communication. In Figure 3, we map the final category of parent concerns as two expectations expressed by parents.

Researchers agree communication is one dimension of parent involvement (Simon & Epstein, 2001) that proves to have a positive relationship with student academic success (Epstein, 1987), learning motivation (Civil & Bernier, 2006; Patall et al., 2008), socio-emotional development (Meier & Lemmer, 2015), and career decisions (Sheldon et al., 2010). However, it is likely that this relationship is affected by the quality, clarity, frequency and methods of communication. Although teachers or schools may intend formal communication, such a report cards or parent-teacher interviews, to be their most important communicative actions, in our study parents perceived homework, assignments and tests sent home to be the primary form of communication about their children's mathematics progress.

Figure 3*Expectations for Communication*

Some parents expressed dissatisfaction with the frequency and volume of products reported back home and asserted their need to be kept informed about what and how their children are learning in mathematics. In the following excerpt, Natalie clearly shares a desire to receive thorough content and particularized progress from school (expectation 3.1):

I think as parents we have the right to see more detail how they're doing and what they're doing. So, to see more work I think would be really good because then you have a full understanding of what they're doing and how they're doing on it and generally speaking then we know when to push.

Although Natalie felt that classroom communication was lacking in her current reality, other parents expressed satisfaction with the level of home-school communication. Parents especially appreciated classroom newsletters that listed the current

mathematics topics being studied. Year plan outlines, regular classroom newsletters, parent-teacher interviews, email, classroom websites and consistent homework were methods of communication that parents repeatedly referred to as helpful. Overall, parents felt that good communication was key to supporting their children at home.

Parent participants framed their concerns about communication related to curricular changes (expectation 3.2) using both their current realities and their past experiences. Criticism often came in a form similar to the adage 'If it ain't broke don't fix it.' James' comment, "Why did you switch from what seemed to be working perfectly fine to something not?" clearly echoes the idiom. Most parents in our study felt that their own mathematics education had been successful or they had survived it, and did not understand why curricular and pedagogical changes had been made. Additionally, observations in

everyday life and media coverage as indirect sources often issued confusing and even conflicting information.

Overall, parents indicated limitations in understanding their children's mathematical learning and a lack of communication around the rationale and pedagogy of the mathematics curriculum. Elise directly identified this lack of communication as a missed expectation, stating, "I think one thing that was lacking for me as a parent was feeling that a solid rationale had been provided to me for why this is the better way to do math." We suggest that unless elementary school teachers and administrators take steps to ensure that evidence, rationale and justification for curriculum changes are successfully communicated to parents they will continue to have difficulty garnering their support.

Discussion

The three categories together summarize the concerns and expectations expressed by the parents in the study. Understanding that parental concerns about current mathematics education may be classified as related to *expected goals*, *essential supports* or *communication* provides teachers and administrators starting points from which to approach discussions. Recognizing that parental critiques are likely born, not only of their current realities, but may also be framed by their past experiences learning mathematics and their aspirations for their children's future, creates possibilities for more productive home-school communication about current mathematics reform. As we question borders erected between parents and their children's mathematics learning in school, we can begin by developing a strong understanding of areas of parental concern and the expectations that may underlie criticism.

The nine parental expectations create a single framework which reflects the diversity of considerations to take into account when engaging with parents. NCTM (2014) asserts that "effective teaching is the nonnegotiable core that ensures that all students learn mathematics at high levels and that such teaching requires a range of actions at the state or provincial, district, school, and classroom levels" (p. 4). Our research emboldens us to suggest that an important action included in the "range of actions" suggested by NCTM is developing a strong understanding of the concerns of parents and effectively engaging their support in current approaches to mathematics learning. Identifying which expectations may be at the root of parent critiques will allow educators to create a foundation for productive conversations that honor parent experiences.

This study provides insights into areas of parental concern and nine possible expectations parents may hold about their children's mathematics learning. While choosing vocal parents who are active in the school community provided us with a wide range of strongly expressed beliefs, these opinions may not be representative of all parents of elementary school aged children. Further study is required to investigate if the categories and expectations hold true for a wider cross section of parents. Additionally, while identifying parental expectations allow us insight into parental concerns, we did not provide any intervention to address these concerns. Intervention studies focused on parent education or the development of more effective classroom communication methods could begin to ascertain how best to engender parental support for current mathematical practices.

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