How Do You Feel? Using Scribblers in the Math Classroom to Elicit Mathematical and Personal Connections

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In this article, we discuss using what we call math scribblers in two very different contexts: in a mathematics curriculum and instruction course for preservice teachers and in a Grade 3 mathematics classroom.

Despite the varying contexts, we used the math scribblers to similar ends. In particular, our focus was to heighten students' awareness, of both the *doing* of mathematics and *how they felt* in doing mathematics. The scribblers, which we will describe in greater detail, functioned as both a repository of students' mathematical problem solving and a space where students could reflect on how they attended to the mathematics, how it resonated in their lives and the feelings it elicited.

In this article, we discuss artifacts of student work from both contexts and suggest implications for classroom practice.

Positioning Ourselves

Josh is an instructor in the Faculty of Education at the University of Lethbridge, where he teaches various courses, including a curriculum and instruction course for mathematics majors. Raeesa is a recent graduate of the education program, in which she

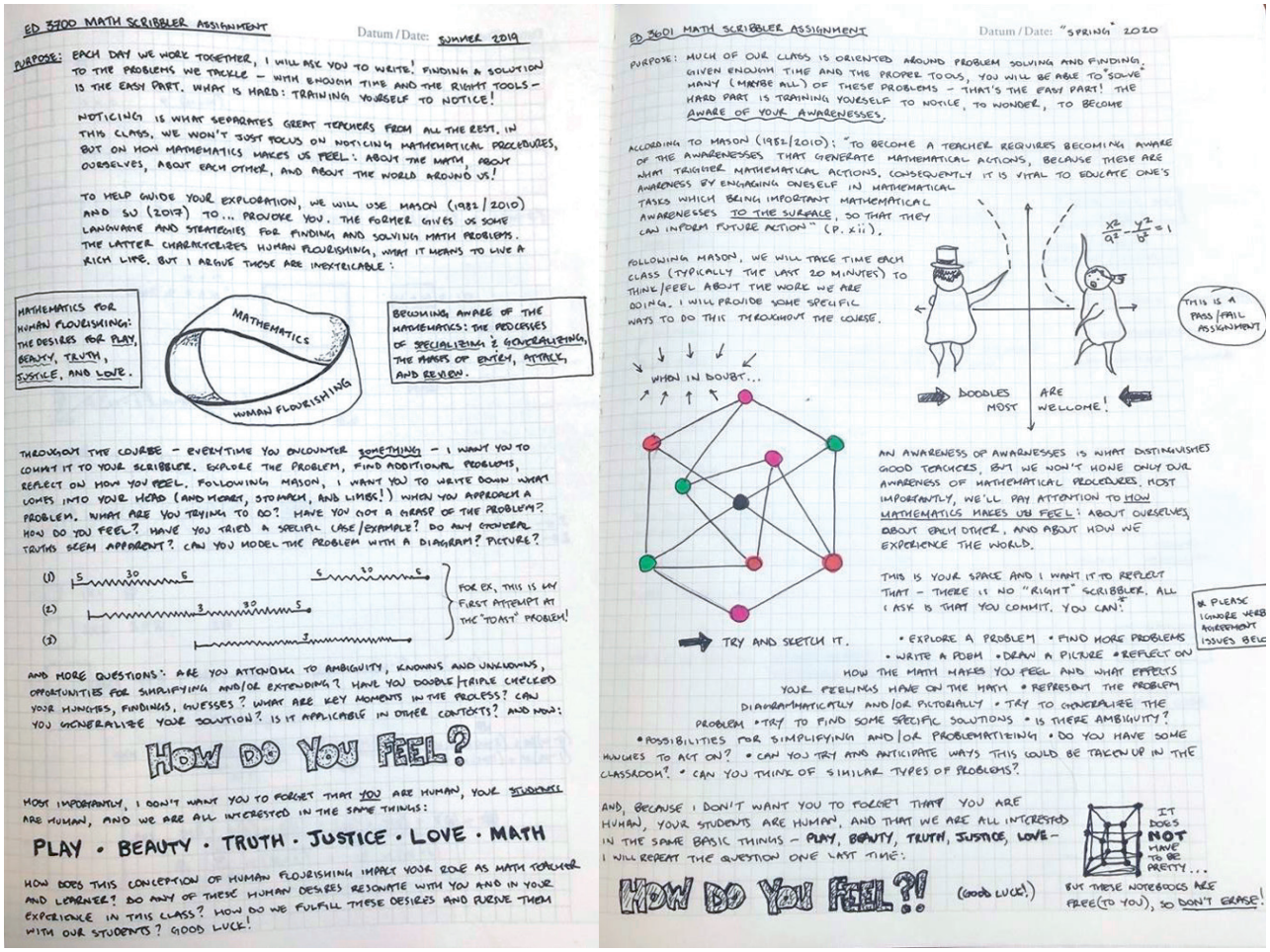

FIGURE 1. *Math scribbler assignments from a curriculum and instruction course for preservice teachers.*

majored in mathematics education. We worked together first in a general curriculum and instruction course (fall 2018) and then in a curriculum and instruction course for mathematics majors (spring 2020).

It was in the latter course that Josh assigned the math scribbler. A copy of the assignment was stapled to the inside of a blank notebook distributed to each student. Figure 1 shows the assignments from summer 2019 and spring 2020. Both emphasize heightening students' awareness of how they do mathematics and end with the question, How do you feel?

Raeesa had the unique experience of working with the math scribbler both as a student and as a teacher. In her final teaching internship, in which she held a half-time teaching assignment in a Grade 3 classroom for four months, she developed and implemented her own version of the math scribbler with her students. This idea was included in her professional inquiry project, in which she investigated, researched and implemented ideas on the importance of reflection in the mathematics classroom. Her idea was that reflection in mathematics could help students better understand fundamental math concepts, deepen their comprehension and keep them engaged. One way she brought reflection into her classroom was through the use of math scribblers.

Using the Math Scribbler with Preservice Educators

I (Josh) teach math-focused curriculum and instruction courses for both preservice teachers majoring in math and preservice teachers majoring in other subjects who want to explore math as a teachable subject.

In my experience, the relationships those two groups have with doing mathematics are complex and often significantly different.

Students in the former group tend to be comfortable with mathematics and have a history of success in the subject. This is perhaps unsurprising, given

their choice to become math teachers. Yet, despite their proficiency in solving mathematics problems, I often observe that these students struggle to make explicit their problem-solving processes and personal connections to the material. Mathematics is conceived as something to be done, not lived.

A similar issue arises with the students who are not mathematics majors—but for different reasons. These students often associate mathematics with failure, anxiety and frustration, which also seems to be grounded in their history with the subject. In the same way that proficiency and familiarity might affect students who major in math, anxiety and fear hamper these students from making rich personal connections to mathematics.

I implemented the math scribbler as an assignment in my classes to cultivate a heightened awareness in students of their approach to problem solving and to give them the opportunity to realize that mathematics was a part of their lives that they had reason to value. Mason, Burton and Stacey (2010, xii; italics added) note that "to become a teacher requires becoming *aware of the awarenesses* that generate mathematical actions, because these are what trigger pedagogical actions." The scribbler was a space where students could engage in tasks oriented toward making explicit how they approached mathematics, not simply finding a solution.

However, I wanted students to heighten their awareness of more than just their problem-solving processes. I also wanted them to reflect on how mathematics manifested in their lives. Discussion prompts for each problem asked students to make connections to Su's (2017) mathematics for human flourishing and how his five human desires—play, beauty, truth, justice and love—resonated in a piece of mathematics. Above all, I wanted students to make an emotional connection to the mathematics they did. This was often provoked by returning to a simple prompt throughout the problem-solving process: How do you feel?

In their discussion of mathematical identity, Black et al (2019) identify the importance of emotional experiences in doing mathematics. "An experience of emotion," they write, "can become crystallised into a mathematical identity if one encounters re-iterations of that emotional experience, allowing time for the essential reflections on the experience that may be verbalized as 'I am . . . .'" (p 381). The math scribbler became a space for those encounters.

Two Perspectives on Using the Math Scribbler

In this section, I (Raeesa) discuss my experiences with using math scribblers both as a student and as a teacher.

Using the Math Scribbler as a Student

When Josh first introduced the math scribbler assignment in our curriculum and instruction class, I immediately started to worry. A math assignment with no clear rules or guidelines was distressing to someone like me. I wanted to know what I had to do to get a good grade and what Josh expected from me as a student.

The open-endedness of the math scribbler made me uncomfortable, but as we progressed through the first week of the course, I began using my scribbler as a place to jot down questions, answers, connections, ideas, thoughts and feelings about what we were learning and the math we were interacting with. I began to really like the openness of the assignment. It was different from anything I had experienced before. As I continued to use my scribbler, I worried less about the grade attached to it and focused more on how much freedom I had with it and how much I felt I could express myself through it.

My math scribbler was my own personal place to voice anything related to mathematics. I would connect what we were learning to previous mathematics I had learned and reflect on how it made me feel. If something challenged me, I would express my anger about not being able to figure it out. I would also express my confidence and happiness when I was able to get past a math problem that had tested me.

Using the math scribbler was a unique way of approaching a mathematics class, and I found it engaging and personal. I wasn't worried about how neat my scribbler looked, the grade I would get or whether my answers were correct. I knew that Josh cared more about my feelings and ideas when I was interacting with the math: How did I approach the problem? How did I revise my thinking to accommodate new information? What did the math remind me of? How did the math make me feel?

Figure 2 shows pages from my math scribbler. The top right and bottom left panels show my thinking around the use of manipulatives in the classroom and how I felt about using them.

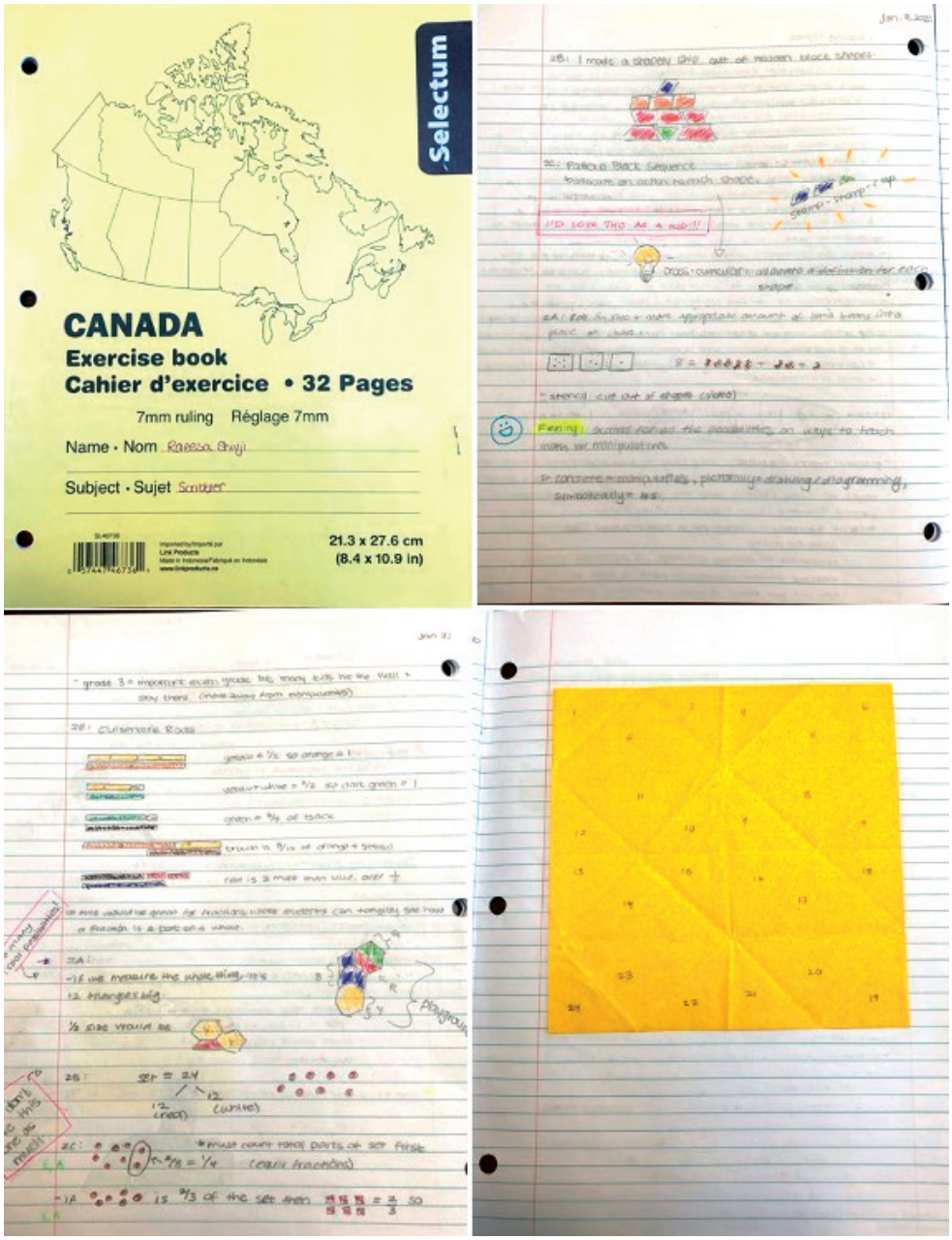

FIGURE 2. *Pages from Raeesa's math scribbler.*

Using the Math Scribbler with Grade 3 Students

When I began my final four-month teaching internship, I knew that I wanted my Grade 3 students to have a similar experience with math scribblers, but I was also uncertain about how to implement the scribblers and how they would be received. I was especially intimidated as an intern teacher, a situation in which I would be assessed by more-experienced colleagues based on the lessons I taught. But I had thoroughly enjoyed the assignment as a student, and I wanted to give my young students the opportunity to enjoy it too.

I introduced the scribbler assignment as a way for my Grade 3 students to express their mathematical ideas, thoughts and feelings to me. I used pictures and keywords to modify Josh's scribbler assignment, since many of my students were still learning to read (Figure 3). When I told my students that I had done the same assignment for my university class, they were excited to try it.

Here, I describe work my students did on a numberless word problem that I created to address

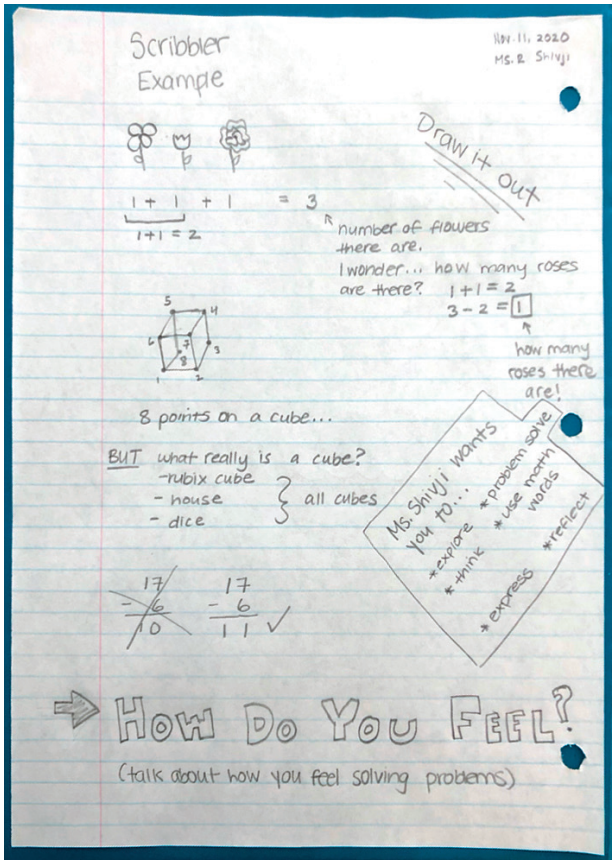

Figure 3. *Raeesa's Grade 3 scribbler assignment.*

one- and two-digit addition. I presented the following problem to my class:

> Ms Shivji had some money in the bank. She added a few more dollars yesterday.

My objective was to have students think critically about addition. Along with the numberless problem, I provided guiding questions and prompts to encourage personal and emotional connections to the problem. The students were forced to challenge the way they thought, to dig deep, and to make connections with the word problem and what they had learned previously.

The students were uncertain at first. This was a task different from anything they had seen before. Despite their uncertainty, they bravely embraced the task. Many of them responded to my written and verbal prompts and used them as starting points for further exploration, often feeding off the ideas of their classmates. Some students doodled as they thought, but as they began to mathematize the problem, their hands started shooting up and they were eager to share what they were noticing.

I first asked the students, "What math do you notice in this problem?" This was meant to get them thinking about where math exists, other than in the form of a number. For a Grade 3 student, this is a tough concept to grasp, but my students were eager to find ways to show that there was math in the problem. At first, they expressed how difficult it was for them to see the math. I encouraged them to look harder and told them that there was indeed math in the problem.

One student wrote that there was "no math at all" (Figure 4). But, after some discussion, the student wrote that I had some money in the bank and I added a few more dollars. This student, like others, was able to realize that the phrases *some*, *added* and *a few more* were related to amounts. They were mathematical words. The students immediately began to write the problem down in ways they considered to be more mathematical.

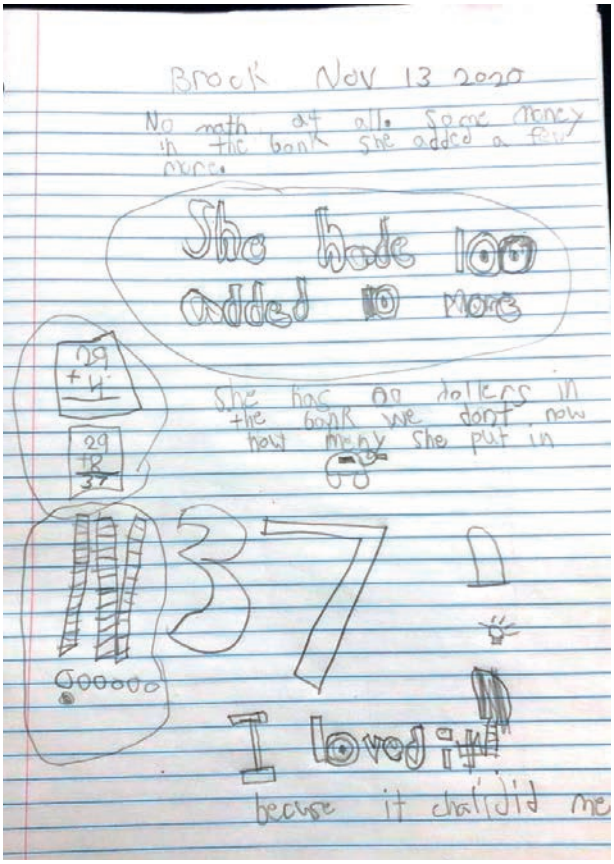

Figure 4. *A student beginning to see some math in the problem.*

Gradually, I provided additional information and a number, followed by another piece of information and another number, until the students had all the information and numbers, as well as a question to solve. After introducing a new piece of information,

I would ask students questions such as the following:

- How does this change what we know?
- What else do we need to know in order to solve this problem?
- What question could I ask you about this situation?
- What type of problem is this?
- Can you estimate an answer to this problem?

I consistently encouraged students to answer these questions in their scribblers. The questions got them thinking about the problem critically, as well as mathematically, and allowed them to build on what they knew in order to expand the problem.

One student noted that we would need to know whether the problem involved addition or subtraction (Figure 5). This student was also able to recognize that we needed to know how much money I had put in the bank in order to solve the problem (which at that point didn't actually present a question to solve).

The students' math scribblers captured not only the mathematical products of their work but also their processes. The scribblers reflected their heightening *awarenesses* (Mason, Burton and Stacey 2010, xii). From the beginning, I encouraged the students to tell me how the mathematics made them feel, no matter what that feeling was. I encouraged them to write down how they felt at the beginning and at the end—to see if their feelings had changed. I told them that all feelings were valid. Whether they were confused, excited or frustrated, I wanted to know.

When the students had all the information and a question to answer, I encouraged them to show their work while solving the problem and to use strategies they had learned in class—such as drawing a picture, counting forward from the biggest number and being mindful of how they felt. I challenged students who finished early to find other ways to solve the problem. Many tried solving the problem in multiple ways and recorded their strategies in their scribblers. Some of the strategies they used were vertical addition using regrouping, base-10 blocks, drawing pictures, and using a number line or hundreds chart. They were able to see that the solution could be reached in

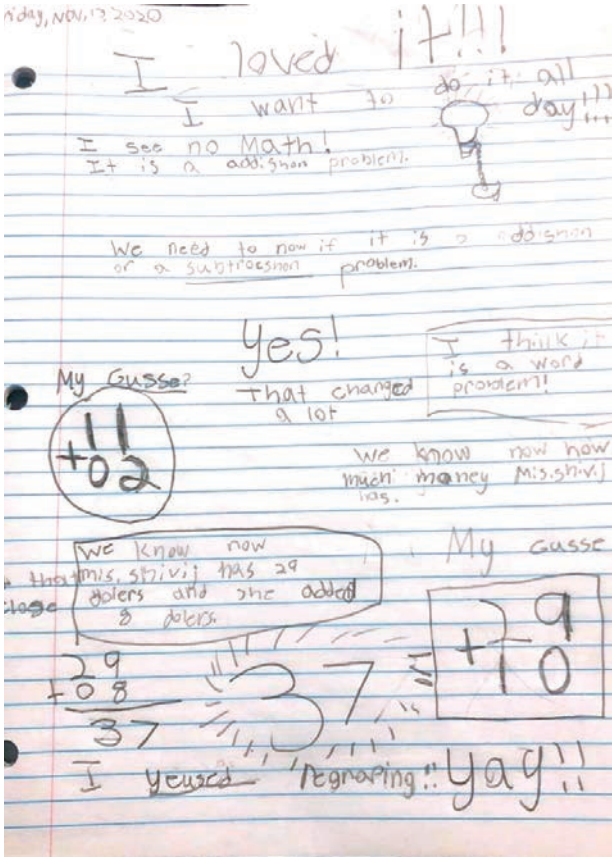

Figure 5. *Modelling a problem.*

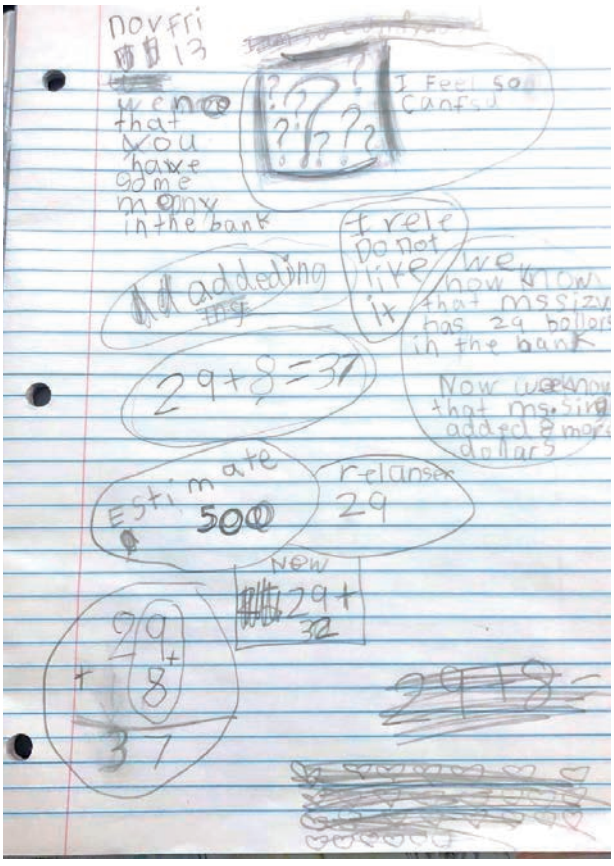

Figure 6. *A student's feelings of confusion and frustration, as expressed in the math scribbler.*

multiple ways and that they often had different ways of approaching the problem.

For me, the most valuable aspect of this process was being able to observe the emotional connections my students had with mathematics. The student who at first saw "no math at all" in the problem reported that they had "loved" the task (Figure 4). Other students wrote about how the work made them feel good, and others expressed frustration and confusion (as shown in Figure 6).

I was so glad to see my students expressing all these feelings in their scribblers, but I paid particular attention to the students who reported feelings other than simply enjoying working on the problem. Telling your teacher that you are confused is daunting, and I hoped that my students would trust me enough to tell me what they were feeling. The student in Figure 6 expressed her confusion through both question marks and words. At the top of her page, she drew a box filled with question marks and wrote, "I feel so [confused]." She even wrote, "I [really] do not like it." This allowed me to reassure her that it was perfectly fine to be confused and to not like something. Some students reported being scared. One student was so confused that all he wrote was "What are we doing what." This helped me understand which students needed more support and which students I would need to closely guide the next time we used our scribblers.

Implications for Classroom Practice

We have discussed using math scribblers in disparate contexts—a university course and a Grade 3 classroom. In both cases, math scribblers became a space for students to focus on the process of doing mathematics and to become more aware of their personal connections to doing mathematics.

Raeesa's account of her experiences as a student and the work of her Grade 3 students demonstrates some of the benefits of using a math scribbler from a student's perspective. The math scribbler becomes a space for making visible the messiness of mathematical thinking, making explicit one's mathematical awareness and voicing one's feelings about doing mathematics (whether frustration or joy).

From a teacher's perspective, the benefits are clear. In both Josh's curriculum and instruction course and Raeesa's Grade 3 classroom, the math scribbler became an invaluable formative assessment tool, yielding rich insight into not only students' mathematical problem solving but also their emotional connections with the subject.

References

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