Developmental mathematics from our students’ perspective

The case of Sasha

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Introduction

The data presented here are part of a larger study that explores adult returning students’ proportional reasoning and how this reasoning interacts with mathematics presented in the classroom.

Three questions; three data sources
Outline for this session

- Ethnography?
- Sasha and her mathematics
- Sasha’s experience in Basic Math
- Sasha’s mathematics after completing the course
What is ethnography?

Ethnography is a research methodology that asks broadly, “What is going on here?” when trying to understand an unfamiliar culture.
Eisenhart (1988) observed that mathematics education researchers “tend to assume they know the intersubjective meanings of the group they are studying” (p. 111).
Sasha
Sasha’s mathematics

- Math at work: restaurant manager, photographer.
- Math at home: Sasha reported using math while shopping and cooking, and, of course, when helping her children with their math homework.
“I have a big family, so we usually end up with – I would say – an average four-person meal – and I have to make that into a seven-person meal or a six-person meal. So trying to... Okay, that takes three cups, but I need to make a bigger batch so I would add and sometimes subtract certain things to make it ... to make sure it turns out the way it is supposed to. Without having the actual set up, how it is supposed to be.”
Sasha’s mathematics

Sasha discussed her thinking on several mathematics problems during her first interview, including the following.

- A percent discount problem
- Which is the better buy?
- The flower stem problem with a variation
The percent discount problem

Fred Meyer is having a sale. A $35 pair of jeans is marked 40% off. Can you buy the jeans for $20 or less? How do you know?
Ann: I just want to ask you a question about that 40% off. So, when you hear the phrase 40% off, what does that mean to you?

Sasha: 40 cents off the dollar.
Sasha: …This is what I do. When I’m at the store, for example, and I have this situation. I would go to 50% off. So if it was half of 35, I would be looking at... so if it was 40, it would be 20. So, it would $22.50, if it was half off. So, that tells me already... No, wait, that’s wrong. If it was half off, it would be... 30 would be 15. 2.50... 16, 17, 17.50. So it would be $17.50, if it was half off. So, that’s under $20. So, then I would still need to put into consideration that it is not half off.
Ann: Okay, so half off would be $17.50. It’s not half off. So, then what do you do?

Sasha: So, then I would estimate higher. They would cost more, so I would add about $3. Why? I don’t know. I just do. So, 17, 18, 19, 20… So it’s still $20.50. So, it wouldn’t be less than $20 for the pair of jeans.
Which is the better buy? An 8-ounce stick of deodorant priced at $4.50 or a 12-ounce stick priced at $6.50?
Which is the better buy?

*Sasha:* This is what I do all the time. This is what I do at the store, because it seems like it is better, but it really isn’t.

*Ann:* Which one seems like it’s better?

*Sasha:* The 12 ounce...
Which is the better buy?

_Sasha:_ And the reason I say this is because if you double your 12-ounce you are going to get 24 ounces for $13. So that’s 24 ounces. If you go with two 8 ounces, you are going to get 16 ounces for $9. So, you are definitely going to get more... even though it seems like it cost more, you’re still going to get a better amount.
Which is the better buy?

*Sasha:* For eight more ounces, I only have to pay like three more dollars. If I bought three 8 ounces for $4.50, it would still be more than if I bought more than the it would be more than if I bought the two for the $13.
Valentine’s Day is approaching, and you want to buy flowers for someone special. Three flower stems cost $2. How much will 15 stems cost?

Suppose 18 flower stems cost $15. How much would you pay for 6 flower stems?
The flower stem problems

**Sasha:** Because I needed to know how many sets I needed and then I needed times those sets by the amount to give me the final cost. For how much it would cost total to make it up to the 15 stems.
The flower stem problems

**Ann**: So, what this student wrote here... what these students wrote... Would that be an accurate way of how you thought about it too?

**Sasha**: Yeah. Pretty much, because you’d have to, you wanted to divide your 15 groups by the three because every $2 will give you a set of three. So you would divide it out to give you the five, because you need to times the groups times the dollar amount.
Suppose 18 flower stems cost $15. How much would you pay for 6 flower stems?
The flower stem problems

Suppose 18 flower stems cost $15. How much would you pay for 6 flower stems?

\[
\begin{array}{c}
9 & 7.50 \\
-15 & \hline \\
3 \\
\end{array}
\]

\[
\begin{array}{c}
8.00 \\
4.00 \\
3.25 & 3.25 \\
\hline \\
3.75 & 3.75 \\
\hline \\
5.00 \\
\end{array}
\]
The flower stem problems

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The flower stem problems
"Problem solving"

**Ann:** If you were actually shopping ... it seems like you would be pretty comfortable with your estimates. It would be pretty easy.
Sasha: …with problem solving, you are expected to get an exact answer. And when you are in the grocery store and buying something, no matter what it is, you have your set dollar amount, and just estimate and be happy when you have extra change. Or be upset when you underestimate it and you are going to have to put something back... whatever your situation is. But when it’s on paper, it’s not really asking for an estimate. It is asking you for the exact answer.
The class met once a week for four hours

Sasha’s instructor, Ms. Rose, is new to community college teaching, but has previous experience teaching middle school.

A typical day started with Ms. Rose answering questions about the assignment followed by a quiz or “cupcake,” which was followed by the introduction of new material.
There are 23 students – 10 male students and 13 female students. Three rows of students face the teacher at the front of the room.

On the first day, Sasha sits in the back of the last row; this back row is predominantly male. The second row is dominated by a group of older females students.
Sasha’s mathematics class

- Sasha earned a B in the course.
- Sasha’s classmates earned the following grades:
  
  A:4  B:7  C:2  F:6  W:5
Adults’ informal mathematical reasoning often does not accompany adult students when they return to the classroom.

Knijnik (2007) describes this phenomenon as adults students’ “forgetfulness about this world outside school, about this mathematics with its difference uses and grammar” (p. 59).
A different grammar

Ms. Rose writes on the board:

\[
\frac{120}{10} = 12
\]
A different grammar

Ms. Rose writes on the board:

\[
\frac{30}{40} = \frac{x}{100}
\]

\[40x = 300\]

Ms. Rose annotates

Sasha asks about this step.
Ms. Rose asks students to solve four proportion equations:

\[
\frac{7}{20} = \frac{35}{x} \quad \frac{0.3}{0.5} = \frac{3}{x} \\
\frac{4}{6} = \frac{x}{21} \quad \frac{0.12}{x} = \frac{0.03}{1.5}
\]
A different grammar

Sasha volunteers to write her solution on the board.

\[
\frac{0.3}{0.5} = \frac{3}{x} = \frac{1.5}{5}
\]
Implicit knowledge in the classroom

- Notation is unfamiliar
- Reasoning about quantity occurs in the background
Ms. Rose poses the following question:

A 3 by five inch photograph is to be enlarged so that the short side now 5 inches. What is the length of the enlarged photograph?
Sasha does not forget

Sasha objects and lists actual photograph sizes:

3 x 5
4 x 6
5 x 7
8 x 10
11 x 13
Context interferes

Sasha experience with photography makes a simple application inaccessible.
Sasha forgets
Questions
Thank you

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Sasha and thirds