Transcript: Permutations of 2, 4, and 7

Elementary Mathematics Laboratory
University of Michigan School of Education
Tuesday, July 31, 2012

Seating Arrangement

Cody								Klara
Johnathan								Caitlyn
Kevin								Viviana
CJ								Alexxis
Ron								Marcus
Rabia								Jarvier
Shandel								Kenneth
Charlotte								Joel
Nastaja								Harlee
Ilana								Teryn
	Cynatt	Adriana	Tiana	Seven	Kamal	Caleb	Ernesto	Calley	Alexis

July 31, 2012:
How many different three-digit numbers can you make using the digits 2, 4, and 7, and using each digit exactly once? Show all the three-digit numbers that you found. Prove that you found all the possible numbers.

Conditions of the problem:
1. *Must use 4, 7, and 2*
2. *Must use each number exactly once*
3. *Must be a 3-digit number*

Focus questions:
- *How are students thinking about this problem?*
- *What do you notice about the role or practices of the teacher?*

Teacher: Kevin, can you explain what you mean by "each number gets to be in each spot once?" I'm gonna ask people to be able to explain what Kevin's saying, so look at him and make sure you can follow.

Kevin: Well, what- How I'll explain it was that if I had seven, two, and four, if I wrote a number out like this, and then I will have to switch up the numbers so every number could be in the middle once. So if I wanted to do four, seven, two, I wanna do two, seven, four, and I would keep going like that so every number could be in the middle. (*Writes 472, 742, and 724 on the board*).

Teacher: Okay. So sometimes when you get up to the board, it's a good idea to see what you're gonna say and then think about it. Now, could you say it again 'cause two people said to me "I can't quite hear him." So could you say again what you just said and say it louder, please?

Kevin: Say if I wrote the number four hundred seventy-two. I would have to switch the seven and the four around so the seven could be in the middle, and then- I meant the four could be in the middle, and then I would have to switch the two and the four around so the two could be in the middle, and then each number would be in the middle one time.

Teacher: So that's three of them, but there are six, so how did you get the other three?

Kevin: 'Cause then I could change around the first numbers, like I could put two, four, seven or four, two, seven, and I could keep going on like that. (*Writes 247 and 427 on the board*).

Teacher: Okay. Can someone explain what Kevin's doing? What is Kevin doing? Okay. Turn to your partner and tell the partner what Kevin did. There are too few hands up again. What did Kevin do?

Teryn: Switching the numbers in the hundreds' place and the- What is it? Tens' place? There- She's switching it around.

Harlee: Yup. Like she's taking- Like you would write seven, four, two. All she did was move the two in the first place.

Teacher: Okay. Alright, stop.

Harlee: So seven, two-

Teryn: No, no, no.

Teacher: I'd like somebody who can now explain what Kevin did to say- And to Kevin, I want you to see if you think the person understands. Everyone's looking up right now. Ron and CJ, you did a great job of explaining, now listen. Okay, Caitlyn, what do you think that Kevin did?

Caitlyn: He switches them out and lets everyone get- lets every number get to be in the middle.

Teacher: I don't think people could hear 'cause there's side conversation again. Caitlyn, bigger voice.

Caitlyn: He gets- He puts every number in the middle.

Teacher: Talk to the class.

Caitlyn: He switches the numbers out and put one in the middle every time he goes.

Teacher: Is that what you're doing?

Kevin: Yeah.

Teacher: Shandel?

Shandel: Technically, he drew it like a third-grade line. Everyone gets to be second, everyone gets to be first, everyone gets to be last. I'm saying-

Teacher: Say it again.

Shandel: I'm saying it's like a third-grade line. Everyone gets to be first, everyone gets to be in the middle, everyone gets to be last.

Teacher: One time, and then he gets it a second time. How do you get the second time?

Shandel: Well, you'll just switch the first- Well, you can just switch all the numbers around, like you'll switch the other two with the sevens' place, then switch the fours with the twos' place and we'll just keep switching them around to make different numbers.

Teacher: What is- That is really interesting what Shandel just thought about. Can someone explain what she's picturing? So she made a connection between writing down numbers and thinking about kids lining up. That's really interesting, Shandel. Can someone explain what she's picturing and why it's like the numbers? Ilana, do you think you understand what she's saying?

Ilana: I think she's saying that every number gets to be at one spot at a certain time.

Teacher: You can sit down, Kevin. I'm sorry. Thank you. Start again. I'm sorry for interrupting you.

Ilana: I think she's saying that every number gets to be first, second, or third at least once.

Teacher: Cynatt, do you want to add to that?

Cynatt: Uh-huh. She was basically picturing a kindergarten line like-

Kamal: Third.

Cynatt: What?

Teacher: Kamal, just listen right now, please. Go ahead. A kindergarten line, a third-grade, whatever.

Cynatt: Any type of line. Who cares. And she was just doing math with the pictures, like every kid do be in the middle, every kid be in front, every kid be in back. And she just thought about that in math. And, I guess, put this together.

Teacher: Is that right?