| Description: Clip 6 of 10: Connecting the Combinatorics Notation for Tower Choices when Selecting from Two Colors to the First 5 Rows of Pascal's Triangle<br>Parent Tape: Early Algebra Ideas About Binomial Expansion, Stephanie's Interview Five of Seven<br>Date: 1996-03-13<br>Location: Harding Elementary School<br>Researcher: Professor Carolyn Maher | Transcriber(s): Aboelnaga, Eman<br>Verifier(s): Yedman, Madeline<br>Date Transcribed: Fall 2010<br>Page: 1 of 5 |
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| Time | Line | Speaker | Transcript |
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| 0:00 | 1 | R1 | Let's do this. If I picked none, exactly none, out of one. |
| | 2 | Stephanie | Out of one? |
| | 3 | R1 | Does that make any sense? Okay, I have one high. I have this one high, if I have no red. I still have my yellow- |
| | 4 | Stephanie | But- oh- but you have the yellow though. |
| | 5 | R1 | See notice that it didn't make any sense, but once you started thinking about- |
| | 6 | Stephanie | Oh, well then there's one. |
| | 7 | R1 | Oh, isn't that right? And if I said to you, "Exactly one out of one." See this is no reds. You said there's one, right? |
| | 8 | Stephanie | Yeah. |
| | 9 | R1 | Exactly one red. |
| | 10 | Stephanie | That would be one. |
| | 11 | R1 | That would be one. See, now it has meaning. |
| | 12 | Stephanie | Yeah. |
| | 13 | R1 | But you look at this notation and say, "What does this mean?" But see, this will help you think of selections. Ok, so if we were to think about this, um, if we're thinking of for towers for n = 1, that's one high towers, right? |
| | 14 | Stephanie | Mm-hmm. |
| | 15 | R1 | So, we can think about this as [*writing*] this and this, right? Or we can think about this as one and one. Isn't that cool? |
| | 16 | Stephanie | Mm-hmm. |
| | 17 | R1 | So I thought we'd do something else that might. . . . now two. Right? So if we're doing two now, again, what do you want to think of red or yellow? Does it matter? You told me it doesn't matter. |
| | 18 | Stephanie | Yeah, it would be one. |
| | 19 | R1 | There's one way. You saw that right away. What made you see that right away? |
| | 20 | Stephanie | Well, because there's always going to- if there's- you can't do |

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| | | | none of one, and there's another color, it's obviously going to be all the other color. |
| | 21 | R1 | Good, that's great. Ok, so now, if we're gonna do – I'm going to pick one out of two. |
| | 22 | Stephanie | Um, two ways, I guess. One on top or one on bottom. |
| | 23 | R1 | Mm-hmm. Can you see that? |
| | 24 | Stephanie | Yes. |
| | 25 | R1 | And if it's two out of two? |
| | 26 | Stephanie | It would be one. |
| | 27 | R1 | Okay. So, when I have n = 2, here I had one, right, that's no reds or one, that was one red, which was one high. Now, if I'm talking two high, I could have one red, I could have two reds, or I could have one red. No reds. One red or two reds. So this one is this piece, this one is this piece, this one is . . . let me just put the numbers in now. |
| | 28 | Stephanie | Okay. |
| | 29 | R1 | See if you notice what's happening here. $n = 3$. |
| | 30 | Stephanie | Ok, so, for, like, there's one. |
| | 31 | R1 | Okay. |
| | 32 | Stephanie | Um, I don't know, maybe there's two? |
| | 33 | R1 | Want to think about that? (inaudible) yeah- |
| | 34 | Stephanie | Yeah, I think there's more than . . . . I don't know. |
| | 35 | R1 | Think about it. |
| | 36 | Stephanie | Um, I need a few… |
| | 37 | R1 | Yeah, that's fair enough. It's always good to take your time to think about it. |
| | 38 | Stephanie | There's one choice, I'm gonna do them, like, as towers this time. When there's three it could be, um, you have red and yellow, it could be red-yellow-yellow and there's gonna be three. It could be red and it could be like that. There's three. |
| | 39 | R1 | You absolutely sure of that? What was-um, what was- combinations were you selecting one from? |

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| | 40 | Stephanie | Two. |
| | 41 | R1 | Ok. Um, what do you think it would be when selecting one from four? Exactly one from four? |
| | 42 | Stephanie | Four? |
| | 43 | R1 | What would you think it would be if I could select one from *n*? |
| | 44 | Stephanie | *n*? |
| | 45 | R1 | See that? Can you imagine that? |
| | 46 | Stephanie | Yes. |
| | 47 | R1 | If it's five, can you see them all up there? If it's six, can you see them? You can make it as tall as you want, you can just see them exactly- |
| | 48 | Stephanie | Yes. |
| | 49 | R1 | Isn't that helpful? |
| | 50 | Stephanie | Yeah. |
| | 51 | R1 | To have that visual kind of thing? |
| | 52 | Stephanie | Yes. |
| | 53 | R1 | You didn't even have any unifix cubes, that's great. Okay, so- |
| | 54 | Stephanie | So, there would be three- |
| | 55 | R1 | You know that, do you know exactly two? Do you know that? Do you have to think a lot? |
| | 56 | Stephanie | I don't know. There's- oh- wouldn't it be the same thing? |
| | 57 | R1 | Why? |
| | 58 | Stephanie | Because it's just the opposite, right? |
| | 59 | R1 | Isn't that right? |
| | 60 | Stephanie | So that would be three. And then, three, three, is one. |
| | 61 | R1 | Right? |
| | 62 | Stephanie | Yeah. |
| | 63 | R1 | See how fast you got those? |
| | 64 | Stephanie | Yeah. |
| | 65 | R1 | Now, I'm going to write for *n* equals three here, look, put a one, three, three, one. Now do you notice something happening here. I have a one-one, for these two. I have a one-two-one, a one- |

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| | | | two-one for none, one and two. I have a one-three-three-one, one-three-three-one for the case of three. Do you want to predict what it's going to be like for four? |
| | 66 | Stephanie | It's going to be, like, one-four and then there's another number. And then, four-one. |
| | 67 | R1 | Okay, now that's the interesting. . . . |
| | 68 | Stephanie | Well, I know that that one's six though. |
| | 69 | R1 | Oh, but notice something, no? |
| | 70 | Stephanie | Oh, is it, cause like, the 1 and 2- 1 and 1 are 2, 1 and 2 are 3, 1 and 2 are 3, 1 and 3 are 4, 1 and 3 are 4, 3 and 3 is 6? |
| | 71 | R1 | Isn't that exciting? Now, I'd like to have this case in here [*writes*]. |
| | 72 | Stephanie | Okay. |
| | 73 | R1 | It looks pretty, doesn't it? So, what would that be? Gosh. This was $n = 1$. |
| | 74 | Stephanie | Mm-hmm. |
| | 75 | R1 | This would have to be $n = 0$. Right? Right? |
| | 76 | Stephanie | Mm-hmm. |
| | 77 | R1 | So, what would you have to make selecting none from none, by definition, to make this all look pretty? |
| | 78 | Stephanie | Selecting none from none? |
| | 79 | R1 | See it makes almost no sense to think about. |
| | 80 | Stephanie | Yeah, cause like . . . |
| | 81 | R1 | But remember you told me, like, if I took a number to the zero power, that doesn't make any sense? |
| | 82 | Stephanie | Yeah. |
| | 83 | R1 | Remember we had that conversation in the car? |
| | 84 | Stephanie | Yes. |
| | 85 | R1 | Well, this is almost like that. It doesn't make any sense, but if you want this picture to be so nice and symmetry and all, and if you want it to turn out to be that way, what would you want it to be? |

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| | 86 | Stephanie | I guess it would have to equal one. |
| | 87 | R1 | Yeah. So people find it convenient to make that one. That’s how definitions sometimes arise. There’s- motivated by some symmetry or beauty. Is there another reason to make that one? I don’t know of any. Do you? Taking no things from nothing? One way? [*to researchers*] |
| | 88 | R2 | Well, (inaudible) |
| | 89 | R1 | See, it just works out nicely. Can you guess five high, what these numbers would be? |
| | 90 | Stephanie | All right. It would be 1. Um, and then it would be 1 + 3, oh, 5. And then it would be 10, 10, 5, 1. |
| 6:44 | 91 | R1 | I put the one there. |