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| <p>Description: Working backwards from towers 4-cubes tall selecting from blue and green cubes, with exactly two green cubes, to towers with exactly one green cube</p> <p>Parent Tape: Early Algebra Ideas About Binomial Expansion, Stephanie's Interview Six of Seven (student view)</p> <p>Date: 1996-03-27</p> <p>Location: Union Catholic</p> <p>Researcher: Professor Carolyn Maher</p> | <p>Transcriber(s): Aboelnaga, Eman</p> <p>Verifier(s): DeLeon, Christina</p> <p>Date Transcribed: Spring 2009</p> <p>Page: 1 of 7</p> |
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| 1 | R1 | Right? We were building them four tall – that when we moved – let me try to understand. When we moved from one green exactly. Right? To two green exactly. Right? From each of the three positions you got two. |
| 2 | Stephanie | Um hm. |
| 3 | R1 | But you found out you had two when you were all done. |
| 4 | Stephanie | Yeah. |
| 5 | R1 | You got a pair, so it wasn't twelve again you had this... |
| 6 | Stephanie | It was six. |
| 7 | R2 | It was six. |
| 8 | R1 | It was six. It was twice the three, right? |
| 9 | Stephanie | Um hm. |
| 10 | R2 | Right. |
| 11 | Stephanie | Yeah. |
| 12 | R1 | (inaudible) in an interesting way. |
| 13 | R2 | I have a question now. |
| 14 | Stephanie | Yeah. |
| 15 | R2 | Okay. If these are the old ones, and these are the new ones, then we had a method for building new ones from the old ones. |

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| 16 | Stephanie | Um hm. |
| 17 | R2 | And then when we went from the old ones to the new ones we found that we got twelve, but they weren't all different. |
| 18 | Stephanie | Um hm. |
| 19 | R2 | They came in... |
| 20 | Stephanie | Pairs. |
| 21 | R2 | They came in pairs. Okay. I'm interested in why they came in pairs, instead of triplets or quadruplets, or whatever. And, uh, so let me ask you a question maybe that would point the other way. Okay. Here's a tower that's four high with two greens. <i>[He picks up the</i> $\begin{bmatrix} G \\ G \\ B \\ B \end{bmatrix}$ <i>tower.]</i> |
| 22 | Stephanie | Um hm. |
| 23 | R2 | Let's suppose it's a new one. |
| 24 | Stephanie | Okay. |
| 25 | R2 | Where did it come from? |
| 26 | Stephanie | Umm. |
| 27 | R1 | That second green you mean? |
| 28 | R2 | In other words |

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| 29 | R1 | Where did the second green come from? |
| 30 | R2 | Yeah. No, no, no |
| 31 | Stephanie | Well, it could come from |
| 32 | R1 | I'm not so sure I understand the question. |
| 33 | R2 | I'm just seeing two greens here, and I don't know which is first and which is second. Right? |
| 34 | Stephanie | Okay. |
| 35 | R2 | But, let's just say it came up in this process and it was one of the new ones. |
| 36 | Stephanie | Oh, you mean, where would I put it? |
| 37 | R2 | No. Where did it come from? |
| 38 | Stephanie | Like, which one of these? [<i>Stephanie points to the towers with one green and three blue.</i>] |
| 39 | R2 | Yeah. |
| 40 | Stephanie | It came from one of these. [<i>She points to</i> $\begin{bmatrix} G \\ B \\ B \\ B \end{bmatrix}$ <i>and</i> $\begin{bmatrix} B \\ G \\ B \\ B \end{bmatrix}$ <i>].</i> |
| 41 | R2 | Which one? |
| 42 | Stephanie | It probably came from both. You probably had two, like if you had two. I don't know which one exactly it came from. |

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| 43 | R2 | Why two and not three? Why two ancestors instead of three? |
| 44 | Stephanie | Because, there's two of them with, um, with the, um, that can move, that like that can have a green on the bottom of it and on the top, to get that. Like I can have, I have one with a green on top, so I can put a green under it. |
| 45 | R2 | Um hm. |
| 46 | Stephanie | I have one with a green on the bottom, so I can put a green on top. |
| 47 | R2 | Okay. Your, your fingers were, uh, focusing on these two positions in the tower. [He points to the two green in the $\begin{bmatrix} G \\ G \\ B \\ B \end{bmatrix}$ tower.] |
| 48 | Stephanie | Yeah. |
| 49 | R2 | Why did you focus on those two in the old towers, to relate to this new tower? |
| 50 | Stephanie | Because, um, oh those were the two positions where the greens were. |
| 51 | R2 | Excellent. Thank you. I understand you. Okay. So it seems like, if you took, okay, so let's take another one. Let's take one of these two. [The duplicate $\begin{bmatrix} B \\ G \\ B \\ G \end{bmatrix}$ towers.] Which one, which ancestors could it have had? Which of the old ones could have produced it? |

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| 52 | Stephanie | Ummm – this one [<i>the</i> $\begin{bmatrix} B \\ G \\ B \\ B \end{bmatrix}$ tower] |
| 53 | R2 | Okay. |
| 54 | Stephanie | or this one. [<i>the</i> $\begin{bmatrix} B \\ B \\ B \\ G \end{bmatrix}$ tower] |
| 55 | R2 | This one. |
| 56 | Stephanie | Because this one has the green there and that one has the green there. |
| 57 | R2 | Excellent. |
| 58 | Stephanie | So, these were the two places. |
| 59 | R2 | Now, can you tell me why they came in pairs, instead of, say triples? |
| 60 | Stephanie | Because, there are two like, I guess, parents that have a green in that position. |
| 61 | R2 | And why two? |
| 62 | Stephanie | Because, I guess, maybe before that, I don't, because they came from, I don't know, just |

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| 63 | R2 | Well, remember when we were looking at this one? [the $\begin{bmatrix} G \\ G \\ B \\ B \end{bmatrix}$ tower] |
| 64 | Stephanie | Yeah. |
| 65 | R2 | Your fingers were touching the two greens. |
| 66 | Stephanie | Well, because there were probably two before them that had two in that position. |
| 67 | R2 | Okay, but it was |
| 68 | Stephanie | Er, um. |
| 69 | R2 | Well, let's imagine it this way. |
| 70 | Stephanie | Okay. |
| 71 | R2 | How does, how does a new one come from, how do you get the old one starting from a new one? Um. Let's say this is the new one. [the $\begin{bmatrix} B \\ B \\ G \\ G \end{bmatrix}$ tower] |
| 72 | Stephanie | Okay. |
| 73 | R2 | How do we find, how would we actually take the blocks and then, make one of the old ones that it came from? |

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| 74 | Stephanie | Well, if you're using green, um, you would have to take away either this one or this one, and make it a blue. |
| 75 | R2 | Ah, so the, the old ones depend on the, that there are two greens |
| 76 | Stephanie | Yes. |
| 77 | R2 | over here. Okay. Very fine. Okay. Should we try the big step? |