

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 Parent Tape: Early Algebra Ideas About Binomial Expansion, Stephanie's Interview Six of Seven (student view) Date: 1996-03-27 Location: Union Catholic Researcher: Professor Carolyn Maher	Transcriber(s): Aboelnaga, Eman Verifier(s): DeLeon, Christina Date Transcribed: Spring 2009 Page: 1 of 7
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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. $\begin{bmatrix} G \\ G \\ B \\ B \end{bmatrix}$ 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. $\begin{bmatrix} B \\ G \\ B \\ G \end{bmatrix}$ duplicate 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 [$\begin{matrix} B \\ G \\ B \\ B \end{matrix}$ tower]
53	R2	Okay.
54	Stephanie	or this one. [$\begin{matrix} B \\ B \\ B \\ G \end{matrix}$ 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? $\left[\begin{array}{c} G \\ G \\ B \\ B \end{array} \right]$ 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. $\left[\begin{array}{c} B \\ B \\ G \\ G \end{array} \right]$ 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?