Description: Clip 9 of 10: Relating Coefficients of the Binomial Expansion to Pascal's Triangle and to Unifix-cube Towers, Selecting from Two Colors **Parent Tape: Early Algebra Ideas About Binomial Expansion, Stephanie's Interview Five of Seven** **Date: 1996-03-13** **Location: Harding Elementary School** **Researcher: Professor Carolyn Maher**	**Transcriber(s): Aboelnaga, Eman** **Verifier(s): Yedman, Madeline** **Date Transcribed: Fall 2010** **Page: 1 of 6**

Time	Line	Speaker	Transcript
0:00	1	R1	Well, I asked you to think about something the last time. Do you remember that?
	2	Stephanie	Yes.
	3	R1	Remember what it was?
	4	Stephanie	It was, um, like, a plus b quantity to the fourth and then to the fifth. I worked it out on paper.
	5	R1	Do you have it?
	6	Stephanie	Yes.
	7	R1	Can you show it to me?
	8	Stephanie	All right. [*leaves table*]
	9	R2	[*off camera; whispering*] The standard with combinatorics is two (inaudible) subscripts on each side…
	10	R1	[*off camera*] Well that's another way.
	11	R2	[*off camera; whispering*]-that's (inaudible)
	12	R1	[*off camera*] I thought that was permutations.
	13	R2	[*off camera; whispering*] One's a *P* and one's a *C*.
	14	R1	Oh, okay, thank you.
	15	Stephanie	[*returns to table*] There's, um, the fourth.
	16	R1	I just want to look at something. Do you mind if I do something? I don't want to mess up yours.
	17	Stephanie	No, go ahead.
	18	R1	I want the camera to take a picture of this before I mess it up. Who's taking a picture of this?
	19	R3	Me- one second.
	20	R1	I need another piece of paper.
	21	R3	Lined? (inaudible)
	22	R1	I'll take lined paper. I want you to study this for a minute. This is really very nice. I can see you worked hard at this. Now, for a moment, you see your *a′* s and *b*'s?
	23	Stephanie	Mm-hmm.
	24	R1	Right? *a* plus *b* to the zero equals one, right?

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	25	Stephanie	Mm-hmm.
	26	R1	I'm not going to worry about the *a* and *b*, I'm going to worry about the number in front of it. What's the number in front of *a* here, when you don't put a number- when you have just *a* and you don't have any number written, there's a number that it's understood. Did you know that? So if I write *a*-
	27	Stephanie	Oh one.
	28	R1	It's one. So that's one *a* plus one *b*.
	29	Stephanie	Yeah.
	30	R1	Right, so if I'm going to write this is one you wrote. And then *a* plus *b*. That's one *a* and one *b*. That's my one.
	31	Stephanie	Yes.
	32	R1	And *a* squared plus 2*ab* plus *b* squared. That's how many *a* squared?
	33	Stephanie	Uh-huh. [*pause*] One?
	34	R1	There's one *a* squared.
	35	Stephanie	And one *b* squared.
	36	R1	And two *ab*.
	37	Stephanie	Yeah.
	38	Stephanie /R1	And one *b* squared.
	39	R1	One- two- one- those are my coefficients. The coefficients here, even though you don't see them, are ones.
	40	Stephanie	Yeah.
	41	R1	Right? Now, read off my next set of coefficients.
	42	Stephanie	There's *a* cubed.
	43	R1	One.
	44	Stephanie	And there's three *a* squared *b* and there's three *a b* squared and there's *b* cubed. Isn't that the same thing?
	45	R1	What do you mean?
	46	Stephanie	As the towers?
	47	R1	Why?

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	48	Stephanie	It just is.
	49	R1	Ok so, what do you have for the next one? Let's continue and compare this.
	50	Stephanie	Um, *a* to the fourth.
	51	R1	One of them?
	52	Stephanie	Yeah. And you have
	53	R1	4-
	54	Stephanie	four *a* cubed *b*.
	55	R1	And 6 – 4 – 1 .
	56	Stephanie	Oh, okay.
	57	R1	And the next one?
	58	Stephanie	1 –5 – 10 – 10 – 5 – 1 .
	59	R1	You did all that hard work but I'm going to tell you what those coefficients are- 1 – 6- 15 – 20 – 15 – 6 and 1 . Let's see if I'm right.
	60	Stephanie	Yeah.
	61	R1	Hmmm. So, the only difference is here you have an *a* squared and what does *a* squared mean?
	62	Stephanie	*a* times *a*.
	63	R1	Or two factors of *a*.
	64	Stephanie	Yes.
	65	R1	Right?
	66	Stephanie	Ok.
	67	R1	So you have two factors of *a*, right?
	68	Stephanie	Mm-hmm.
	69	R1	You have one of those. One thing with two factors of *a*, one thing with two *a*'s in it.
	70	Stephanie	Mm-hmm.
	71	R1	I don't want to think of *a*'s; I want to think of red.
	72	Stephanie	Ok.
	73	R1	Can you switch that a minute? So now I have one thing with two reds. What thing could I be thinking of if I have two reds?

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	74	Stephanie	A tower that's two high?
	75	R1	And here I'm talking about two things.
	76	Stephanie	Mm-hmm.
	77	R1	One is-
	78	Stephanie	-red-
	79	Stephanie /R1	-and one is yellow.
	80	R1	Is that possible in two high?
	81	Stephanie	Yeah.
	82	R1	To have the one red and one yellow? There are two of them.
	83	Stephanie	Yeah. 'Cause one is- the red can be on top or on the bottom. And the yellow -same thing.
	84	R1	And what about b squared?
	85	Stephanie	Um- two yellow.
	86	R1	Ok, so I could think about this as these coefficients tell me how many of combinations of them and these tell me which ones – exactly two red, right?
	87	Stephanie	Mm-hmm.
	88	R1	-exactly one red and a yellow-
	89	Stephanie	Mm-hmm.
	90	R1	-exactly two yellow.
	91	Stephanie	Yeah.
	92	R1	Does that work here?
	93	Stephanie	It's- yeah, I guess, there's three red.
	94	R1	So I'm talking about towers of three red. How many of those? Exactly three red?
	95	Stephanie	Mm-hmm.
	96	R1	There's one?
	97	Stephanie	Yes.
	98	R1	And here I have…
	99	Stephanie	Um . . . towers . . . um . . . of red and yellow, three high, I guess? Since there's three of them?

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Time	Line	Speaker	Transcript
	100	R1	Right, and how many are reds and how many of them are yellow?
	101	Stephanie	Two are red and one is yellow. And . . .
	102	R1	And there are three of those.
	103	Stephanie	Yes. And the next. . .
	104	R1	Do you really believe that?
	105	Stephanie	Yes.
	106	R1	Two are reds and one are yellow? Can you see them? The three? The yellow, the yellow, the yellow?
	107	Stephanie	Yeah uh yeah. I mean, you could have, um, the red, the red, the yellow. The red, the yellow, the red. The yellow, red, red.
	108	R1	Say that again. That was too fast for me. I was trying to concentrate.
	109	Stephanie	The red, the red, the yellow. The red, the yellow, the red. Or the, um, yellow, yellow, red- uh- yellow, red, red.
	110	R1	I'm going to believe what you said is true, but somehow I'm having trouble focusing. Um. One more time.
	111	Stephanie	Red-
	112	R1	On the bottom?
	113	Stephanie	On the top.
	114	R1	Ok, that's why I'm having trouble. Red on the top.
	115	Stephanie	-red, yellow.
	116	R1	Red, red, yellow's on the bottom.
	117	Stephanie	Red, on the top, yellow, red.
	118	R1	Mm-hmm.
	119	Stephanie	Or yellow on the top, red, red.
	120	R1	Alright, I think I see it. We'll listen to the tape. I'm getting tired. But you see the relationship here between towers?
	121	Stephanie	Yes
	122	R1	Good. You can write that up for me for next time.
	123	Stephanie	Ok.
	124	R1	So you see, all this hard work, when you get a test, you know, or

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			take a college board-
	125	Stephanie	Mm-hmm.
	126	R1	-and they say expand *a* plus- you know, *a* plus *b* to the sixth,
	127	Stephanie	Mm-hmm.
	128	R1	Think how fast you can do that.
	129	Stephanie	Yeah.
	130	R1	That's very nice. Maybe this is where we should stop unless Ethel has a question, or Steve? Or Elena? Oh, Steve had said- said- whispered something to me when you went over there, that, he reminded me of something that I had not remembered, that you might also see this notation in books. You might see the five here and the zero here [*writes* $_5C_0$].
	131	Stephanie	Ok, but it's the same thing?
5:55	132	R1	It's the same thing.