Description: Beginning to make sense of (x+y)(x+y) **Parent Tape: Early Algebra Ideas About Binomial Expansion, Stephanie's Interview One of Seven** **Date: 1995-11-08** **Location: Harding Elementary School** **Researcher: Professor Carolyn Maher**	**Transcriber(s): Aboelnaga, Eman** **Verifier(s): Yedman, Madeline** **Date Transcribed: Fall 2010** **Page: 1 of 5**

1		R1	Now. You – you already came up with *a* times *x* plus *y*. Another way to write that is $ax + ay$. And you believe that that's always true. And you sorta gave me a nice little argument.
2		Stephanie	Okay.
3		R1	Okay, I'll buy that.
4		Stephanie	Okay.
5		R1	Okay. Um. Now – could I do this? *[Dr. Maher writes (x + y)(x + y).]*
6		Stephanie	You probably could. I don't know how, but you probably um
7		R1	What do you think it means?
8		Stephanie	It means that – um – *x* plus *y* times – OH! Could you just do it *x* squared times *y* squared?
9		R1	What do you think this means?
10		Stephanie	It means that you're multiplying – 'cause you can't combine these terms, right?
11		R1	I'll buy that.
12		Stephanie	So…
13		R1	Why can't you, by the way?
14		Stephanie	'Cause they're not the same variable.
15		R1	Okay.
16		Stephanie	Uh. Because you can't combine them, um you have to multiply them by – okay – you're supposed to multiply these. But you can't combine these either.
17		R1	Um hm.
18		Stephanie	So – but you can't exactly take this (inaudible)
19		R1	Um. It's interesting, isn't it?
20		Stephanie	I can't figure out how to get around it. But I'm pretty sure that if I could, the answer would be *x*-squared plus *y* – squared.
21		R1	Why don't you put a question mark here and let's test it.
22		Stephanie	Okay.
23		R1	Okay. Your conjecture – Stephanie's conjecture – this is *x* – squared plus *y* – squared. Test it. Try some numbers and see.
24		Stephanie	Alright. *[She tries 2 and 3.]* Two plus three. Two plus

			three. Two squared plus three squared. Nine. Four. Equals five – oops, that's not right. *[She throws down her pen.]*
25		R1	Didn't work, huh?
26		Stephanie	No, it didn't work.
27		R1	Hm.
28		Stephanie	I don't know what it is then.
29		R1	Hm. So – It was a reasonable guess. *[makes a noise]* These things are tricky, aren't they?
30		Stephanie	I don't know, because I can't – I can't figure out how to get rid of the – the um.
31		R1	Hm. Let's try to think about meaning. Let's try to think about meaning.
32		Stephanie	Okay.
33		R1	Okay. Remember how you made an argument that this is the same as this?
34		Stephanie	Um hm.
35		R1	What did you imagine in your head? Tell me about what you saw in your head.
36		R1	Okay. How many times did you get those rows of *x*'s and those rows of *y*'s?
37		Stephanie	A lot. 'Cause I didn't have any stopping point and that –
38		R1	You did have a stopping point.
39		Stephanie	Well, it was *a*, but I didn't –
40		R1	It was *a*.
41		Stephanie	But I didn't know what *a* was.
42		R1	Right. Exactly. Okay. Show – Now we're thinking of – Remember that. Remember. *a* could be anything.
43		Stephanie	*a* could be anything.
44		R1	Could *a* be *x* plus *y*?
45		Stephanie	Oh.
46		R1	You said *a* could be anything. That's what you're telling me.
47		Stephanie	(inaudible)
48		R1	Could *a* be *x* plus *y*? Now does it help you now to think of what this means if you think of *a* as *x* plus *y*?
49		Stephanie	I don't see why it couldn't.

50		R1	Okay.
51		Stephanie	I mean-
52		R1	So tell me what you're imagining in your head.
53		Stephanie	Well, now I just see a times a. 'Cause you told me…
54		R1	You told me – Oh, 'cause that's – that's really neat. That's very nice. a times a. I could buy that. That's nice.
55		Stephanie	Um.
56		R1	Okay. That's true. But that's not going to get you out of figuring –
57		Stephanie	Yeah.
58		R1	-out what x plus y times x plus y is.
59		Stephanie	I (inaudible)
60		R1	But that's absolutely reasonable. I like that. Nice and simple.
61		Stephanie	I – (inaudible) I'd have to find a way to make – I can't just say it's a though. I can't just go x plus y is a. You know.
62		R1	Okay. Well. So. Now. But – you're thinking of a times x plus y, right?
63		Stephanie	I can't even add x plus y, though. Which is my problem. Like I can't add x plus y together. 'Cause they're different.
64		R1	Okay. But if this were a times, you would imagine x plus y a times in your head?
65		Stephanie	Um hm.
66		R1	x plus y, x plus y, x plus y. But now, this is not a, right?
67		Stephanie	Right.
68		R1	This is x plus y. So how many times are you imagining x plus y in your head?
69		Stephanie	Once. Right now, just because there's not an a amount of times. And it's x plus y, x plus y amount of times.
70		R1	Is it x plus y x plus y amount of times? Okay. I'm asking how many? - This is your x plus y.
71		Stephanie	Okay.
72		R1	Alright?
73		Stephanie	Yeah.

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74		R1	You have a bunch of them.
75		Stephanie	Yeah.
76		R1	How many of them do you have?
77		Stephanie	I have *x* plus *y* times *x* plus *y*, so I have it *x* plus *y* amount of times, but I don't know.
78		R1	Okay. Don't lose that idea.
79		Stephanie	Okay.
80		R1	Why don't you just get that idea? Make sure of it. Write it down, 'cause that's a that's a good thing to hold on to. - - You have *x* plus *y* *x* plus *y* amount of times. That's pretty good. - - Do you really believe that?
81		Stephanie	That's what I'm getting.
82		R1	Or *a*.
83		Stephanie	Or *a* plus *a* – a times *a*. I just – 'cause…
84		R1	So you've got *x* plus *y* *x* plus *y* amount of times.
85		Stephanie	That's what it is.
86		R1	Okay.
87		Stephanie	That's what it is.
88		R1	Alright. Now. What makes this kind of messy, 'cause you're thinking about this *x* plus *y* amount of times. It was nice when you – you thought *a* amount of times was bad enough – but that was sure easier than –
89		Stephanie	Yeah.
90		R1	*x* plus *y*. Right?
91		Stephanie	Yeah.
92		R1	So can you break down the way you think about it in terms of *x* plus *y* amount of times? Do you have to think about it *x* plus *y* amount of times?
93		Stephanie	No. If I break down, I can think of it *x* amount of times and *y* amount of times.
94		R1	Okay. Very interesting. So – so you can think of *x* plus *y* – you could have *x* amount of times, right?
95		Stephanie	Um hm.
96		R1	And you could have it *y* amount of times. Isn't that right?
97		Stephanie	Yes.
98		R1	Is that a way to think about it?

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99		Stephanie	Oh! Yeah.
100		Stephanie	Oh. That it's um *x* times *x* plus *y* or *x* plus and *y* plus *y* *a* amount of times. And since I didn't know *a*, it was just like rows and rows and rows of numbers.