Description: Early Algebra Ideas About Binomial Expansion, Stephanie's Interview Two of Seven: Clip 5 of 6, Testing the Geometric Solution for the square of (a+b) **Parent Tape: Early Algebra Ideas About Binomial Expansion, Stephanie's Interview Two of Seven** **Date: 1996-01-29** **Location: Harding Elementary School** **Researcher: Carolyn A. Maher**	**Transcriber(s): Aboelnaga, Eman** **Verifier(s): Yedman, Madeline** **Date Transcribed: Fall 2010** **Page: 1 of 4**

Line	Time	Speaker	Transcript
1		R1	Um. Is this what we started with? You said *a* plus *b* quantity squared does not equal *a* squared plus *b* squared.
2		Stephanie	Yes.
3		R1	Okay. Now you, using some geometry and things about area of a square
4		Stephanie	Um hm.
5		R1	you told me that *a* plus *b* quantity square equals *a* squared plus two *ab* plus *b* squared.
6		Stephanie	Yes.
7		R1	That’s what you, I believe, were working on for this last hour and fifteen minutes.
8		Stephanie	Yes.
9		R1	Okay. So if your arithmetic work is correct, I , you should be able to test some numbers – at least to see if you don’t get a counter example right away.
10		Stephanie	So you want me to test numbers?
11		R1	What do you think? Wouldn’t you be inclined to test
12		Stephanie	Oh. Well, yeah
13		R1	some numbers.
14		Stephanie	I didn’t know
15		R1	for *a*’s and *b*’s and see what happens?
16		Stephanie	All right. So let me do some really easy numbers. Um. If
17		R1	Try a very try a easy number. That’s a good idea.
18		Stephanie	Yeah. So
19		R1	Especially this time of day.
20		Stephanie	*a* is two and *b* is three.
21		R1	That’s what you did before.
22		Stephanie	Yeah. So it would be
23		R1	You’ve got half of it done already.
24		Stephanie	[*talking under her breath as she writes*] Two is four, plus two times two time three plus three squared, that’s a nine (inaudible) [*Stephanie has written:* $2^2 + (2 \cdot 2 \cdot 3) + 3^2$*; beneath that she wrote: 4 + 12 + 9; beside her work she*

			added 16 + 9 and got 25] [*pause*] Twenty-five. It works.
25		R1	It worked for that example.
26		Stephanie	Yeah.
27		R1	But when you claim it's true, how many does it have to work for?
28		Stephanie	All of them?
29		R1	All of them. Yeah.
30		Stephanie	(inaudible)
31		R1	Could you possibly test all of them?
32		Stephanie	No-o! [*laughs*] There's too many numbers. Um. Do you want me to try again?
33		R1	Well, you might want to convince yourself with something else.
34		Stephanie	All right.
35		R1	Does it work for zero?
36		Stephanie	Well, zero you'd just get zero.
37		R1	Maybe that will give you some insight why zero worked here and why it
38		Stephanie	Well, zero would work anywhere 'cause it's always gonna be zero.
39		R1	Um hm. Okay. Now, do you believe this? What you just built? That *a* plus *b* quantity squared is *a* squared plus two *ab* plus *b* squared, by that geometry you've just done? You've just done some geometry.
40		Stephanie	Yeah.
41		R1	Now the question is: How can we take what we know about arithmetic and algebra to convince us that's true, because we can't test every number to prove it. Right? You just said that there are infinitely many of them.
42		Stephanie	Um hm.
43		R1	Isn't that true?
44		Stephanie	Yes.
45		R1	And we impossibly can't – you you tried one. You might want to try a few more.

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46		Stephanie	Um hm.
47		R1	The problem is with when students try a couple and they make a mistake in computation,
48		Stephanie	Um hm.
49		R1	they they might discard something that they worked real hard to build because they've made a computation mistake. So you've got to be real careful with your computation. It might not be a bad idea to try another one.
50		Stephanie	Okay.
51		R1	(inaudible) another piece of paper. Just to convince yourself and then
52		Stephanie	And what should I use? Four and five?
53		R1	Whatever you think.
54		Stephanie	Okay. Four squared
55		R1	It depends on how much you want to do arithmetic.
56		Stephanie	[*laughs*] plus four times four times five plus five squared. [*writes:* $4^2 + (4 \cdot 4 \cdot 5) + 5^2$] Twenty-five. [*writes 25 under the* 5^2*; brings down the + to the left of 25; writes 80 below the* $(4 \cdot 4 \cdot 5)$*; brings down the + to the left of 80; writes 16 under the* 4^2*. To the right of this, Stephanie adds 96 + 25 and obtains 121*] And what was the original? *a* plus *b* squared?
57		R1	Tell me what you're doing. [*taps near the* 4^2]
58		Stephanie	Four times four.
59		R1	No. What's what's this first sentence?
60		Stephanie	Oh. Four squared plus four times four times five
61		R1	Where did that four come from? I don't see the four
62		Stephanie	Oh! It's two!
63		R1	Okay.
64		Stephanie	Okay. [*corrects her work; writes 2 over the first 4 of the middle term; scribbles out the 80 and writes 40 in its place*] Forty. [*crosses out the previous addition; adds 56 + 25 and gets 81*] Um. (inaudible) [*writes:* $(4+5)^2$] Nine squared. That's eighty-one. Yeah. It works.

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65		R1	Just a lucky two numbers. [*Stephanie laughs*] We're gonna try again. If you don't make a computation mistake.
66		Stephanie	Yeah. If I don't make a mistake. Yeah.
67		R1	You sort of inclined to believe this?
68		Stephanie	Yeah.
69		R1	Does this make sense to you? What you did here?
70		Stephanie	Well, after I kinda knew what I was like doing, yeah.