Description: Early Algebra Ideas About Binomial Expansion, Stephanie's Interview Two of Seven: Clip 1 of 6, Is the Square of the Quantity (a+b) the same as (a squared) + (b squared) ?	Transcriber(s): Aboelnaga, Eman
Parent Tape: Early Algebra Ideas About Binomial Expansion, Stephanie's Interview Two of Seven	**Verifier(s): Yedman, Madeline**
Date: 1996-01-29	**Date Transcribed: Fall 2010**
Location: Harding Elementary School	
Researcher: Carolyn A. Maher	

Time	Line	Speaker	Transcript
	1	R1	Okay. – Um. – Let's see. Maybe you can rebuild it. Okay? Um. [*takes paper and pen. Writes $(a + b)^2$*] Do you remember what that means?
	2	Stephanie	Um. I – this is yeah and didn't we distribute it so that it was like [*writes $a^2 + b^2$*]?
	3	R1	Okay. Do you want to test it? [*Stephanie makes a noise.*] Tell me what it means and test it.
	4	Stephanie	[*Stephanie writes $a \cdot a + b \cdot b$; puts down pen*] or like two *a* plus two *b*.
	5	R1	Well. Let's let's try some things. Um. Pick something for *a* and pick something for *b* and
	6	Stephanie	Okay.
	7	R1	test it.
	8	Stephanie	[*Stephanie writes $2 \cdot 2 + 3 \cdot 3$; under $3 \cdot 3$ she writes 9, brings down the + and under the $2 \cdot 2$ she writes 4. She follows the 4 + 9 expression with + 13*] Now do you want me to …?
	9	R1	Okay. So tell me what you did.
	10	Stephanie	Well
	11	R1	What were you testing?
	12	Stephanie	This. [*points the pen at $a^2 + b^2$*] Like, oh. Wait – should I do it this way too? That would be [*writes 2 above the a in $(a + b)^2$ and 3 above the b*] – six. Seven. That's twelve. – that's one less. *[writes 12 to the right of $(a + b)^2$]*
	13	R1	Now tell me what you just did.
	14	Stephanie	Well. Um. Like from the start? Or what I was testing?
	15	R1	Well. Anything you think you want to tell me.
	16	Stephanie	All right. Well. Um. I put distributed – well you gave me that and I distributed the um *z*, I guess, to um *a* and *b*.

Description: Early Algebra Ideas About Binomial Expansion, Stephanie's Interview Two of Seven: Clip 1 of 6, Is the Square of the Quantity (a+b) the same as (a squared) + (b squared) ? **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: 2 of 8**

	17	R1	This is a two. [*points to the square of* $(a + b)^2$]
	18	Stephanie	Oh. That's a two. The two to *a* and *b* and then um you told me to like work it out, so it would be a times *a* plus *b* times *b*. And then it was, you told me to put in numbers. Two times two plus three times three.
	19	R1	Okay. I'm confused now. What number is that? [*points to the 12*]
	20	Stephanie	Twelve.
	21	R1	And what number's that? [*points to the 13*]
	22	Stephanie	Oh! Wait! That's five. [*crosses out the 12 and writes 5*]
	23	R1	And how did you get five?
	24	Stephanie	Well, because two plus three is five. – And then it's five times five makes twenty-five. [*writes 25 below the crossed out 12*]
	25	R1	So what's twenty-five?
	26	Stephanie	This. [*draws a line around* $(a + b)^2$] Like if you distribute um if you put two and three in here.
	27	R1	So – you're putting, why are you putting the two and the three in there? Tell me again.
	28	Stephanie	'Cause you asked me to put numbers in-
	29	R1	So
	30	Stephanie	-in place of the letters
	31	R1	So so what so the two is being used for
	32	Stephanie	*a* and the three is *b*.
	33	R1	Three is for *b*. And when you did that you have
	34	Stephanie	Um. Well, this
	35	R1	This to be twenty-five.

	36	Stephanie	Turns out to be five and then five squared is
	37	R1	Okay. And when you did it, when you, you said, what is this? [*points to* $a \cdot a + b \cdot b$ *that Stephanie wrote earlier*]
	38	Stephanie	Oh. You told me um well you said 'what is this?' [*the* $a^2 + b^2$] and I said that it would be like *a* squared plus *b* squared. Obviously, it's not.
	39	R1	Ah ha.
	40	Stephanie	Because it doesn't work out.
	41	R1	Okay. So. So then in in your testing it
	42	Stephanie	[*Stephanie chuckles.*]
	43	R1	Your conjecture
	44	Stephanie	Yeah.
	45	R1	that *a* plus *b* in parentheses
	46	Stephanie	Um hm.
	47	R1	that quantity squared is not the same as *a* squared plus *b* squared. You've just proved it's not.
	48	Stephanie	Yes.
	49	R1	By counter-example, haven't you? That's sort of a proof.
	50	Stephanie	Yeah.
	51	R1	So, so why don't you write down what you just said- that *a* that this [$(a + b)^2$] is not equal to this [*points in the vicinity of* $a^2 + b^2$] is something you just found. Why don't you write out what you just discovered?
	52	Stephanie	So like [*pause*] is not equal to um [*writing*]

	53	R1	Would you have to test something else to prove it's not equal? If if you show it doesn't work once is that- is that okay?
	54	Stephanie	Well, yeah. Because if it doesn't work once then it can't like be true.
	55	R1	Okay. So so you proved in essence then that this is not true. So the question was, I go back to my original question.
	56	Stephanie	[*chuckling*] What is that?
	57	R1	What is it, right?
	58	Stephanie	Yeah.
	59	R1	Okay. So I'll let you struggle a little bit and think about that.
	60	Stephanie	Um.
	61	R1	That about- you know- what it means. Think about meaning.
	62	Stephanie	[*Stephanie inaudible*]
	63	R1	And maybe maybe what might help you – think about what what you know about meaning in the simplest way, to think about what this could be in meaning. What does *a* plus *b*, that quantity squared, mean?
	64	Stephanie	It means that you [*chuckles*] it means like – well – I
	65	R1	What does something squared mean?
	66	Stephanie	It means that
	67	R1	Try something.
	68	Stephanie	you're multiplying it by itself.
	69	R1	Oh. Okay. So what is being
	70	Stephanie	*a* plus *b*.

	71	R1	So so tell me what you just – let's number these pages. Because I know what will happen. This is number one and today's date is the twenty-ninth.
	72	Stephanie	Twenty-ninth.
	73	R1	Okay. This is for my benefit.
	74	Stephanie	Um hm.
	75	R1	'Cause I – This is what we know. So this - you can be numbering them now. Um. So so you know what *a* plus *b* quantity squared means.
	76	Stephanie	Yeah.
	77	R1	So moving from meaning
	78	Stephanie	Oh. What does it like
	79	R1	So write down what you think it means. You know what *a* squared means. You clearly know what *a* squared means.
	80	Stephanie	Well, yeah.
	81	R1	You believe that *a* squared, if *a* is two, is the same as two times two?
	82	Stephanie	Yes.
	83	R1	You know that. Right? And *b* squared here is the same as three times three. That you believe?
	84	Stephanie	Yes.
	85	R1	Okay. So what does *a* plus *b*, that quantity squared, what does that mean?
	86	Stephanie	*a* plus *b* times *a* plus *b*?

	87	R1	So why don't you write that down? What that means: *a* plus *b* quantity squared. [*pause*] Okay.
	88	Stephanie	Oh! Okay.
	89	R1	Right?
	90	Stephanie	This is this is what we did last time (inaudible).
	91	R1	I don't know. Does it look familiar to you?
	92	Stephanie	Yeah, but we used *x* and *y*.
	93	R1	Oh! Does it matter?
	94	Stephanie	No.
	95	R1	Okay. Could we use *w* and *r*?
	96	Stephanie	Yeah.
	97	R1	Do you prefer to use *x* and *y*?
	98	Stephanie	No. This is fine. [*chuckling]*
	99	R1	Is *a* and *b* okay? Okay. I didn't really do that deliberately to throw you off.
	100	Stephanie	No. I just – that's what I remembered.
	101	R1	Okay. So. Uh. It might be useful, um, Stephanie - - to write down that this *[(a + b)(a + b)]* equals this thing [*it appears that the researcher is pointing to the* $(a + b)^2$] or you know – not to lose sight of what this is supposed to represent.
	102	Stephanie	Oh.
	103	R1	You know what I'm saying. As a as a whole sentence. Because that you absolutely believe, right?
	104	Stephan	Um hm.

		ie	
	105	R1	You believe that?
	106	Stephanie	Yes.
	107	R1	And why do you believe that? Why is that true?
	108	Stephanie	Because um when you square something it's like multiplying it by like itself? And so it would be like *a* plus *b* times *a* plus *b*.
	109	R1	Okay. So. Um. Here you have squared.
	110	Stephanie	Um hm.
	111	R1	And you have two factors of what you're squaring. You have *a* plus *b* as a factor two times. Right?
	112	Stephanie	Um hm.
	113	R1	'Cause it's squared.
	114	Stephanie	Yes.
	115	R1	And if I had a three here? [*indicates the exponent*]
	116	Stephanie	You'd do it three times.
	117	R1	What would you do three times?
	118	Stephanie	*a* plus *b* times *a* plus *b* times *a* plus *b*.
	119	R1	times *a* plus *b* [*simultaneously with Stephanie's last 'a plus b'*] Okay. And you get twenty-five times?
	120	Stephanie	It would be *a* plus *b* twenty-five times. Like times *a* plus *b*.
	121	R1	We we're going to get there – twenty-five times. That's sort of our vision.
	122	Stephanie	Okay.
	123	R1	All right. But I want you to build this for yourself so that um if

			we get to come together next time and I ask you what *a* plus *b* quantity squared, you may not remember what that is, but you're going to tell me what it's not.
	124	Stephanie	Okay.