Jacqueline Stewart and Elizabeth Phillips,
Connected Mathematics Project.

Transcript for February 13 – 18, 2007

"Developing an Algorithm for Multiplying Decimals:
Bits and Pieces III, Computing with Decimals and Percents
Investigation 2"

The class is seen working on Investigation 2.2,
"Missing Factors"

The video was shot in real time and edited from 1.5 days,
Approximately 1.5 hours, to 29 minutes.

•*Bits & Pieces III, Investigation 2*
Class: 6th Grade•
Date: February 15 and 19

Chapter 1: Launch Bits and Pieces III, 2.2
Approximate time 00 – 02:10 (Times from start of video)

Slide:
Developing and Algorithm for Decimal Multiplication (Title slide)

Slide:
Launch
Real Time : 3 minutes
The class has just finished Bits and Pieces III, Problem 2.1 and the teacher begins 2.2 in the same class period.

Line 1, 00:24 T: Come on, guys. We're on a roll, so let's keep at it. 'Cause we're on a roll. This is problem 2.2. I want you to take a peek at this, because this is different.

T: Let's look at letter A. It says use what you know about fraction multiplication and place value, okay. So look at letter A, number 1. What number times six gives the product thirty-six hundredths?

Student (unidentified): Six.

Line 10, 00:59 T: Now I heard somebody yell out six. Does six times six get thirty-six hundredths?

Class: No.

T: Really? Really?

T: Six tenths times six oneths equals thirty-six hundredths?

Class: No. That's thirty-six tenths.

T: This is thirty-six hundredths. This isn't thirty-six tenths, right.

Hayden: You need another tenths -

Line 20, 1:24 T: Oh, you're saying this would be thirty-six tenths. Okay. So, I don't want you - I want - you gotta think these through. Okay. You need to figure out what number times six will end up getting this little teeny size piece. I think whether you'd want to go through the trouble of switching to fractions or not, that that would probably be very helpful for you. Maybe eventually we'll let go of that fractions stuff, but I think right now we're all sort of - it's helping us out. So, I want you to go ahead and work
Line 30, 2:00 your way through A and B and C. And this is a tougher problem. So think about what we have examples of over and over and over up here. Why don't we move these up a little bit so you can see a bunch of examples.

Chapter 2: Exploring 2.2A part 1, The Teacher Helps Caleb
Approximate time 2:10 – 4:00 (Times from start of video)

Slide
Explore:
Real Time 18 minutes

Line 1, 2:24 T: How's it going? Kind of stuck?

Caleb: Yeah.

T: So why don't we use our fraction? We, we, we have a handle on fractions, so why don't we do that? Six - can you write six as a fraction? What would that look like?

Caleb: Six over one.

T: Why don't you write that down - six over one. But, where did the six tenths come from?

Line 20, 2:50 Caleb: Well, um, six times six tenths, that's thirty-six hundredths.

T: Is it? Prove that to me. Write it in fraction form and prove that to me. Six over one, right? Write them as a fraction and we'll - let's look at it. Times - what are you saying, six tenths?

Caleb: Six tenths.

T: Is that going to get you thirty-six hundredths?

Caleb: Yeah.

T: Well, one times ten. Is that going to get you a
Line 30, 3:20 hundred?

Caleb: No.

T: So this can't change, but this can. Why don't you write your answer in fraction form so you can see what it looks like. Your answer's gotta be thirty-six one hundredths.

Caleb: Thirty-six tenths,

T: Nope. The answer's thirty-six hundredths. It tells you it's gotta be. See, you're saying six times what. Oh, this right here is thirty-six tenths.

Line 40, 3:49 Caleb: Yeah.

T: And we can't change this one, so what'd we have do with that one?

Caleb: Make it six hundredths?

T: I don't - try it and see. Switch it to hundredths and see if you end up with hundredths.

Chapter 3: Exploring 2.2A part 1, The Teacher Helps Emily
Approximate time 4:01 – 4:35 (Times from start of video)

Line 1, 4:02 T: But, Emily, we gotta read the problem again. It says what number times six gives the product of thirty-six hundredths. So let me see your pencil for a second. You're trying to take this times something. Your answer is thirty-six hundredths. Your answer is that. You're not multiplying those two together. This says your product is thirty-six hundredths. So, do you remember how to - if we're going to write a fraction here do you remember how
Line 10, 4:30 to multiply with fractions?

Emily: Yeah.

T: What do you have to do?

Emily: You have to times the numerator by the numerator.

Chapter 4: Exploring 2.2A part 3, Ellie and Maddie
Approximate time 4:36 – 5:27 (Times from start of video)

Slide:
Showing student notebook

Line 1, 4:40 Ellie: Fifteen times what equals forty five?

Maddie: Three times?

Ellie: Um hmmm. So it's three thousandths times, um, fifteen tenths equals forty-five. And then, number 4, it's like, what strategies did you use to solve this problem. Uh, one is like changing it to fractions and stuff, you know how we

Maddie: Yeah.

Line 20, 5:12 Ellie: Always change it to fractions. And then the thing I did was like I got my decimal my denominator first and then I found my numerator by using division.

Maddie: Change it to fractions.

Chapter 5: Exploring 2.2C part 1, Becca and Hannah
Approximate time 5:27 – 6:47 (Times from start of video)

Hannah: Nine...
Becca: Wait. What if you did -

Hannah: Hundredths. Right?

Becca: Nine hundredths, but you just want to get a plain nine.

Student (unidentified): Can I see your cool little calculator?

Becca: No. You're on 2.1 right.

Hannah: Yeah.

Becca: Okay.

Line 10, 5:44

Hannah: It'd be three ones, maybe.

Becca: Well, it just has to be like three, yeah, 'cause -

Hannah: Three ones times three ones.

Becca: But that'd give you -

Hannah: But that's two tenths.

Becca: Times two.

Hannah: No. One times one is one. Nine oneths.

Becca: Oh, okay.

Line 20, 6:06

Hannah: But that's still a tenth because it's in the tenths place. So, it'd have to be - the closest would be nine tenths.

Becca: Times what?

Hannah: Three tenths times three.

Becca: Wait. What -

Hannah: Or, we could just make it three tenths by three.

Becca: What if you had timesed it to get nine tenths?

Hannah: Nine tenths is almost a whole.

Line 30, 6:43

Becca: Dalton, how would get plain nine?

Dalton: What?

Becca: How would you get plain nine?

Chapter 6: Summary 2.2A part 1, Ellie and Maddie
Approximate time 6:47 – 11:10 (Times from start of video)

Slide
Summary
Real Time: 35 minutes

The Summary of 2.2 was done on the day after the Launch and Explore phases of 2.2.

Line 1, 7:00 T: We're going to try and figure out what's going on here when we're multiplying with decimals. We've been trying to use fractions to help us, because remember we talked about the denominator of a fraction is like what with our decimals?

Student (unidentified): The place value?

T: The place value. So if I have a hundred in my denominator, I can show that by sitting something in my hundredths' place, right? Okay. So that's what we're trying to figure out today. Alrighty, here we
Line 20, 7:29 go. A number 1. "Use what you know about fractions to figure this out. What number times six will give us thirty-six hundredths?" So somebody who worked on this one, come up and talk to us about what you did.

Ellie: Um, we changed it to fractions, the one sixth into six ones, and the thirty-six into thirty-six hundredths, and we got our denominator because we knew anything times one would be that number, so we knew a hundred, that it has to be a hundred, so a hundred times one is a hundred.

Line 30, 8:12 Maddie: Yeah, and then, hundredths -

Ellie: Thousandths -

Maddie: Six thousandths times six tenths equals -

Ellie: Okay. Um, six thousandths times six wholes equals thirty-six hundreds and we did that by dividing six by thirty-six, because six times six is thirty-six. So then

Maddie: One times a hundred equals a hundred, so it's thirty-six hundredths.

Ellie: So then my answer, so the number that would
Line 40, 8:50 be missing is six thousandths.

Student (Unidentified): That's what we did.

Student (Unidentified): I have six hundredths.

Student (Unidentified): I put, yeah, I put six hundredths. Yeah.

T: Come on, you guys, with a question or a comment ready here. What, Nicky?

Nicky: I got six hundredths.

Ellie: Yeah, I know -

Student (Unidentified): Don't you have to change it -

Ellie: 'Cause -

Line 50, 9:10 Student(Unidentified): To the same place value?

Ellie: Yeah, it's in a different place value, so, we -

T: Can you tell us what that number is in the box, because you've got a decimal inside a fraction.

Ellie: Yeah -

T: Is your denominator a hundred?

Ellie: Yeah. See, there wasn't supposed to be those two numbers.

T: There's just supposed to be a six up there?

Ellie: Yeah.

Line 60, 9:26 T: Okay.

Ellie: See, this is the fraction line, like what it actually is in decimals, and then we just kind of changed it into fractions.

Ellie: Yeah, so we, um, put one point 00.

T: So you guys said that you got six hundredths for that?

Ellie: Yeah.

T: Okay. Can I just look at this for one second? Can I make a change on there? Is that okay with you?

Line 70, 9:52 Ellie: Yes.

T: Just to make it - excuse me for just a second, okay? I followed you all the way up until you got here. You said you changed this to this, and you changed this to this. So you said one times a hundred will get me a hundred, so my denominator has to be a hundred. I totally followed you. But now your numerator you're trying to get thirty-six in your numerator, and you already have six. So what should go in your numerator?

Line 80, 10:17 Ellie: Six.

T: A six, right? I'm going to cut it right over the top of this for a second. So now, does this number sentence work?

Ellie: Yeah.

T: Six times six is thirty-six, a hundred times one is a hundred. So my answer is thirty-six hundredths like it's supposed to be. Now, if I want to take this

six hundredths and switch it back to a decimal, what would it be?

Line 90, 10:37 Ellie: Six hundredths?

T: How, what does that look like, though?

Ellie: Zero point zero six.

T: Zero six. Okay. Times six equals thirty-six hundredths, right? Okay. Thanks, you guys.

T: How many of you knew that some form of six had to go in there?

T: Okay. How'd you know that? How'd you know that, anybody?

Student (Unidentified): Because six times six is thirty-six thirty-
Line 100, 11:04 six divided by six equals six.

T: Okay. So some of you thought about it backwards, thirty-six divided by six. Or some of you knew six times six is thirty-six. Okay. Alrighty.

Chapter 7: Summary 2.2A part 2, Drew and Justin
Approximate time 11:10 – 13:09 (Times from start of video)

Line 1, 11:11 Teacher: Now, let's go to the next one and see what's happening. It says "What number times nine tenths will get us two and seven tenths?"

Justin: Okay. Well, we thought of it just as, like, just nine, 'cause then we could just figure out a number times what would equal, um, two and seven tenths. So we did three times nine tenths, which is, well, three times nine, we did that, was twenty-seven, but then we had to put back in the decimal to
Line 10, 11:44 make it into tenths, so, it went right there, so two and seven tenths is what we got for this.

T: Okay. So with your fractions, you switched this to nine tenths, and your answer had to be in tenths, too, so this one go ahead, did you have something you wanted to go ahead?

Drew: Well, pretty much we just switched the zero and nine tenths to nine tenths, and then the three to three ones, and that equaled twenty-seven tenths and that's equal to two and seven tenths.

Line 20, 12:16 T: Okay. Thank you. Okay, guys. We are going to come to something today. Thank you. Alrighty. So, let's see here for a second. I heard Justin say some interesting things. He said "We pretended like it wasn't there and we knew nine times three is twenty-seven." Did any of you sort of look at it that way? Maybe it was going to have something to do with three 'cause you know nine times three is twenty-seven? Let's take this original problem nine tenths times something is equal to two and seven tenths. If there
Line 30, 12:46 were no decimal points, would you have known what was going in there?

Class: Um, hmm. Yeah.

T: Okay. So if I think about it without the decimal points, I know it's got to have something to do with three. But this isn't nine wholes, it's nine tenths times something,and I want my answer to be in tenths. So would it have to be just three wholes?

T: Okay. Alrighty. Let's take another one of them. We can stop and look at these, okay.

Chapter 8: Summary 2.2A part 3, Kristen
Approximate time 13:09 – 13:52 (Times from start of video)

Line 1, 13:11 Kristen: Okay. Well I, first I switched one and five tenths to fifteen tenths, and then I switched forty-five thousandths to forty-five thousandths. And then to get the numerator I did, um, forty-five divided by thirteen and I got three, so I knew that the numerator had to be three, and then I had to figure out, um, I did a thousand divided by ten to get my denominator, and I got a hundred, so I had three hundredths times fifteen tenths equals forty-
Line 10, 13:43 five thousands.

Kristen: That one's like it too because three times fifteen is forty-five.

T: Right, you're right. So your answer was three hundredths? So can I stick your answer in up here?

Chapter 9: Hayden Spots a Pattern
Approximate time 13:52 – 15:52 (Times from start of video)

Line 1, 13:54 Hayden: Wait a minute. What about, if, if you add up the place values that you're timesing, then divide one, two, three,

T: Yup. You're absolutely right.

Student (unidentified): What?

T: Say that again, Hayden. She said "What?"

Hayden: If you add up the two place values that is in like three hundredths, if you add, like, in decimals, it would be one, two, and then if you add
Line 10, 14:25 up the place values it equals the number of place values that the answer needs.

T: So this is in the hundredths place, right? Instead of three, it's three hundredths. How many place values did I move my decimal point?

Student (unidentified): Two.

T: Two place values, right? Tenths, hundredths, you're getting ten times smaller every time, right? This isn't fifteen, it's tenths, right?

Student (unidentified): Yup, yeah.

Line 20, 14:55 T: So how many place values at ten a hundred times ten is a thousand, right? How many place values is that?

Student (unidentified): Three.

T: Three. So, one, two, three. So if I took it out and I called this three times fifteen equals forty-five, right? But I'm not trying to get forty-five. I'm trying to get something, how much smaller, you guys, is this, than that?

T: Well, how many times smaller is it?

Line 30, 15:27 Jesse: A thousand?

T: A thousand times smaller. Because that's forty-five wholes, and this is forty-five thousandths. I got a thousand times smaller. So this times this has got to be in the thousandths place. These are hundredths, right? A hundred times smaller. This was in the tenths, ten times smaller.

Class: Oh -

T: Okay. Okay. Thank you. Let's keep going.

Chapter 10: Summary 2.2B, The Teacher Refocuses
Approximate time 15:52 – 19:34 (Times from start of video)

Slide:
Teri has asked two groups to show their solution for B1 and B2. After listening to their presentations she realizes she needs to add to them to focus students on place value and the decimal point.

Line 1, 16:06 T: Thanks, you guys. I, I want to do something for this particular problem. Do you see how they used two times six hundred and seventy-two for the first one? I want to use those two factors for all three of them. Okay? So let's look at their first number sentence. Two times six hundred and seventy-two is one thousand three hundred and forty-four. Their next number sentence they said they divided backwards, so their next number sentence they left
Line 10, 16:34 two alone but they called this sixty-seven and two tenths and then they got one hundred and thirty-four and four tenths. Right? And then for the last one they did, they did something different, but, let's see here for a second. If I want to use these same two, if I want to use these same two numbers, is there a way I can get this using two and, is there something I can do to these, can, do you see how she used these same two digits, she just messed around with the size of them? Can I use these same digits to
Line 20, 17:12 get the answer to this one?

Class: Yes.

T: Okay. So let's look up here for a second. Do you see she didn't change the two. But here, instead of making it six hundred and seventy-two, she called it sixty-seven and two tenths. How much smaller is this number than that number?

Class: Ten times smaller.

T: Ten times smaller. Do you see what happened to the decimal point? It went over here. Now instead of
Line 30, 17:37 six hundred and seventy-two oneths, it's six hundred and seventy-two tenths. You see how it got ten times smaller? So if this number gets ten times smaller, what should happen to my answer.

Class: It should get ten times smaller.

T: It should get ten times smaller. Because we didn't do anything to this, but we did switch that. So shouldn't my answer be in the tenths' place?

Class: Yes.

T: Okay. Now, I want to get my answer to be in the
Line 40, 18:05 ten thousandths' place. So what do I have to do to this, to this, or to both of them,so that I end up with such a little answer? Anybody. What, what should we do?

Student (unidentified): A thousand times smaller.

Student (unidentified): Change it to six --

T: A thousand times smaller? Which one do you want -

Student (unidentified): Change it to six and seventy-two hundredths --

Line 50, 18:23 T: You want to change this to six wholes and seventy-two hundredths, or six hundred and seventy-two hundredths. That's okay. We can do that. Now, what am I going to have to do with my two, then? Because right now I have two over one. My answer should be hundredths, and I need thousandths, ten thousandths. What do I have to do with my two? I've got to change it if I'm trying to get ten thousandths down here. What do I need to make - change this to?

Student (unidentified): Two hundredths.

Line 60, 18:51 T: If I change it to ten, my answer's going to be thousandths. But what do I have?

Student (unidentified): Two hundredths.

T: I need to change it to hundredths. Now will that work? Is a hundred times a hundred ten thousand?

Class: Yes.

T: Is two times six seventy-two one thousand three hundred and forty-four?

Class: Yeah.

Line 70, 19:10 T: Cool. So now let's write this as a decimal and see what it looks like. So we took this number sentence and this answer and we did something to it. We wanted to make it so that my answer got a whole lot smaller, ten thousand times smaller. So if I take my six hundred and seventy-two and make it a hundred times smaller, and I take this and make it a hundred times smaller, will my answer be ten thousand times smaller?

Chapter 11: Jesse Summarizes
Approximate time 19:34 – 20:08 (Times from start of video)

Line 1, 19:36 T: So tell - somebody try to summarize what we're seeing.

T: What do you see? What's happening? Jesse, what's happening?

Jesse: Um, we're going the place value times place value

T: Okay.

Jesse: And then the parts and the parts the numbers

T: Place value times place value should give me
Line 10, 19:55 whatever the place value of my answer should be.

Jesse: And then we do the numbers behind the decimal point times each other as wholes to get to the number answer.

Chapter 12: The Teacher Checks for Understanding
Approximate time 20:08- 22:18 (Times from start of video)

Line 1, 20:11 T: What if I gave you twenty-five hundredths times three tenths. What would this look like in fraction form?

Class: Twenty-five over a hundred ten times three three over one.

T: So what, what should my place value be?

Class: Thousandths.

T: Thousandths.

Class: Seventy-five -

Line 10, 20:33 T: Okay. Now, let's do it like this. Let's take out our decimal points for a second. What's twenty-five times three?

Class: Seventy-five.

T: Seventy-five -

Hayden:three place values.

T: But - three place values. So if I change it, one, two, three place values, will I get the same thing that I got here?

Class: Yeah, yes.

Line 20, 20:50 T: Oh. Because this wasn't twenty-five, it was twenty-five hundredths. And this wasn't three, it was three tenths. So hundredths times tenths - we're going to get something a thousand times smaller.

T: Let's do forty-two times three, but let's put a decimal point here and let's make this hold on a second - let's make this really little. Okay. Think about it like fractions. What do we have?

Class: Forty-two tenths.

T: Forty-two tenths. And what do we have here?

Line 30, 21:26 Class: Thousandths, three thousandths.

T: So our answer's going to be in what place value?

Class: Ten thousandths.

T: In the ten thousandths place, right? Now, if I take my decimal points out, what's forty-two times three?

Student (unidentified): One eight six.

T: Be careful.

Student (unidentified): A hundred and twenty-six.

Line 40, 21:40 T: A hundred and twenty-six. There you go. But I don't want a hundred and twenty-six, I'd want a hundred and twenty-six ten thousandths. What's that going to look like? Zero point what?

Class: Zero, zero, zero - four - zero one two six -

T: You said four place values out, right? Here's three place values, here's another place value. Do you see how we change from forty-two to four and two tenths?

Class: Yeah.

Line 50, 22:04 T: What happens when I move my decimal point from here to here? How much times smaller does it get?

Class: Ten, tenths.

T: Ten times smaller. What happens when I go from here to here?

Class: A hundred times -

T: How many times, ten every time -

Class: Ten thousand -

T: Another ten

T: A thousand times smaller.

Chapter 13: Summary 2.2C part 2, Nikki
Approximate time 22:18 – 24:02 (Times from the start of the video)

Slide:
Summary continues with solutions for part C

Line 1, 22:27 Nicky: First I did twelve times ten equals, uh, one point two, 'cause I knew you just moved the decimal over -

T: Okay. Say more about that. What do you mean by that?

Nicky: Uh, every single time you times it by ten you get ten times bigger so automatically the decimal moves over one digit.

T: Are you buying that?

Line 10, 22:46 Class: Yeah. Uh huh.

T: If I get ten times bigger, all I have to do is take my decimal [01:22:48;29]and move it to the right one place value?

Nicky: Um hmm.

T: Okay.

Nicky: And then, that wasn't enough, so then I tried one hundred and than got me twelve, and then twelve was only half of twenty-four, so I timesed one hundred by two, and I got two hundred.

Line 10, 23:09 T: What do you guys think?

Nicky: Jesse?

Jesse: Well, what I used to figure out, like, how you're going to do it with two hundred, I used division. I did twenty-four divided by, um, twelve one hundredths and I just switched it over to fractions then used our algorithms.

T: Right. So you kind of used our fact family knowledge, didn't you, using - how many of you did that? You worked the problem backwards and used
Line 20, 23:33 division. Okay. So on that problem you've got twelve hundredths, right? Let's put this twelve hundredths here, and you ended up with twenty-two hundred oneths and that equals twenty-four twenty-four hundred one hundredths,

Jesse: Yeah.

T: Is that the same thing as twenty-four?

Class: Yeah, yes.

T: Yeah. So this second number had to get bigger. I had twelve cents and I was trying to get all the way up to twenty-four dollars.

Chapter 14: The Teacher Keeps the Focus on the Decimal Point
Approximate time 24:02 – 25:16 (Times from the start of the video)

Line 1, 24:05 T: Nicky said a mouthful when she said "Well, if I want to times it by ten or make it ten times bigger, all I have to do is move the place value over one." And that's the beauty of our place value system, because it's a base ten system.

T: So when we take this multiplication, you guys say "I want my answer to be thousandths or a thousand times smaller," it can be thinking about what's happening with the decimal point. Let me get a, an
Line 10, 24:35 easy one, an easy one for you guys to do in your heads. So, if I think about this problem, I've got tenths times what?

Class: Hundredths.

T: Tenths times hundredths. So I want my answer to be how many times smaller?

Class: A thousand, thousandths -

T: A thousand, thousandths, right? So if I take out these decimal points for a second, what is thirty-three times three?

Line 20, 24:56 Class: Ninety-nine.

T: Ninety-nine. But I don't want it to be ninety-nine. I want my answer to be a thousand -

Class: Thousand -

T: Times smaller than that.

Class: Ninety-nine thousandths -

T: So I'm going to make it ten, hundred, a thousand times smaller, right? Because if I actually multiplied these fractions out, I would get ninety-nine thousandths.

Line 30, 25:16 Hayden: I just figured out the algorithm.

Chapter 15: Hayden States the Algorithm
Approximate time 25:16 – 27:13 (Times from the start of the video)

Line 1, 25:18 T: Okay.

Hayden: You take out the decimals and you times it by the, um, times the whole value, the whole, and then you count up and then you write it down and then you count up the place values that you're timesing each other by and then if it's hundredths you get just like you did.

T: So like this is tenths, and this is hundredths. I'm going to multiply those guys, right, and the size
Line 10, 25:44 of my piece has got to be what -

Hayden: You already have two so you just add ten times four

T: Yup. I've got to take my ninety-nine and make sure that it's in my correct place value. Now what about this one? What if I do ... Can I do the same thing?

Class: Yeah.

Student (unidentified): Four thousand five hundred over -

T: That would be my final answer, four thousand five
Line 20, 26:17 hundred?

Class: No.

Student: But that was a thousandths' place -

T: Okay. If I'm taking this out, 've got four thousand five hundred. But I don't have fifteen, I have fifteen -

Class: Hundredths.

Jesse: So this -

T: Hundredths. This is just one.

Jesse: Four thousand five hundred one hundredths.

Line 30, 26:31 T: Four thousand five hundred one hundredths, right. So now how do I write that as a decimal?

Student (unidentified): It would just be forty-five.

T: It would just be forty-five. Right? Because if I'm trying to make that hundredths, I have, I'm trying to make that answer a hundred times smaller. Ten times smaller, a hundred times smaller.

Ellie: Is that like you're doing, though, in fractions, because you do the top and then the bottom and that's basically how you get your answer.

Line 40, 26:59 T: Exactly.

Ellie: But you do it with the point instead of the line.

Slide:
There are still two more problems in Investigation 2. It is not until 2.4C that students are formally asked to describe an algorithm.

"C. Describe an algorithm you can use to multiply any two decimal numbers."

Chapter 16: The Teacher Reflects
Approximate time 27:33 – end

No transcript available