1	01:00:52:00	01:00:54:10	NARRATOR: In the final session of the course,
2	01:00:54:12	01:00:56:20	the class is given an opportunity to discuss
3	01:00:56:22	01:00:59:11	how the ideas they have explored about measurement
4	01:00:59:13	01:01:02:20	translate into classroom practice.
5	01:01:02:22	01:01:05:16	So, what I thought we'd do today
6	01:01:05:18	01:01:09:20	is actually take one topic, the topic of area,
7	01:01:09:22	01:01:13:07	and first, generate together
8	01:01:13:09	01:01:17:11	some of the big ideas about area.
9	01:01:17:13	01:01:20:20	"Area is a measure of how much surface is covered."
10	01:01:20:22	01:01:24:10	Seems pretty obvious to us, it is not obvious to students.
11	01:01:24:12	01:01:27:08	It's one reason they confuse so often area, perimeter,
12	01:01:27:10	01:01:29:20	and sometimes even refer to solid shapes as,
13	01:01:29:22	01:01:33:03	"Oh, that's square," when they really are talking about a cube.
14	01:01:33:05	01:01:38:22	So, this is an important thing for us to constantly ask kids:
15	01:01:38:24	01:01:40:15	"What is area?"
16	01:01:40:17	01:01:42:06	"Some shapes cover a surface
17	01:01:42:08	01:01:44:06	more completely than other shapes."
18	01:01:44:08	01:01:47:29	Namely, we can cover this floor with square tiles,
19	01:01:48:01	01:01:51:03	but if we tried to cover this floor with circular tiles,
20	01:01:51:05	01:01:54:20	we'd have to have a lot of grout or something in between
21	01:01:54:22	01:01:57:14	to fill in the spaces.
22	01:01:57:16	01:02:00:24	"The units associated with area measurement are square units."
23	01:02:00:26	01:02:04:04	Have you noticed how often in this course I would ask you...
24	01:02:04:06	01:02:07:12	you would give me an answer, and I'd say, "What?"
25	01:02:07:14	01:02:10:13	Now, we as educators have to be very careful
26	01:02:10:15	01:02:14:12	to use the correct units and not to just say the numbers.
27	01:02:14:14	01:02:15:14	"It's 36."
28	01:02:15:16	01:02:17:01	"It's 36 what?"
29	01:02:17:03	01:02:18:20	If we don't focus in
30	01:02:18:22	01:02:21:05	on that we're talking, in this case, square units
31	01:02:21:07	01:02:23:26	we are missing opportunities to really help students
32	01:02:23:28	01:02:25:12	identify that unit.

33 01:02:25:14 01:02:27:04 Getting back
to "How do we measure?"
34 01:02:27:06 01:02:29:11 Well, we have to think
about the attribute,
35 01:02:29:13 01:02:31:25 and then what is the unit
that best can be used
36 01:02:31:27 01:02:33:07 to measure that attribute?
37 01:02:33:09 01:02:35:07 Well, here,
because we want to cover--
38 01:02:35:09 01:02:38:12 and we want
to cover it completely--
39 01:02:38:14 01:02:40:28 we want to use square units.
40 01:02:41:00 01:02:42:16 "The smaller the square unit,
41 01:02:42:18 01:02:44:11 "the more square units
are necessary
42 01:02:44:13 01:02:46:03 to determine the area."
43 01:02:46:05 01:02:48:15 CHAPIN:
In our final class, what we did
44 01:02:48:17 01:02:52:24 was, first, try to list
some of the big ideas
45 01:02:52:26 01:02:56:00 around the measurement of area.
46 01:02:56:02 01:03:00:04 And then, once we had
some of the ideas articulated,
47 01:03:00:06 01:03:03:17 I sent everyone back
into grade-level groups
48 01:03:03:19 01:03:08:08 to discuss how do those ideas
get translated into practice:
49 01:03:08:10 01:03:12:20 What kinds of activities could
one do at their grade level
50 01:03:12:22 01:03:15:25 and what mathematics
was being highlighted
51 01:03:15:27 01:03:18:25 around, in this case,
the topic of area?
52 01:03:18:27 01:03:20:16 When you talked
about estimation,
53 01:03:20:18 01:03:22:16 I think it's important
for younger kids
54 01:03:22:18 01:03:24:10 to have benchmarks
for estimation.
55 01:03:24:12 01:03:26:22 Many times we give them
something to estimate,
56 01:03:26:24 01:03:28:20 we're not giving them...
we just say
57 01:03:28:22 01:03:31:07 "Oh, use this
to estimate something."
58 01:03:31:09 01:03:33:12 Instead of doing that
59 01:03:33:14 01:03:35:26 is actually giving them
a benchmark
60 01:03:35:28 01:03:38:19 by putting two or three
piece of paper,
61 01:03:38:21 01:03:40:09 or whatever it takes
to cover
62 01:03:40:11 01:03:42:01 one end of the table.
63 01:03:42:03 01:03:43:27 And... giving them
a benchmark.
64 01:03:43:29 01:03:47:00 In other words,

this would be three
and a little more.

65 01:03:47:02 01:03:51:03 "How many now do you think
would cover this area?"

66 01:03:51:05 01:03:54:08 This gives them
a visual to work with.

67 01:03:54:10 01:03:55:26 I think again, too,
going back

68 01:03:55:28 01:03:58:01 to what we were talking
about with area

69 01:03:58:03 01:03:59:25 on, um... shapes:

70 01:03:59:27 01:04:02:28 If we start to look
at how shapes fill...

71 01:04:03:00 01:04:05:07 a, um, a larger shape--

72 01:04:05:09 01:04:08:05 how many triangles,
how many trapezoids,

73 01:04:08:07 01:04:10:11 how many rhombuses
would fill a hexagon?

74 01:04:10:13 01:04:12:01 Starting
to encourage children

75 01:04:12:03 01:04:13:24 to think about the why of that.

76 01:04:13:26 01:04:15:08 "Why is that happening?"

77 01:04:15:10 01:04:18:11 And then that gets
to your units, to your, um...

78 01:04:18:13 01:04:21:20 and to the understanding
that the smaller the unit

79 01:04:21:22 01:04:23:19 the more...
units you need

80 01:04:23:21 01:04:25:19 to measure
a certain area.

81 01:04:25:21 01:04:27:02 The larger the...

82 01:04:27:04 01:04:28:12 But it also makes
them think

83 01:04:28:14 01:04:30:10 that some units *have*
to be broken down.

84 01:04:30:12 01:04:32:10 I mean, like, for instance,
with my kids,

85 01:04:32:12 01:04:33:29 I give them a shape,

86 01:04:34:01 01:04:36:10 and they have to fill it in
with different shapes

87 01:04:36:12 01:04:37:20 in order to see...

88 01:04:37:22 01:04:39:16 And I put it on acetate
and I slide it over

89 01:04:39:18 01:04:40:20 onto Plexiglas,

90 01:04:40:22 01:04:42:07 and they look underneath,
see the holes

91 01:04:42:09 01:04:44:17 and they realize that,
"Oh, there's a hole.

92 01:04:44:19 01:04:46:16 I need to fill it in
with something."

93 01:04:46:18 01:04:49:07 So they start breaking shapes
into smaller pieces;

94 01:04:49:09 01:04:51:02 it's no longer
an abstract thought.

95 01:04:51:04 01:04:52:25 We give them too many abstracts,

96 01:04:52:27 01:04:54:14 you know--

a number is abstract.

97 01:04:54:16 01:04:56:03 You know,
area is abstract.

98 01:04:56:05 01:04:59:18 Perimeter, well, they can walk
around a perimeter, but...

99 01:04:59:20 01:05:01:19 it's an abstract concept.

100 01:05:01:21 01:05:03:03 So we need to make sure

101 01:05:03:05 01:05:05:16 we keep it tactile,
keep it oral

102 01:05:05:18 01:05:08:17 or keep it something
that they can visually see.

103 01:05:08:19 01:05:12:18 I think it's essential for them
to physically take one shape

104 01:05:12:20 01:05:15:12 to cover another shape
over and over again

105 01:05:15:14 01:05:17:20 for them to get
that understanding

106 01:05:17:22 01:05:21:08 that area is the measure
of a surface with no spaces.

107 01:05:21:10 01:05:22:24 And I love that idea
of the acetate

108 01:05:22:26 01:05:24:08 and having them
look up,

109 01:05:24:10 01:05:26:04 because then they'll
really get the idea

110 01:05:26:06 01:05:28:05 of "Oh, look at all
this light coming down

111 01:05:28:07 01:05:29:08 and pouring through."

112 01:05:29:10 01:05:30:27 WOMAN:
You had mentioned
an umbrella

113 01:05:30:29 01:05:32:04 as another way
to do that...

114 01:05:32:06 01:05:33:20 We talk about
building an umbrella,

115 01:05:33:22 01:05:35:20 and that seems to be
a good metaphor
for them

116 01:05:35:22 01:05:37:00 because then
they understand,

117 01:05:37:02 01:05:39:15 "Oh, I really can't
have any holes in there

118 01:05:39:17 01:05:40:29 because I'm going
to get wet."

119 01:05:41:01 01:05:44:09 Conservation, I think,
is a fundamental concept

120 01:05:44:11 01:05:45:21 that they need
to be able to have

121 01:05:45:23 01:05:46:26 in order to build on

122 01:05:46:28 01:05:48:12 to get any of these
other concepts.

123 01:05:48:14 01:05:50:15 WOMAN:
And I guess the last one

124 01:05:50:17 01:05:52:10 would be standardization,

125 01:05:52:12 01:05:54:18 that they understand
that you need to have

126 01:05:54:20 01:05:56:25 a standard measurement
at any given time
127 01:05:56:27 01:05:58:08 that you could...
128 01:05:58:10 01:06:00:15 The measurement
might change
129 01:06:00:17 01:06:02:10 depending on
your... setting,
130 01:06:02:12 01:06:05:01 but when you're measuring
one thing at one time
131 01:06:05:03 01:06:08:11 you need to have
a consistent standard
or unit of measure.
132 01:06:08:13 01:06:11:16 NARRATOR:
Later in the school year,
we visited
133 01:06:11:18 01:06:14:16 one of the participants of the
summer session, Mary Guerino,
134 01:06:14:18 01:06:16:04 a second-grade teacher
135 01:06:16:06 01:06:18:09 at the Mabelle M. Burrell
Elementary School
136 01:06:18:11 01:06:20:14 in Foxboro, Massachusetts.
137 01:06:20:16 01:06:21:29 Good morning.
138 01:06:22:01 01:06:24:20 STUDENTS:
Good morning, Mrs. Guerino.
139 01:06:24:22 01:06:28:10 NARRATOR:
Building upon knowledge learned
in the measurement course,
140 01:06:28:12 01:06:31:09 Ms. Guerino is teaching
a series of mathematics lessons
141 01:06:31:11 01:06:34:22 on the concept of area.
142 01:06:34:24 01:06:36:12 GUERINO:
My goal for today's lesson
143 01:06:36:14 01:06:38:22 is to move children
from nonstandard measurements
144 01:06:38:24 01:06:40:08 to standard measurement.
145 01:06:40:10 01:06:41:26 In the past few days,
146 01:06:41:28 01:06:46:01 children have been using paper
clips, links, buttons
147 01:06:46:03 01:06:48:08 to cover different objects.
148 01:06:48:10 01:06:50:06 Children need to be exposed
149 01:06:50:08 01:06:52:27 to using different,
nonstandard measurements
150 01:06:52:29 01:06:55:00 to get the use of counting it
151 01:06:55:02 01:06:58:00 and how to lay them out
on top of objects
152 01:06:58:02 01:07:03:26 before they can be introduced
to the terminology of area
153 01:07:03:28 01:07:06:09 in that it is covering a unit
154 01:07:06:11 01:07:10:02 with a specific, um,
measurement tool or unit.
155 01:07:10:04 01:07:13:14 Each one of these,
we measured the same book,
156 01:07:13:16 01:07:15:28 but we got different quantities.
157 01:07:16:00 01:07:19:29 Would that help me if I was
going to cover that book?
158 01:07:20:01 01:07:22:05 Haley, would it help me?

159	01:07:22:07	01:07:23:23	Um, no.
160	01:07:23:25	01:07:25:18	No, why not?
161	01:07:25:20	01:07:27:28	Because objects might have holes in them
162	01:07:28:00	01:07:29:12	like the links, and you...
163	01:07:29:14	01:07:32:05	and you couldn't cover the whole thing.
164	01:07:32:07	01:07:34:15	Okay, so none of these...
165	01:07:34:17	01:07:38:03	all right, were able to cover the entire object.
166	01:07:38:05	01:07:40:16	We used...
167	01:07:40:18	01:07:43:04	rods...
168	01:07:43:06	01:07:46:21	we used paper clips...
169	01:07:46:23	01:07:49:13	we used a playing card
170	01:07:49:15	01:07:51:04	and we used buttons.
171	01:07:51:06	01:07:53:03	I want to go over this.
172	01:07:53:05	01:07:55:26	Why wouldn't buttons... cover it?
173	01:07:55:28	01:07:58:00	When you put them on next to each other,
174	01:07:58:02	01:07:59:16	and there's a little space.
175	01:07:59:18	01:08:02:18	There's a little space, any circular object.
176	01:08:02:20	01:08:06:20	Would it cover the entire thing-- anybody know, yes or no?
177	01:08:06:22	01:08:09:09	If you put them like this and one on top,
178	01:08:09:11	01:08:11:20	there's a little hole in the middle.
179	01:08:11:22	01:08:13:19	There's still a little space.
180	01:08:13:21	01:08:15:04	So this isn't an object
181	01:08:15:06	01:08:18:07	that always would cover an entire object,
182	01:08:18:09	01:08:21:15	like the book that we measured, right, okay?
183	01:08:21:17	01:08:23:15	How about the paper clip?
184	01:08:23:17	01:08:25:06	Chris.
185	01:08:25:08	01:08:26:12	They wouldn't cover it
186	01:08:26:14	01:08:28:11	because they have holes in the middle.
187	01:08:28:13	01:08:29:24	It has holes in the middle.
188	01:08:29:26	01:08:33:23	Then we had rods.
189	01:08:33:25	01:08:34:24	Okay?
190	01:08:34:26	01:08:36:16	What happened with the rods?
191	01:08:36:18	01:08:37:27	Jessica.
192	01:08:37:29	01:08:42:07	Some went off, because one was in the middle
193	01:08:42:09	01:08:46:23	and one was at the top that was sticking out.
194	01:08:46:25	01:08:49:09	Okay, can you use measurement words for them?
195	01:08:49:11	01:08:51:08	Was it too long?

Was it too short?

196 01:08:51:10 01:08:53:06 It was too long.

197 01:08:53:08 01:08:55:13 It was
too long, okay?

198 01:08:55:15 01:08:58:20 We are going to be doing
a lesson this morning

199 01:08:58:22 01:09:00:28 that talks about going from...

200 01:09:01:00 01:09:05:02 these are all what we call
nonstandard measurement, okay?

201 01:09:05:04 01:09:07:00 We all got different answers.

202 01:09:07:02 01:09:09:09 Didn't we all
get different answers?

203 01:09:09:11 01:09:12:03 Why did we get
different answers?

204 01:09:12:05 01:09:16:02 Because some
of us were using
different things,

205 01:09:16:04 01:09:19:05 like some of us
were using buttons.

206 01:09:19:07 01:09:21:05 So we were all using
different objects?

207 01:09:21:07 01:09:22:21 Okay, so that's why we got...

208 01:09:22:23 01:09:24:04 Were the objects
the same size?

209 01:09:24:06 01:09:25:13 No.

210 01:09:25:15 01:09:27:01 Okay, so we got
different answers.

211 01:09:27:03 01:09:32:15 Today we're going to use
the same *size* objects

212 01:09:32:17 01:09:34:12 to move from...

213 01:09:34:14 01:09:35:29 nonstandard measurement

214 01:09:36:01 01:09:38:20 to what they call
standard measurements--

215 01:09:38:22 01:09:44:11 measurements that we use
all the time... in the world.

216 01:09:44:13 01:09:46:27 CHAPIN:
Area is
a very difficult concept.

217 01:09:46:29 01:09:50:01 We have to first make sure
that children understand

218 01:09:50:03 01:09:52:09 that it is a covering
of a surface

219 01:09:52:11 01:09:56:01 and that covering must
be completed with units

220 01:09:56:03 01:10:00:15 that do not leave any holes
or gaps between the units.

221 01:10:00:17 01:10:03:06 This may seem rather
straightforward,

222 01:10:03:08 01:10:07:25 but surprisingly, that is not
an easy idea for young children.

223 01:10:07:27 01:10:11:28 In our exploratory
measurement today,

224 01:10:12:00 01:10:14:17 we're going to use...

225 01:10:14:19 01:10:19:21 square-inch tiles...

226 01:10:19:23 01:10:23:06 and centimeter cubes.

227 01:10:23:08 01:10:26:09 We're not concerned

about the cube today,
228 01:10:26:11 01:10:29:27 we're concerned about
the surface on the bottom,
229 01:10:29:29 01:10:32:11 which is a square... centimeter.
230 01:10:32:13 01:10:35:22 You have two papers
in front of you.
231 01:10:35:24 01:10:38:14 Would you turn them over now
232 01:10:38:16 01:10:42:23 and find the one that has
on the top of it...
233 01:10:42:25 01:10:44:25 a square tile.
234 01:10:44:27 01:10:47:23 I want you to take
a minute or two--
235 01:10:47:25 01:10:50:17 without using anything--
236 01:10:50:19 01:10:55:22 and predict which shape
you think is larger.
237 01:10:55:24 01:10:58:09 And then take a pencil--
238 01:10:58:11 01:11:01:18 you have to agree
between the two of you--
239 01:11:01:20 01:11:05:00 all right, and circle
the one where it says
240 01:11:05:02 01:11:08:08 number one
or number two.
241 01:11:08:10 01:11:10:14 A square is, like, bigger
on the other side.
242 01:11:10:16 01:11:18:12 Four, four equal sides
makes a square, remember?
243 01:11:18:14 01:11:20:12 And then four right angles
also makes a square.
244 01:11:20:14 01:11:21:24 Mm-hmm.
245 01:11:21:26 01:11:23:22 But they're pretty much
both squares, right?
246 01:11:23:24 01:11:25:24 Because, remember...
247 01:11:25:26 01:11:28:02 I would say it's this one,
wouldn't you?
248 01:11:28:04 01:11:29:08 Yeah.
249 01:11:29:10 01:11:30:11 All right.
250 01:11:30:13 01:11:32:27 This part is...
251 01:11:32:29 01:11:34:22 Hold on...
252 01:11:34:24 01:11:37:00 make a line through
half of it.
253 01:11:43:16 01:11:45:09 Put your
fingers on there.
254 01:11:45:11 01:11:47:12 And put your fingers
on here.
255 01:11:50:27 01:11:52:15 They're the same.
256 01:11:52:17 01:11:54:16 Mm-hmm, that way;
but this way...
257 01:11:54:18 01:11:56:03 This is.
258 01:11:56:05 01:12:01:08 Mm-hmm... so that
one would be...
259 01:12:01:10 01:12:03:05 Bigger.
260 01:12:01:10 01:12:03:05 Yup.
261 01:12:05:00 01:12:08:01 CHAPIN:
These activities were very
appropriate for second graders
262 01:12:08:03 01:12:12:02 because it involved them

actually covering surfaces,

263 01:12:12:04 01:12:15:20 counting the actual number of units that were needed

264 01:12:15:22 01:12:19:05 and reflecting on the shape of the unit that was used to cover

265 01:12:19:07 01:12:22:05 as well as the number of units that were necessary

266 01:12:22:07 01:12:25:10 to determine an area.

267 01:12:34:19 01:12:36:23 Jillian, I noticed you were using your hand.

268 01:12:36:25 01:12:39:04 Can you show me what you did at the beginning?

269 01:12:39:06 01:12:42:14 I was looking at the square

270 01:12:42:16 01:12:44:25 to see the size,

271 01:12:44:27 01:12:48:14 and then I kept on moving my hand right here

272 01:12:48:16 01:12:51:10 because I thought it wasn't...

273 01:12:51:12 01:12:54:22 I thought I wasn't moving my hand,

274 01:12:54:24 01:12:57:13 so then I measured it this way.

275 01:12:57:15 01:13:00:26 And so which one did you predict would be bigger?

276 01:13:00:28 01:13:02:17 Um...

277 01:13:02:19 01:13:04:10 shape one.

278 01:13:04:12 01:13:06:02 But then, shape...

279 01:13:06:04 01:13:08:14 When we put on the tiles,

280 01:13:08:16 01:13:10:22 shape two was the bigger one.

281 01:13:10:24 01:13:14:01 Okay, so you used your hand span, like this,

282 01:13:14:03 01:13:15:29 to make a benchmark, okay,

283 01:13:16:01 01:13:18:27 to see whether this was as big as this.

284 01:13:18:29 01:13:21:17 Why do you think that didn't work?

285 01:13:21:19 01:13:25:03 Um... because I kept on

286 01:13:25:05 01:13:28:04 moving my hand, my fingers

287 01:13:28:06 01:13:31:04 and I didn't really think I was.

288 01:13:31:06 01:13:33:12 Okay, so it wasn't staying steady.

289 01:13:33:14 01:13:35:28 It wasn't a steady measurement, okay.

290 01:13:36:00 01:13:38:01 Now, why do you think it works

291 01:13:38:03 01:13:40:23 when we use square tiles?

292 01:13:40:25 01:13:45:24 JILLIAN:
Because when
we count them,
293 01:13:45:26 01:13:49:00 they would be able...
we would be able
294 01:13:49:02 01:13:51:11 to find out the number.
295 01:13:51:13 01:13:53:01 And this one would...
296 01:13:53:03 01:13:57:07 and this one
has eight and two...
297 01:13:57:09 01:14:00:24 This one has four
in each row.
298 01:14:00:26 01:14:02:11 So if we
go like this,
299 01:14:02:13 01:14:04:01 that would be eight,
300 01:14:04:03 01:14:06:02 this would be eight,
301 01:14:06:04 01:14:08:01 and that equals 16.
302 01:14:08:03 01:14:11:11 And there's five
going this way,
303 01:14:11:13 01:14:14:11 and five plus five
equals ten
304 01:14:14:13 01:14:17:08 and ten plus five
equals 15.
305 01:14:17:10 01:14:21:28 Okay, so why isn't
this one bigger
306 01:14:22:00 01:14:24:06 where it has five in a row?
307 01:14:24:08 01:14:27:03 Because when it
goes down,
308 01:14:27:05 01:14:29:28 it's not
an even number...
309 01:14:30:00 01:14:32:21 it's not
the same number,
310 01:14:32:23 01:14:37:01 and that because it
would be right here
311 01:14:37:03 01:14:41:03 and that's how we
got 15 out of this
312 01:14:41:05 01:14:42:22 and we got 16
out of this.
313 01:14:42:24 01:14:44:10 GUERINO:
Okay, very good.
314 01:14:44:12 01:14:45:28 So would you
use your hand
315 01:14:46:00 01:14:47:18 as a measurement
next time,
316 01:14:47:20 01:14:49:26 or do you think tiles
might be more accurate?
317 01:14:49:28 01:14:51:00 Tiles.
318 01:14:51:02 01:14:52:23 Okay, and that's...
319 01:14:52:25 01:14:56:27 GUERINO:
They were asked to cover up
with square-inch tiles first,
320 01:14:56:29 01:15:01:04 and they found that the second
shape on the bottom was bigger.
321 01:15:01:06 01:15:04:28 Then I asked them
to do it again with centimeters
322 01:15:05:00 01:15:08:12 to ask them whether
they could conserve area.

323 01:15:08:14 01:15:12:22 In other words, if something
is bigger in one spot,
324 01:15:12:24 01:15:15:01 will it always be bigger
325 01:15:15:03 01:15:20:26 or does it change
with the size tile we use?
326 01:15:20:28 01:15:24:10 Devon, how many do you
think you'll have?
327 01:15:24:12 01:15:25:24 More than 50.
328 01:15:25:26 01:15:29:08 GIRL:
I think I'll have
more than 100.
329 01:15:29:10 01:15:31:16 Which one do you think
will have more--
330 01:15:31:18 01:15:33:00 this one or this one?
331 01:15:33:02 01:15:34:00 DEVON:
This one.
332 01:15:34:02 01:15:35:04 GIRL:
Why?
333 01:15:35:06 01:15:36:28 I don't know.
334 01:15:37:00 01:15:39:07 I think this one
will have more
335 01:15:39:09 01:15:43:00 because this one
has more at the top
than that one does
336 01:15:43:02 01:15:46:13 and on this side,
this one has more
than this one,
337 01:15:46:15 01:15:48:26 but this one
at the top has more.
338 01:15:48:28 01:15:51:06 Why do you think
this one will have more?
339 01:15:51:08 01:15:53:10 Do you think why,
um... maybe because
340 01:15:53:12 01:15:56:16 this one is
shorter than that one,
like the tiles did?
341 01:15:56:18 01:16:01:07 I don't know,
but I still think
this one will be bigger.
342 01:16:01:09 01:16:04:07 I think this one
will be bigger, Devon,
343 01:16:04:09 01:16:07:16 because the last one
when we used the tiles,
344 01:16:07:18 01:16:10:04 this one was
less than that one,
345 01:16:10:06 01:16:12:11 but this one
could be different,
346 01:16:12:13 01:16:19:15 because these little
square centimeter cubes
347 01:16:19:17 01:16:24:22 are smaller than
the tiles are.
348 01:16:24:24 01:16:27:18 I noticed
that you covered
half of this, okay.
349 01:16:27:20 01:16:30:02 Can you predict which
one will be bigger

350	01:16:30:04	01:16:32:20	covering half of it, do you think?
351	01:16:32:22	01:16:36:27	HALEY: I think that it might be number two.
352	01:16:36:29	01:16:38:06	It might be number two.
353	01:16:38:08	01:16:39:24	Why do you think maybe two...
354	01:16:39:26	01:16:41:05	Well, before you thought
355	01:16:41:07	01:16:43:12	it was number one that would be bigger,
356	01:16:43:14	01:16:45:09	before you started the activity.
357	01:16:45:11	01:16:46:17	Okay, how many...
358	01:16:46:19	01:16:48:16	Now you've filled half, okay.
359	01:16:48:18	01:16:51:15	You're setting a benchmark for yourself.
360	01:16:51:17	01:16:53:16	How many are in here, Haley?
361	01:16:53:18	01:16:54:27	HALEY: Forty-eight.
362	01:16:54:29	01:16:56:04	Forty-eight.
363	01:16:56:06	01:16:58:12	How many do you think would be
364	01:16:58:14	01:16:59:29	twice as many as 48?
365	01:17:03:22	01:17:06:05	How much is 40 and 40?
366	01:17:09:09	01:17:10:11	Eighty.
367	01:17:10:13	01:17:11:22	Eighty.
368	01:17:11:24	01:17:13:12	And how much is eight and eight?
369	01:17:13:14	01:17:15:01	Sixteen.
370	01:17:15:03	01:17:17:18	Sixteen, so 80 and 16
371	01:17:17:20	01:17:20:11	would be... ninety-six.
372	01:17:20:13	01:17:22:21	So this would be your prediction?
373	01:17:22:23	01:17:24:22	There'd be 96 on this one?
374	01:17:24:24	01:17:27:06	Okay, how many did you cover on here?
375	01:17:27:08	01:17:28:11	Fifty.
376	01:17:28:13	01:17:29:16	Fifty, okay.
377	01:17:29:18	01:17:31:06	How much is 50 and 50?
378	01:17:31:08	01:17:32:16	A hundred.
379	01:17:32:18	01:17:35:11	So you think this will have more in it
380	01:17:35:13	01:17:37:26	because you've

covered half, okay?

381 01:17:37:28 01:17:40:10 So if we've covered
half of each of these

382 01:17:40:12 01:17:42:23 and if you're correct
in your prediction,

383 01:17:42:25 01:17:44:24 then the bottom one
would be more.

384 01:17:44:26 01:17:46:15 Would you go ahead and try

385 01:17:46:17 01:17:48:22 and see what
the rest of it would be?

386 01:17:48:24 01:17:49:27 Thank you.

387 01:17:55:26 01:17:58:21 Okay, we've just
done an activity.

388 01:17:58:23 01:18:01:07 What were your findings, okay?

389 01:18:01:09 01:18:05:00 Shannon and Devon,
which did you find were bigger?

390 01:18:05:02 01:18:08:29 Um, the square tiles,
shape two was bigger.

391 01:18:09:01 01:18:10:15 Okay.

392 01:18:10:17 01:18:13:21 And when you did the centimeter
cubes, which one was bigger?

393 01:18:13:23 01:18:15:16 Shape two was bigger.

394 01:18:15:18 01:18:16:26 Shape two also.

395 01:18:16:28 01:18:19:04 When we
find area,

396 01:18:19:06 01:18:20:24 if something is bigger,

397 01:18:20:26 01:18:24:01 do you think it would change
no matter what we used?

398 01:18:24:03 01:18:29:17 You're not switching the shapes
or the sizes of the shapes.

399 01:18:29:19 01:18:31:06 Okay.

400 01:18:31:08 01:18:34:11 Now we're going to
do an activity, okay,

401 01:18:34:13 01:18:37:14 that requires us to use
the tiles only.

402 01:18:37:16 01:18:41:06 We're not going to use
the centimeters anymore.

403 01:18:41:08 01:18:45:25 And I am going to ask you to
make something with the area--

404 01:18:45:27 01:18:48:09 and this is a little different

405 01:18:48:11 01:18:51:01 than what we did before,
all right--

406 01:18:51:03 01:18:57:28 that has an area
of 24 square inches

407 01:18:58:00 01:19:01:14 and we are going to make
rectangles only.

408 01:19:01:16 01:19:03:26 CHAPIN:
In the last activity,

409 01:19:03:28 01:19:08:02 many students made rectangles
that were hollow inside.

410 01:19:08:04 01:19:10:11 They did not realize that

411 01:19:10:13 01:19:12:23 when they were trying
to make the rectangle,

412 01:19:12:25 01:19:14:20 it had to be a solid rectangle

413 01:19:14:22 01:19:17:05 in order to be able
to talk about its area.

414 01:19:17:07 01:19:20:04 The teacher went and asked
the students questions
415 01:19:20:06 01:19:22:05 to try to probe
their understanding
416 01:19:22:07 01:19:25:11 of whether or not a surface
could be covered
417 01:19:25:13 01:19:27:12 with a hole in the middle,
418 01:19:27:14 01:19:30:24 and children, when they were
actually confronted
419 01:19:30:26 01:19:33:27 with their error,
then began to reconsider.
420 01:19:33:29 01:19:36:11 Are we sure we
have 24 tiles out?
421 01:19:36:13 01:19:37:21 Let's count.
422 01:19:37:23 01:19:39:17 BOTH:
One, two, three, four,
423 01:19:39:19 01:19:41:29 five, six, seven, eight,
424 01:19:42:01 01:19:45:11 nine, ten, 11, 12,
13, 14, 15, 16,
425 01:19:45:13 01:19:49:18 17, 18, 19, 20,
21, 22, 23, 24.
426 01:19:49:20 01:19:52:24 So what
do you think
we need to do?
427 01:19:52:26 01:19:56:02 Hmm...
428 01:19:56:04 01:19:58:02 Are we allowed
to leave them out?
429 01:19:58:04 01:19:59:12 Nope.
430 01:19:59:14 01:20:01:02 It has to cover
the entire thing
431 01:20:01:04 01:20:02:17 and it has to be
a rectangle.
432 01:20:02:19 01:20:04:23 So can we have
that shape,
do you think?
433 01:20:04:25 01:20:05:29 KIDS:
No.
434 01:20:06:01 01:20:07:14 Can you try it
a different way?
435 01:20:07:16 01:20:11:20 Oh, oh, maybe we could make it
half skinnier maybe.
436 01:20:11:22 01:20:13:01 Like that.
437 01:20:13:03 01:20:15:11 But then we can also make it
a little longer.
438 01:20:15:13 01:20:17:26 No, we can
make it like that.
439 01:20:17:28 01:20:20:21 Why are you always
leaving this opening?
440 01:20:20:23 01:20:23:08 Because then we
have to fill in that.
441 01:20:23:10 01:20:26:05 Well, why don't you
fill it in as you go?
442 01:20:26:07 01:20:28:16 See, maybe that
will help you, okay,
443 01:20:28:18 01:20:30:05 to make a
rectangle shape.

444 01:20:30:07 01:20:31:11 Yeah.
445 01:20:54:01 01:20:56:19 Oh, wait, I don't...
I don't...
446 01:20:56:21 01:20:58:14 We don't...
yep, we have enough.
447 01:20:58:16 01:20:59:26 GUERINO:
Does it fit?
448 01:20:59:28 01:21:01:03 Yeah!
449 01:21:01:05 01:21:02:05 Okay,
now let's see
450 01:21:02:07 01:21:03:21 if you can make
some more.
451 01:21:03:23 01:21:05:24 Do each of
these rectangles
452 01:21:05:26 01:21:07:07 have an area
of 24?
453 01:21:07:09 01:21:08:16 Yup.
454 01:21:08:18 01:21:11:22 Can you show me
which ones do?
455 01:21:11:24 01:21:13:16 This one
does.
456 01:21:13:18 01:21:15:06 How do we know
457 01:21:15:08 01:21:17:26 that it has
an area of 24?
458 01:21:17:28 01:21:19:17 We could count.
459 01:21:19:19 01:21:22:01 Okay-- Amanda,
would you count yours?
460 01:21:22:03 01:21:23:22 We could count
by two's.
461 01:21:23:24 01:21:24:26 Two's, okay.
462 01:21:24:28 01:21:28:00 Two, four, six,
eight, ten,
463 01:21:28:02 01:21:36:28 12, 14, 16, 18,
20, 22, 24.
464 01:21:37:00 01:21:40:07 Okay, what's the definition
of area, do you think?
465 01:21:40:09 01:21:43:07 How many it has
all together?
466 01:21:43:09 01:21:46:01 How many it has
all together.
467 01:21:46:03 01:21:49:06 If I filled a cup,
is that area?
468 01:21:49:08 01:21:51:20 When we talked
before about...
469 01:21:51:22 01:21:55:10 what did I ask
you to do with
the two shapes,
470 01:21:55:12 01:21:58:02 when we did it
before with tiles?
471 01:21:58:04 01:22:05:00 You... asked us to...
fill in the shapes.
472 01:22:05:02 01:22:07:12 GUERINO:
To fill in the shapes
473 01:22:07:14 01:22:09:11 or to... cover
them, okay.
474 01:22:09:13 01:22:13:17 So an area is

a... covering.

475 01:22:13:19 01:22:15:16 CHAPIN:
When you use 24 squares,

476 01:22:15:18 01:22:19:08 there are exactly four distinct
rectangles that can be made--

477 01:22:19:10 01:22:24:20 a 1 x 24, a 2 x 12,
a 3 x 8 and a 4 x 6.

478 01:22:24:22 01:22:26:28 It was very difficult
for students

479 01:22:27:00 01:22:28:14 because in many cases

480 01:22:28:16 01:22:30:26 they did not see
that two rectangles

481 01:22:30:28 01:22:33:25 such as a 3 x 8 and an 8 x 3
were identical.

482 01:22:33:27 01:22:36:06 They thought that
as soon as you changed

483 01:22:36:08 01:22:38:03 the orientation of the rectangle

484 01:22:38:05 01:22:40:07 it actually had changed
in some way.

485 01:22:40:09 01:22:42:24 Okay, is this
a different rectangle
than this?

486 01:22:42:26 01:22:43:26 Yup.

487 01:22:43:28 01:22:45:02 Yes.

488 01:22:45:04 01:22:46:24 Why, Amanda?

489 01:22:46:26 01:22:54:28 Because this rectangle
is facing, um... across

490 01:22:55:00 01:22:59:09 and this rectangle
is facing, um... up.

491 01:22:59:11 01:23:01:20 All right,
if I flipped them,

492 01:23:01:22 01:23:04:12 would they be
the same rectangle?

493 01:23:07:28 01:23:09:03 Yes.

494 01:23:09:05 01:23:10:14 Yes, okay.

495 01:23:10:16 01:23:13:15 So they're not
a different rectangle.

496 01:23:13:17 01:23:16:23 They're just
placed differently.

497 01:23:16:25 01:23:19:28 Okay, we're going
to get more into
that, okay?

498 01:23:20:00 01:23:24:10 How many made this rectangle?

499 01:23:27:09 01:23:29:28 Okay, how many shapes, Jonathan,

500 01:23:30:00 01:23:33:12 are on... how many
are on the top of this?

501 01:23:33:14 01:23:34:21 Twelve.

502 01:23:34:23 01:23:36:18 And twelve
on the bottom.

503 01:23:36:20 01:23:38:13 How many are
on the side?

504 01:23:38:15 01:23:39:19 Two.

505 01:23:39:21 01:23:41:05 And how many are
on the other side?

506 01:23:41:07 01:23:42:21 Two.

507 01:23:42:23 01:23:45:10 How many made this one?

508 01:23:45:12 01:23:47:09 Is it the same rectangle?
509 01:23:47:11 01:23:48:12 KIDS:
Yes.
510 01:23:48:14 01:23:50:07 Okay?
511 01:23:50:09 01:23:54:00 Whether I move up or down,
it's the same rectangle, okay?
512 01:23:58:20 01:24:00:23 How many made this shape?
513 01:24:00:25 01:24:04:06 Shannon, how many
are on the top of this?
514 01:24:04:08 01:24:05:12 Six.
515 01:24:05:14 01:24:06:21 How many are
on the bottom?
516 01:24:06:23 01:24:07:21 Six.
517 01:24:07:23 01:24:08:21 How many are
on the side?
518 01:24:08:23 01:24:09:19 Four.
519 01:24:09:21 01:24:10:26 How many are on the other side?
520 01:24:10:28 01:24:11:20 Four.
521 01:24:11:22 01:24:12:21 How many made this one?
522 01:24:12:23 01:24:13:28 CHAPIN:
I think in the future,
523 01:24:14:00 01:24:15:16 the teacher will
probably want to do
524 01:24:15:18 01:24:19:08 more activities that involve
covering with standard units,
525 01:24:19:10 01:24:22:05 asking students to reflect
on both the size of the unit
526 01:24:22:07 01:24:25:27 and the number of units,
as well as continuing to look at
527 01:24:25:29 01:24:31:05 what happens to the area
of a shape when it is rotated.
528 01:24:31:07 01:24:34:01 Are square tiles more efficient
529 01:24:34:03 01:24:36:29 for covering something
than buttons?
530 01:24:37:01 01:24:39:06 Or paper clips?
531 01:24:39:08 01:24:42:19 Or the other kinds of things
that we used?
532 01:24:42:21 01:24:43:21 Yes.
533 01:24:43:23 01:24:45:02 Why?
534 01:24:45:04 01:24:49:26 Because squares have,
usually have sharp edges
535 01:24:49:28 01:24:54:27 and they're easier, and they
don't leave much spaces.
536 01:24:54:29 01:24:57:19 Okay, in our
measurement system
537 01:24:57:21 01:24:59:18 uses square inches,
538 01:24:59:20 01:25:03:17 square yards
to measure different things.
539 01:25:03:19 01:25:06:03 So you've learned
why we need to use
540 01:25:06:05 01:25:09:15 a standard form of measurement
to cover things.
541 01:25:09:17 01:25:12:02 And to cover things
is what, Amanda?
542 01:25:12:04 01:25:13:07 Area.
543 01:25:13:09 01:25:14:22 Area--

everybody?

544 01:25:14:24 01:25:15:27 CLASS: Area.

545 01:25:15:29 01:25:17:14 Area, when we cover something.

546 01:25:17:16 01:25:18:20 Okay, good job.

547 01:25:20:12 01:25:23:19 Captioned by Media Access Group at WGBH access.wgbh.org