

The Teacher To Teacher Initiative was created by the US Department of Education to provide the latest strategies and research on educational practices that work inside a classroom. Good morning, I'm Cindy Stone. I am from El Paso, Texas, and this is my 24th year in education. When students have a good grasp of mathematics, it opens the door to many possibilities for them. You can not become an engineer; you can not become an architect. There are a lot of jobs in technology that if you're not good in math that door is closed to you. We have to understand why we're teaching, what we're teaching at the grade level we're teaching. This series features teachers from across the country presenting techniques that can be used with students of all ages. It's just one way the Department of Education is helping teachers get the support they need so that no child is left behind.

(MUSIC)

Good morning. I'm Cindy Stone. I am from El Paso, Texas, and this is my 24th year in education – 15 years of those as a classroom teacher, several years doing professional development, and I've recently become an assistant principal. I've had a lot of experience. I began my career in high school math, and quickly realized that elementary was my forte, so I really focus a lot on conceptual development and I'd hesitate to call it hands on math – its more minds on math. Because you can do hands on activities that are just activity mania, so I'd like to go through the goals of today's session. One of the goals is that you get a little bit of an understanding of what the research says. My main goal is for you to understand those big mathematical ideas in the activities and why we teach what we teach. When I began teaching 1st grade, we would measure tables with paper clips, and I thought what is that all about – why are we using paper clips? So, we have to understand why we're teaching what we're teaching at the grade level that we're teaching, and for you to form a network of colleagues and a support system. Some of you came with friends – hopefully you'll leave having more friends and a network, and also to familiarize you with the Department of Education website that has a lot of resources for us. One of the things that the National Research Council says is that students need to mentally structure and revise their construction of space. That may be kind of a mouthful and you think “what does that mean”, but as we go along I think that will become clearer. Another thing that we hear that we don't like to hear is that we're not really doing an adequate job of teaching measurement, perimeter, area and volume and geometry. We don't like to hear that. Sometimes we become defensive because we all work very, very hard and we don't want to hear from some international research that in the United States we're not doing as good a job as in some other countries. And another group of researchers said that in order for students to come to

deep understandings and understanding sophisticated ways of using math and science. Those that are able to construct and analyze mathematical models and create mental models are going to be an advantage. If you've ever taken – and I know you have – how many of you have taken geometry in high school and in college? Do you remember working through those theorems in geometry? Does anybody remember how to do that? Does anybody remember why we did that? Well, that's why we have to do it a different way, because math is really the gatekeeper. When students have a good grasp of mathematics, it opens the door to many possibilities for them. You cannot become an engineer, you cannot become an architect – there are a lot of jobs in technology that if you're not good in math that door is closed to you. It isn't that everybody wants to become an architect or an engineer, but if our students want to we want them to have that possibility. And so when students are able to construct those mental models, those are the kids that are going to be able to go into those kinds of careers. One of the things that we want is a lot of modeling. When we're talking about spatial reasoning, we want the kids to have something more to grasp than just paper and pencil. The way that we did geometry was – at the very most – was drawing pictures and writing out those theorems. That was very abstract, and that's probably why most of us didn't have a good grasp of it. Those that did have a good grasp got to that point because it came natural to them. It wasn't because the teacher taught them something; it was something that was innate. And we want kids to come away with a generalization of concepts. If this works here, and it works here, and it works here, then I might be able to say that this solution would work in all cases – so we want them to be able to do that. And we want them to justify why they do what they do, or why they say what they say. If they can't justify how they got their answer, then it's very probable that they don't really understand. And these have to be taught imbedded in the activities that they do. It isn't that we teach kids processes over here and then we do something else – it has to be in conjunction. And as I said, approaching the content through investigations is going to give kids the flexibility – in other words, if I try this and this doesn't work, do I have the confidence to try something else, and that doesn't work, do I have something else in my toolbox to pull out – some other ideas. We want kids to develop fluency in using mathematical skills. We talk about fluency all the time in reading, don't we? But, how often do we talk about fluency in mathematics. We want it to be so easy for them that they have these skills that they can pull right out of their toolbox. I'm going to touch very briefly on assessments. I look at assessment as a photo album – not a snapshot. What we want kids to do is over time – to develop concepts in the first place takes a long time. You don't develop a

concept in a week, you don't develop a concept – especially concepts in geometry and measurement – that doesn't happen very quickly, so kids move from a very naïve understanding to a more sophisticated understanding, and assessment needs to match that. You are certainly not going to expect students at the end of the 1st semester to have the same understanding of a concept that they have at the end of the next semester. So your assessment wants to evaluate in that way. The question you want to ask yourself is how are you going to know when your students know what you want them to know? What is going to be the evidence? What are you going to decide is acceptable evidence? Students might be able to do computation on a paper/pencil test, but that doesn't mean they really understand a particular concept. I could work through those theorems in college – I mean I was one of those nerdy kids – I loved doing that. Ask me what the heck it meant. I don't know. But, I worked through it. So you need to decide what's acceptable evidence that students understand that concept. Then the other thing is how can you grade a hands-on task if you're doing the kind of teaching that you want your students to come to this understanding and you do a lot of hands-on, minds-on activities, then you turn around and give them a paper/pencil test only, is that really a fair assessment to those students? So you want to balance, but you need to be able to give grades to the students. You need to be accountable for the understanding that the kids have all the way along through the development of that concept. So how do you grade a hands-on task? The best resource for the answers to all these questions is at your grade level at your school. Collaboration with your colleagues – and I know that some schools are further along than others in that collaboration, but research also shows that when teachers collaborate with each other, you're the best resource – not me, not some outside consultant – you have the ideas already, but you need to talk to each other and you can answer these questions, and decide what's acceptable at your school. How am I going to grade these? How will I grade a hands-on task? For me the key word in assessment is balance. You know, a lot of times in education we swing from one side to another and from one idea to another. Balance in grading those concrete tasks, grading those hands-on tasks, grading semi-concrete – and by semi-concrete I mean can they draw a picture of it – to me that's semi-concrete. And then abstract. Can they answer those paper/pencil tests. And rubrics I'm going to just mention very briefly that there are two different kinds of rubrics. There's a holistic rubric, where you're looking at the whole work, which might be when you're grading writing or something like that. And then there are analytical rubrics, which is more like a checklist. To me the key thing here is; don't keep it a secret from the kids. If you have a rubric

– and for me personally in the classroom, I had my students create the rubric with me. They know what good work is. They know what they need to know. And so together we would write the rubric and I would have the kids on the carpet, or if they were older kids they would be at their desk, and I'd on a chart tablet create the rubric and stick it up there and say "when we do hands-on math activities, these are the things that you need to be able to do, and this will show me that you're understanding." And I did it with 1st graders, I did it with 5th graders, so even if they're very small children they can still create that rubric with you and then they take ownership of the work – they know, they've internalized what they need to do. Whatever task you give them, find a connection to the real world. I think a lot of us have been doing that for quite a while. Connections to prior lessons – again, research has shown that that's the piece that's missing in our mathematics classes in the United States. We don't help students to make those connections. Not that I'm going to tell the student what the connection is, but by your questioning you ask them "Does this sound like something we've done before? Is it anything like you've seen out in the real world?" Our kids constantly ask us "When am I going to use this? Where am I ever going to use this?" If you can't answer that question, you probably shouldn't be teaching it. So you need to ask yourself first, so you can draw that out of your students. The task should be open enough to provide challenge to gifted students, while allowing success for at-risk. At breakfast this morning, I was talking to a couple of gentlemen and I said at the point in time when I changed the way I taught, I had gone to a workshop many years ago on teaching students with dyslexia. Then about a year later or so, I went to another workshop on teaching students that are gifted, and the techniques were the same. The strategies were the same. And I thought that's really strange. If I should be using these wonderful things with gifted students, and I should be using these wonderful things with students with learning disabilities, why would that not be good for all kids? And so I began to teach that way with all kids, and amazingly I had a lot fewer referrals to resource. Kids that I thought couldn't do, could do. It was a wonderful experience when you start using those strategies. Tasks should be based on standards – not what the teachers likes to teach. How many of you have those love units that you just can't give up? I love to teach about oceans. I live in the desert. 1st graders don't have a clue what the ocean means. They can see pictures, they have seen videos, but it's still not really real to them. So, you need to start with your state standards, and teach what your standards say to teach. If I'm the 1st grade teacher and learning about ecosystems is something in the 3rd grade, I don't need to be teaching it, even if I want to. You need to teach what's in the

standards. When you're asking questions in the classroom, there are 2 kinds of questioning. There are questions that the teachers ask, like "This is the concept we're working on today. Can you draw me a picture of that?" If a child in 1st grade cannot draw a picture of what $4 + 3 = 7$ means, they don't really have an understanding of it. It's like in reading – a child may be able to recite the alphabet, but he might not know what the letter A looks like, or the sound that it makes. So it's the same thing in mathematics. If students can do computations, but they can't draw you a picture of it, they don't really have an understanding of the concept. Ask kids questions like that. My colleague and I advocate that every child has a math and a science journal, and they do all their work in math journals. If you put up a problem on the board – again I'll go back the $4 + 3$ in 1st grade. Put $4 + 3 = 7$ on the board and ask the kids to write a story problem for it. Ask them to draw a picture of what that story problem means, and then you know – instead of them doing a whole page of computation – you know that they understand that concept. Ask them to write about it. Ask them how they solved it. Not I added $4 + 3$, but what does that mean? Ask them to write that out. And in 1st grade, depending on what time of the year it is, you may have to do that for them, or they may have to orally tell you. Ask them "Will your solution always work? If I have 4 cupcakes + 3 cupcakes = 7 cupcakes, and then I have 4 gummy bears + 3 gummy bears, am I always going to get 7 of whatever it is that I'm adding? Is that always going to work?" And that's where those generalizations, where kids start seeing that this always works, then they know that they can come to that generalization. Another thing that we like to do is talk about student questioning. In U.S. classrooms, most of the interaction – if you've got a really great teacher, and I know you all are, you've got a lot of questioning going on teacher to student, teacher to student, teacher to student. How much activity is student to student? How much talking and questioning is student to student? There are ways to teach kids how to do that. We don't have time to do that here today, but when I get into the activity, I will model a little bit of it, so that you can see what I'm talking about. But you have to teach kids to talk to each other in the appropriate ways. We know kids talk a lot, but they're not talking about math, are they? And they're not talking about solving the problem, usually. Students should be provided with opportunities to tell you, or tell their friends at their group, that they don't understand – they need clarification. And you can do that with kindergarten, you can do that with 1st graders, but it depends on the climate that you set in your room. If you have a risk-free environment where they feel safe to do that, they'll do it. What we're going to do is begin with a series of activities. The activities are going to be measurement – and I know that the session says measurement and

geometry – and we’ll talk about; how is that related. You know, we think about usually measurements over here, geometry is over here, but we’ll talk about how that’s related. And this is called “what’s in a bucket?” The first task – and I put used pieces of yarn – but there are other tools in your bucket. When we get started I want you to empty out your bucket, and I want you and your group to talk about what tools you want to use, and use whatever tool you want to measure the bucket. You’re going to measure the diameter, you’re going to measure the circumference, and you’re going to measure the height. And at the end of each group table are a couple of chart tablets, and I would like you to record your results. Go ahead and empty out the tools, and look at the tools that you have and decide what tools you’re going to use to measure the circumference, the diameter and the height of the bucket.

(ACTIVITY)

Now the hard part. I’d like you to pick somebody in your group that is going to be the presenter and get up and talk. And let me teach you a little trick to do. You know, in your classroom – depending on your classroom – all of them want to get up. They’re not like adults where we’re kind of shy. There’s a little strategy from adaptive schools called “fickle finger”. What you do is on the count of 3, everybody in the group points to one person that you want to be the presenter. Now, obviously, everybody’s not going have the same person in mind, but the person with the most fingers pointing to them will be the person that is the presenter. So, are you ready? 1, 2, 3, fickle finger. (LAUGHTER) Alright, do we have a volunteer to go first? Alright, would you come on up? And let me tell you a little – it’s no secret – and I’ve done it and we all do it, because there’s so much to teach, and we don’t have enough hours in the day, that the most critical piece of any learning in the classroom is the discussion, because that’s where the generalizations, that’s where those justifications – for students who are struggling – how many of you in your math classes you did all your work by yourself? I don’t recall ever in all of my years, doing work in a group in mathematics – I did it by myself. So if I didn’t understand something, or if I was doing it the wrong way thinking that I understood, I kept doing it the wrong way, because I never got my papers back for 2 weeks. There were so many papers we produced – didn’t get it back for 2 weeks. And when you do something the wrong way for that length of time, it’s very hard to unlearn. So, the critical piece is immediately following whatever the activity is, having that class discussion so that students like me, who did it the wrong way, or struggled with it, or never did understand it, I can listen to everybody’s ideas, and I can tell you that – just from walking around – there were different ways of doing this, and we want the kids to find, or understand that there are different ways. That helps

them to have that flexibility in solving problems. Okay, so tell us what your group did. Our group started with the diameter, and we used the yarn to measure that. And then we started with the cubes and measured how many cubes it took the length of the string. We found that 10 cubes was the diameter and then we all of our other materials and saw what, in relation to all the other materials, how long it was. So, we said it was $2\frac{1}{2}$ post-it notes, a little less than a scissor-length, $1\frac{1}{2}$ lengths of index cards, and then we just did the same for the circumference and the height. Okay, let me ask you something. If it took 10 cubes, why did it only take $2\frac{1}{2}$ post-it notes, and $1\frac{1}{2}$ index cards and less than one scissors length? Well, the cubes are smaller than the index cards, so you're going to have more cubes linked together because the index cards are bigger. The same with the scissor is a lot bigger than all the cubes put together, so the scissors, just by itself equaled all those cubes together. Is there someone in the group that agrees with Valerie for justification for why it takes fewer post-it notes than 10 cubes? Who agrees? Angela. Angela, would you look at Valerie and tell her that you agree with her and tell her why? And there comes the conceptual development – there comes the – and I would do more than one student in the classroom. We're going to do exactly what I said not to do – we're going to hurry along, but I would ask different kids "Why do you agree with Valerie?" And there might be some students that don't understand that, and they'll say "You know what? I'm confused by that." That's your opportunity to clarify. That's your opportunity if there are misconceptions, to clear up those misconceptions. Again, if I have a misconception, and I carry that misconception along with me for very long, it becomes reality, and it's very hard to unlearn it, so it's the discussion that helps students to clarify. We'll call this the GT group, because I didn't tell them to use more than one unit of measure to do their measuring, but they took it upon themselves to do that. What do I mean by unit of measure? What was the unit of measure here? Okay, it was the cubes, post-it notes, the scissors, and the index cards. What was the unit we were measuring? The bucket – the circumference, the diameter and the height. Okay, thank you very much, good job. Who would like to go next? We had to measure the diameter of a bucket, and we had several items that we used to measure it. We used a long string of yarn, but it was kind of flexible, so it was kind of hard to get an accurate measurement, so we measured it several times. Then we compared it to something more solid, like the cubes – the cubes don't change in size. And then we wanted to make sure that our measurement was passed on accurately, so we had to come up with inches. And, Richard knew that a piece of paper was $8\frac{1}{2}$ x 11, so by laying the length of the yarn across these cubes, and measuring these cubes is a sheet of paper,

we discovered that the sheet of paper – each block was about $\frac{3}{4}$ of an inch – that's what we figured out. It's 15 of these blocks for an 11 inch piece of paper, so it's about $\frac{3}{4}$ of an inch. So, by estimating, we came up with the diameter was about $23\frac{1}{2}$ inches. That's how we sorted it out. Knowing that these were about $\frac{3}{4}$ of an inch, then it was easy to figure out that the diameter, which is 8 inches across, and the height, which is 10 blocks, which is about $7\frac{1}{2}$ inches. Okay, so your circumference then was $23\frac{1}{2}$ inches, your estimating, the diameter is about 8 inches, and the height is about $7\frac{1}{2}$. Roughly, and if the student knows that pi is 3.14, he can figure out that 8 inches times 3.14 is pretty close to $22\frac{1}{2}$ to 25 inches, something of that nature. So we can double check and make sure that these measurements are correct. Okay, very good, thank you. How many of you are kinder, 1st, or 2nd grade teachers? Do your kids know what pi is? It's something you eat, right? And we were talking in this group, as we were doing it; they were remarking that they used the yard, that it took about 3 of the diameter to make the circumference, more or less. Kim said – she knows that pi is 3.14, but she doesn't ever use that word and she doesn't tell the kids that, but when they measure, they always talk about, well it takes about 3 of the diameter to make the circumference. Then in middle school, when our kids get to pi, it's nothing foreign to them. They just introduce the word and the standard unit of measure. One of the things that we did here was use non-standard units of measure, because measurement – if you really want to teach the concept, they have to understand the concept before we apply numbers to it. And so for those of you that teach the upper grades, if you have students that are struggling conceptually with measurement, take them back to non-standard units of measure and talk about what we did with this group. Why is it 10 cubes, but only $2\frac{1}{2}$ post-it notes? It's the relationship of the unit of measure to what's being measured that develops that concept. The smaller they are, the more it's going to take. The bigger they are, the fewer it's going to take. So if they really have those experiences over and over and over, by the time – in our state, in Texas, we are not introduced to standard units of measure until 3rd grade, so they spend kinder, 1st and 2nd grade really developing that concept – then they assign numbers to it. So, depending on your grade level, it also may cause you to attack this problem in a different way. Alright, next group. We found a lot of things that we could measure with and we didn't use just the index cards, we used the lines on the index cards. We also used the cubes. We used the caps off of our markers. We were trying to check a little bit of everything to see if they came up together, and we found out they didn't. We found out that our cubes and our yarn, when we measured the height of our bucket, and then we measured the diameter of our bucket, it was

the same number of cubes, but when we measured it with string, it came up different. What we realized our cubes stood up a little bit taller, so when we measured it with our string for the height, we found out they weren't the same. So, that was something we learned. But then when we put it all together we started laying our string out, and we did. We did lay it together – we found out that our circumference will always be about 3 of our diameter, and we found out that the height changes. So it's not necessarily going to measure with us and it's not always going to be the same as our circumference, so we really learned a lot. Great! Did you find anything peculiar about using the yarn? Were there... We found out that it stretches. So if one person was going to use it, it needed to be the same person that does the height, the circumference, and the everything. Did any of the other groups find that when you used the yarn that it stretched and it kind of confused the issue, didn't it? I thought about using ribbon. For one thing, I'm a teacher, and I look for cheap stuff. Yarn is real cheap. And the other thing was I purposely wanted something that would stretch, so that if everybody decided to use the yarn, it might not come out the same, and then that again gives you a point of discussion. Why is it not the same? You all have the same size bucket. Why is it not the same? Thank you very much. Would your kids – lets say you teach kinder or 1st grade – are they going to know – like the 1st one was $\frac{3}{4}$ of an inch – are they going to know that sort of thing? They're going to know about half, a little less than, a little more than – and that's okay – those are the terms that we want them to begin to understand. Even at kindergarten some kids still struggle with that vocabulary. Speaking of vocabulary, you want to be sure that you use the correct vocabulary – even if the kids don't understand particular words – use the word and define it – use the word and define it – so by the time they become accountable for using that vocabulary, they know the vocabulary. Just like with understanding what pi is, you use it until they become accountable for it, and then they've had several years of hearing that vocabulary.

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So now, each group has presented. And in your classroom – we don't want to leave it there – we want to compare. Let's look at the different measurements. Look at what's up here. Most of you used either the string, the yarn, or the cube – one group used post-it notes – what do you notice? Variations. Did everybody hear that? They're variations – they're not all exactly the same. Why might that be? Okay, we think differently. Okay. How many of you ever had a classroom where everybody was at the same place at the same

time? I don't think that's ever happened in the history of man. So, you have kids that are at different levels of sophistication. So you want to give those multiple opportunities to use a variety of tools so they come to that place when they're ready to come to that place, and you're not forcing them to swim when they can't swim. One more point I wanted to make. When we think about linear measure or our students think about linear measure, how do they think about that? Think about the term linear – what does that mean? Aligned, doesn't it? A straight, or if they're really sharp, might be a zig zag line. But, do they think about linear measure as something that could be in a circle? Not always. They might, but not always. And that's one of those misconceptions that our kids carry with them. So we need to give them opportunities to measure things that are not in a straight line, or a zig zag line. Maybe something that's curved or something that's circular. If you ask the boys, especially about 4th or 5th grade, think about the Indy 500. How is that measured? It's measured in miles – miles are a linear measure. Is the Indy 500 track in a straight line? That's something those kids can understand and they can see that. If you live near or have a track at your school, you can go out and look at the track, you can measure that track, and you could have them estimate it first. So make sure that you give them opportunities to do linear measure that is not in a straight line. The next task is to measure area. We've talked about linear measure, now we're going to measure area. What I would like you to use is any of the tools that you have or tools that you might have brought with you to cover the outside surface of the bucket and measure the area. Again – how did we learn to do area in school? Length times width, right? Can you do length times width on this bucket? Don't tell. If you know a way, don't say it out loud. I want you to figure out a way to measure the area of the outside surface of this bucket.

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Our task was to find the area. I wanted to just take the paper, because I knew if I was able to make this into a rectangle that I could lay it out easier. So we took paper – found the height – and then went around for the circumference. Then we used our unifix cubes to find out the height, and then went down for circumference, so it was about 380 on the unifix cube. We looked at the post-it notes and found out it was 2 ½ on the post-it notes, and I think it was 10 going across with post-it notes, so we were able to come up with our measurements. So if you have 1st graders doing this do you think they would have approached it that way? They would not have approached it the way I wanted to, because they are 1st grade teachers. So what would your 1st graders have probably done? They said they wanted to use the post-it notes just to cover the whole thing. So, again, when you're planning a lesson you want to

think like your kids, and think about the possibilities. What might they do? What if they do something incorrectly or they come up with some misconception? How am I going to address that? Are you going to let them explore it and then have each group present and then bring those out, are you going to correct it at the moment, how are you going to address those misconceptions? And we just decided we didn't want to even look at the bottom of the bucket. It was just a hollow container to us. We didn't want to go there. Probably 1st graders; that might be what they do. I think this group wanted to go next. As kindergarten teachers, we were totally lost with our upper level compadres over there. This would not be the way we would do this, so we're kind of lost even presenting it. But we had wrapped the paper around, as the other group did. We used all of our paper. We discovered that it was approximately 330 of those unifix cubes. Then we did the bottom and we found out it was 60. But as we did that, we realized that the top was different, which it was about 80. And so we're lost, because we would have probably covered it with the post-it notes also. Very good. Next group. We divided our bucket into 3 different sections. The top of it, the middle – because of the different diameters – so we measured the top, the middle – no 4th grade actually – and bottom and came up with 21 $\frac{1}{4}$ notes, and then we took our notes and thought well, we'd try to take it a step further, and we put it on our 8 $\frac{1}{2}$ by 11 paper to try to measure it off into inches, and got around 80 square inches. They're determined to use that standard unit of measure because they're upper elementary. I don't know if Wal-Mart understands post-it notes when you talking about inches and so forth, so we decided to just go ahead and do that. Alright, great, thank you. And next. We teach 2nd grade and so we decided that we're going to think like our 2nd graders. My 2nd graders really want the simple way out. We took the largest thing we had, which was the index cards, and we measured all the way around, and we found that it had 8 index cards all the way around, but there was still some left over. So if you cut an index in half and measure it all the way around, it's 8 $\frac{1}{2}$'s of an index card, which makes 4 fulls, so $8 + 4 = 12$ index cards, so that's how we found the area. Great! What do you notice about these measurements? Why do they vary wildly? The standard was different. The unit of measure was different. There's a big difference between a cube and a post-it note, or a post-it note and an index card. Is it okay sometimes to have approximate measures? It's okay to sometimes guesstimate or say okay it's about this much or it's about that much. Are there times you want exact? When we went to St. Louis we went to the arch and we saw the videotape, the film, about them constructing the arch. Would it have been okay for those engineers to say "Oh, it's going to be about this tall and we're going to start at

both sides” – what would have happened if they had not been exact? It wouldn’t have met – and I believe there are times we need to be more exact than other times. When payroll is doing my paycheck, I do not want an estimate – I want exactly what I’m supposed to get. We talked about linear measure; we talked about area, now we’re going to talk about the weight of the items. In your bucket you have a spring scale. These are very inexpensive spring scales. I believe they were like 6 for \$24 – you can buy more expensive ones. You’re not going to use these all the time. One of the things I tried to do is use materials that if you’re at a school that is lacking a lot of resources, it’s inexpensive. I’m not sure where they got these buckets. The buckets I used in the summertime I paid \$1 each for the buckets. These you could chip in together at your grade level and buy a couple of sets and share. But I want you to get out your spring scale and the cubes. What you’re going to do is measure the weight of the bucket first, have somebody record it, and then you’re going to put 10 items at a time in the bucket. So if you want to connect your cubes, or you don’t want to connect them – whatever way you want to put 10 items at a time in the bucket and you’re going to weight at intervals. Before you begin, let me ask you – do you think that as you put in the 10 items that is it logical that it’s going to weigh the same? Let’s see what happens.

(ACTIVITY)

Can I have everybody’s attention please? We need to wrap it up and I don’t want to leave without discussion. Even if you have to cut an activity a little shorter, and include that most important part, that’s what we need to do. Otherwise the kids just leave and it was just an activity – and there’s not a lot of learning going on, or it doesn’t make sense to them. What I’m going to do is this time I’m going to ask you to come up and put your measurements, because you don’t have any more chart tablets, but I want us to look at the groups and compare. Alright, I have a problem here. You all have the same bucket, you all have spring scales that came from the same company, and we have a difference between 240 to 325 grams for the bucket. What could that possibly be? Sandy what do you think? Okay, the initial calibration of the scale. Are all our units of measure what we’re using to measure with – are they always exactly accurate? No. I know my scale where I weigh myself is not accurate. So, the scale itself could account for some of the difference. What else might be possible reasons for difference? Okay, it could be a little bit different, it could be a little bit different – even though it’s the same bucket it could be a little bit off. And so again, talking about the differences, how could it be? You all have cubes; you all have the same buckets, and you all have the same scale – what could be the possible differences? Your kids are

going to come up with lots of different ways. Now, the next activity we don't have time to do, plus I didn't want to use water, but it would be using volume. And you can use dirt, or rice. We use the same materials to do linear measure, to do area, to do weight, and to do volume. And even though in kinder or 1st grade we don't usually touch much on area, volume, and weight – weight a little bit – but it's a good introduction. Your kids are not held accountable, but you're giving them experiences that connect that linear measure to other things that they're going to be doing. Again, I urge you to use minds on activities, not just hands on, and have that discussion after – that is the critical piece that brings all that learning together. And I thank you very much. You've been a great group.

(MUSIC)

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