Attributes

What kind of "BIG" is it?

Comparison

Nothing is "BIG" in and of itself.

Size is always relative.

Let's Draw a Ruler

What do I need to represent a ruler on the board?

What are the rules of rulers?

When do we need rulers?

Wally's Stories: Rulers

A Conversation in Kindergarten

Big Ideas of Measurement

Topic	Big Ideas	Examples
Attributes 	• Many different attributes can be measured, even when measuring a single object.	• A bucket has many measurable attributes, including height, weight, capacity, or circumference: *What kind of "big" is it?*
Comparison 	• All measurement involves a "fair" comparison.	• Weighing rocks on a pan balance (direct comparison); using a length of string to measure a table in one room and chairs in another (indirect comparison). • A "fair" comparison measures the same attribute. Units must be of equal size, with no gaps or overlaps.
Precision 	• Quantifying a measurement helps us describe and compare more precisely.	• Nonstandard units (such as blocks) and standard units (such as inches) allow for more precision than direct comparison. • There is always a more precise measurement possible – we never get it exactly "right," but it must be "good enough" for the task at hand.

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Development of children's thinking about measurement

Measurement is a complex combination of concepts and procedures that develops over years.

- At 2 years, children intuitively compare, order, and build with materials. They may use gesture to indicate attribute because they lack vocabulary for specific dimensions.
- At 3 years, children identify length as attribute. They often understand length as an absolute ("*I am tall.*") but not as a comparison ("*I am taller than my brother but shorter than my sister.*")

Development of children's thinking about measurement

Measurement is a complex combination of concepts and procedures that develops over years.

- By 4 years, children directly compare two objects to determine which is longer, taller, holds more, and so on.
- 4- and 5-year olds can begin to use indirect comparison. Also, children show an interest in assigning numbers to measures.

Teaching Implications

Teach measurement as more than a simple skill; give children opportunities to explore the ideas of measurement.

- Use informal activities to focus children on size attributes and direct comparison.
- Encourage children to solve real measurement problems. This will naturally lead them to think about quantifying measures and the need for units to count.
- Use manipulative units that closely connect with measurement tools.
- Attend to precision.

Wally's Stories

Conversations in the Kindergarten

VIVIAN GUSSIN PALEY

"A vivid and credible picture
of how five-year-olds think."
—D. J. Enright, *Times Literary Supplement*

Harvard University Press © 1981

Readers Theater Roles (9)
Narrator/Teacher
Wally
Eddie
Jill
Deana
Fred
Kenny
Rose
Andy

Rulers

Rulers were another example of the wide gulf separating my beliefs from those the children demonstrated whenever they were allowed to follow their ideas to logical conclusions. I had not realized that "rulers are not really real." We were about to act out "Jack and the Beanstalk" when Wally and Eddie disagreed about the relative size of our two rugs.

Wally: The big rug is the giant's castle. The small one is Jack's house.

Eddie: Both rugs are the same.

Wally: They can't be the same. Watch me. I'll walk around the rug. Now watch—walk, walk, walk, walk, walk, walk, walk, walk, walk—count all these walks. Okay. Now count the other rug. Walk, walk, walk, walk, walk. See? That one has more walks.

Eddie: No fair. You cheated. You walked faster.

Wally: I don't have to walk. I can just look.

Eddie: I can look too. But you have to measure it. You need a ruler. About six hundred inches or feet.
Wally: We have a ruler.
Eddie: Not that one. Not the short kind. You have to use the long kind that gets curled up in a box.
Wally: Use people. People's bodies. Lying down in a row.
Eddie: That's a great idea. I never even thought of that.

Wally announces a try-out for "rug measurers." He adds one child at a time until both rugs are covered—four children end to end on one rug and three on the other. Everyone is satisfied, and the play continues with Wally as the giant on the rug henceforth known as the four-person rug. The next day Eddie measures the rugs again. He uses himself,Wally, and two other childen. But this time they do not cover the rug.

Wally: You're too short. I mean someone is too short. We need Warren. Where's Warren?
Teacher: He's not here today.
Eddie: Then we can't measure the rug.
Teacher: You can only measure the rug when Warren is here?
Jill: Because he's longer.
Deana: Turn everyone around. Then it will fit.
(*Eddie rearranges the measurers so that each is now in a different position. Their total length is the same.*)
Eddie: No, it won't work. We have to wait for Warren.

Deana: Let me have a turn. I can do it.
Jill: You're too big, Deana. Look at your feet sticking out. Here's a rule. Nobody bigger than Warren can measure the rug.
Fred: Wait. Just change Ellen and Deana because Ellen is shorter.
Jill: She sticks out just the same. Wait for Warren.
Fred: Now she's longer than before, that's why.
Teacher: Is there a way to measure the rug so we don't have to worry about people's sizes?
Kenny: Use short people.
Teacher: And if the short people aren't in school?
Rose: Use big people.
Eddie: Some people are too big.
Teacher: Maybe using people is a problem.
Fred: Use three-year-olds.
Teacher: There aren't any three-year-olds in our class.
Deana: Use rulers. Get all the rulers in the room. I'll get the box of rulers.
Eddie: That was *my* idea, you know.
Deana: This isn't enough rulers.
Eddie: Put a short, short person after the rulers—Andy.
Andy: I'm not short, short. And I'm not playing this game.
Wally: Use the dolls.
Teacher: So this rug is ten rulers and two dolls long? (*Silence.*) Here's something we can do. We can use one of the rulers over again, this way.

Eddie: Now you made *another* empty space.
Teacher: Eddie, you mentioned a tape measure before. I have one here.
(*We stretch the tape along the edge of the rug, and I show the children that the rug is 156 inches long. The lesson is done. The next day Warren is back in school.*)
Wally: Here's Warren. Now we can really measure the rug.
Teacher: Didn't we really measure the rug with the ruler?
Wally: Well, rulers aren't really real, are they?

Rulers are not real, but rug measurers are. Dressing up to look like a mother and using magic to become a lion is real, but having parents die is not real. Does "real" mean that which can be imagined and acted out? Does Wally *see* himself as a mother lion rather than expect to *be* one? Wally once told Eddie he was going to grow up and become Superman. "You can't do that, Wally," Eddie said. Whereupon Wally altered his statement to "I mean *look* like Superman," and Eddie approved.

I discovered that the scale I had just paid twenty dollars for was no more real than the tape measure. We were about to act out *Stone Soup*, by Marcia Brown, a story about three hungry soldiers who trick some selfish peasants into giving them food by pretending to make soup out of three stones. As part of the play, the children brought vegetables to cook.

"Do stones melt?" Rose suddenly asked. "Do we eat the stones?"

"Do you think they melt, Rose?"

"Yes."

I looked around at serious faces. "Does anyone agree with Rose?"

"They *will* melt if you cook them," said Lisa.

"If you *boil* them," Eddie added.

No one doubted that the stones in the story had melted and that ours too would melt.

"We can cook them and find out," I said. "How will we be able to tell if they've melted?"

"They'll be smaller," said Deana.

I lower three stones into boiling water. "How long shall they boil?" I ask. The suggestions range from a few minutes to ten hours. We decide on one hour and finish the story while the stones cook. Just before lunch we remove the stones and place them on a table.

Ellen: They're much smaller.
Fred: Much, much. Almost melted.
Rose: I can't eat melted stones.
Teacher: Don't worry, Rose. You won't. But I'm not convinced they've melted. Can we prove it?
Mickey: Draw a picture of them.
Teacher: And cook them again? All right.
(*Mickey and Earl trace the stones on a piece of paper, and I put them back in the water to cook some more. Thirty minutes later the stones* do *look smaller.*)
Teacher: I know they seem smaller, but it's very hard to match stones and patterns. Is there another way to prove whether the stones have melted?
(*There is no response. Clearly I am after the "right" answer, but the children have enough proof that the stones have melted.*)
Teacher: Let's weigh them on this scale. How much do they weigh?

Everyone: Two.
Teacher: Two pounds.
Lisa: Do we have to cook them again? They'll just keep melting.
Teacher: Maybe not.
(*After a short period we weigh the stones again.*)
Eddie: Still two. But they *are* smaller.
Wally: Much smaller.
Teacher: They weigh the same. Two pounds before and two pounds now. That means they didn't lose weight.
Eddie: They only got a *little* bit smaller.
Wally: The scale can't *see* the stones. Hey, once in Michigan there were three stones in a fire and they melted away. They were gone. We saw it.
Deana: Maybe the stones in the story are magic.
Wally: But not these.

The endless contradictions did not offend them; the children did not demand consistency. Once Lisa told us that she and her family did not believe in the tooth fairy. Her mother gave her a quarter for her tooth. I asked what her mother would do with the tooth and why it was worth a quarter to her. "She can sell it to the tooth fairy and get real gold for it." Lisa saw nothing inconsistent about combining both ideas.

Nor did anyone at Lisa's table think it strange when she asked me if I were really Mrs. Paley. I had spoken of Mr. Paley during lunch and Lisa was surprised. "Then are you really Mrs. Paley?"

"Lisa, you know that's my name," I said.

"Yes," she replied, "but I thought you just called yourself that."

Focus on the Child: Measurement

Questions to Consider While Viewing the Video Clips

- What Big Ideas about measurement do these children seem to understand?
- What Big Ideas about measurement do these children seem to be learning?
- What, specifically, do the children say or do that gives you evidence of their thinking?
- What opportunities for exploring measurement might a teacher provide for these children to encourage them to develop their understanding further?

Clip/Child		Notes about children's thinking
"Comparing Objects by Length"	*Child 20, preschool (0:41)*	
	Child 21, preschool (0:32)	
	Child 3, preschool (0:15)	
	Child 21, preschool (0:14)	
	Child 22, preschool (0:17)	
	Child 23, preschool (0:29)	
"Seriating Objects by Length & Capacity"	*Child 24, preschool (1:06)*	
	Child 21, preschool (1:23	
	Child 20, preschool (1:23)	

Research Lesson: Just Right for Me

Some Questions to Consider While Viewing the Video Clip (6:02 total time)

Questions	Notes
<u>About the Children</u> ▪ What Big Ideas about measurement do these children seem to understand? ▪ What Big Ideas about measruement do these children seem to be learning? ▪ What, specifically, do the children say or do that gives you evidence of their thinking?	
<u>About the Teacher</u> ▪ What kind of instructional decisions has the teacher made in terms of the logistics of this activity? ○ About materials to use? ○ About questions to ask? ○ About space arrangement? ▪ How does the teacher scaffold the children's thinking and explaining?	
<u>About the Activity</u> • What does it do for the children's understanding to describe how they knew an object was "just right"? ▪ What modifications might you make if you were doing this activity in your classroom? ▪ What opportunities for exploring measurement might a teacher provide for these children to encourage them to develop their understanding further?	

JUST RIGHT FOR ME

Big Idea Focus: All measurement is comparison, and comparisons must be "fair." All measurement is approximate.

In this lesson, children:

- Explore the attribute of length
- Make direct comparisons to find classroom objects that are about the same length as their hand
- Practice beginning measuring techniques
- Justify their findings to one another

Materials

- A version of *Goldilocks and the Three Bears* tale
- Objects found in the classroom

1. Review *Goldilocks* and Introduce Activity

Remind children of the tale of *Goldilocks and the Three Bears*. Ask children why they think that the Bear family's things—porridge bowls, chairs, beds—all come in different sizes. Discuss how they know what things belong to Baby Bear. *What size is "just right" for Baby Bear?*

Tell children that today they will get to look around the classroom to find things that are "just right" in size for them.

2. Demonstrate How to Make Direct Comparisons

Ask children to search for things that are about the same length as their own hand. Choose a volunteer to model what they are going to do. For example, say:

- *Let's look at Della's hand first. Where does her hand start? Where does her hand end? That is the* **length** *of her hand* [wrist to tip of longest finger].
- *Do you see anything in the room that might be about* **the same length** *as Della's hand?*

Try out several suggestions from the group. Model how to line up the end of the classroom object with the base of the child's hand. Determine together whether the object is the same length or not. Allow children to decide how precise is "just right" enough to be considered the same length.

Next, give children a few minutes to find and measure objects around the classroom with their hands to see if they can find any they believe are the same length.

Planning Tips

Make sure that children are familiar with the tale of *Goldilocks and the Three Bears* prior to this lesson.

Introduce this lesson to **small groups**. Once children gain experience making direct comparisons, you may want to repeat the lesson at whole group time with various other body measurements such as length of arm, foot, or hand span.

Math Language Learning

Model and encourage children to use attribute language that is specific to length: ***longer***, ***taller***, ***shorter***, ***same length***.

Observation

Do children try measuring objects that seem unlikely to be the length of their hand? Or, are they discriminating, measuring only those objects that are fairly close? Do they become more discriminating with experience?

3. Discuss Children's Findings

Invite children to share what they found. Because children will find objects of various shapes, you may need to help them isolate the attribute of length. Help them line up the end of the objects with the base of their hands when comparing.

Ask children to justify their findings, for example:

- *How did you decide if it was "just right?"*
- *How can you be sure it's about the same length?*
- *How does it compare to the length of your hand?*
- *Did other children find the same objects as you did when they measured with their hand? Why or why not?*

4. Close the Lesson

Remind children that to find a "just right" object for the length of their hand they need to **compare** it by lining up their hand with the object, end to end. Tell them that this works for other measurements of length, too.

Plan to return to this activity over time to provide additional opportunities for children to work with direct comparisons using other body measurements such as length of arm, foot, or hand span.

Observation

*Can children focus on the attribute of **length**, or are they distracted by other size properties of an object such as width, depth, or weight?*

Differentiation

As children are ready, you can ask them to look around the room for objects that are **longer** or **shorter** than the part of their body they are comparing.

Ask children to share their findings so that they will have the opportunity to use comparative language such as, *The crayon is shorter than my hand*. It is also important for children to express the inverse relationship: *My hand is longer than the crayon*. You may need to model the language for them.