Measurement: Length, Capacity, and Time

Summary

These hands-on activities will improve students' measurement skills.

Main Core Tie

Mathematics Grade 3

Strand: MEASUREMENT AND DATA (3.MD) Standard 3.MD.1

Additional Core Ties

Mathematics Grade 3

Strand: MEASUREMENT AND DATA (3.MD) Standard 3.MD.2

Mathematics Grade 3

Strand: MEASUREMENT AND DATA (3.MD) Standard 3.MD.4

Materials

- *Twelve Snails to One Lizard*
  , by Susan Hightower
  Rulers and/or measurement tapes
  Butcher paper
  Pencils
  Crayons
  Scissors
- *My Other Self*
  Math journals
- *Me and the Measure of Things*
  , by Joan Sweeney
- Pictorial representations of the units of capacity
  Teaspoon, tablespoon, cup, pint, quart, gallon
  Containers, cups
  Large containers of water
- *Container Capacity*
- *Capacity Bingo*
- *Capacity Bingo Clues*
- *Me Counting Time*
  , by Joan Sweeney
  Adding machine tape

Additional Resources

Books

- *How Big is a Foot?*
  , by Rolf Myller; ISBN 0-440-40495-9
- *Twelve Snails to One Lizard*
  , by Susan Hightower; ISBN 0-689-80452-0
- *Me and the Measure of Things*
  , by Joan Sweeney; ISBN 0-440-41756-2
- *Me Counting Time*
  , by Joan Sweeney; ISBN 0-440-41751-1

- *Counting on Frank*
  , by Rod Clement; ISBN 0-395-70393-x
- *Measuring Penny*
  , by Loreen Leedy; ISBN 0-8050-6572-5
- *Inch by Inch*
  , by Leo Lionni; ISBN 0-688-13283-9
- *Inchworm and a Half*
  , by Elinor J. Pinczes; ISBN 0-618-31101-7
- *If You Hopped Like a Frog*
  , by David M. Schwartz ISBN 0-590-09857-8
- *Jim and the Beanstalk*
  , by Raymond Briggs; ISBN 0-698-11577-5
- *How Tall How Short How Faraway*
  , by David A. Adler; ISBN 0-8234-1632-1
- *Hershey's Mile Chocolate Weights and Measures*
  , by Jerry Pallotta; ISBN 0-439-38877-5
- *Bats Around the Clock*
  , by Kathi Appelt ISBN 0-688-16469-2
- *Telling Time with Big Mama Cat*
  , by Dan Harper ISBN 0-152-17380
- *Something Furry in the Garage at 6:30 A.M.*
  , by Betsy Franco
- *Millions to Measure*
  , by David M. Schwartz; ISBN 0-688-12916-1

Videos

- *How Long? How Far?*
  Available from Media House Publications, Regina, SK. (Catalogue No. V981) Suitable for Grades 3-7.
- *How Much Does It Hold?*
  Available from Media House Publications, Regina, SK. (Catalogue No. V9820). Suitable for Grades 3-7.

Additional Media

- *Timetown*
  CD --Rom. Steck-Vaughn Interactive Learning. Suitable for K-6
- *Cyber Chase*
  television program on the educational channels. (Many episodes on weight, capacity, perimeter and area.)

Background for Teachers

A measurement always has two parts: a number and a unit. Standard units include: inches, feet, yards, centimeters, meters, teaspoons, cups, gallons, pounds, minutes, etc. Nonstandard units include: paper clips, bricks, frogs, marbles, pencils, toes, etc.

In different parts of the world at different times, there have been many systems of measurement. In the past, people often used one man's cubit or steps as a standard. That man was usually the people's leader or king. Kings would not travel from house to house to measure things, so standard measuring sticks were made (refer to the book, *Millions to Measure*, under additional resources). Today only two systems are widely used. The customary, or inch-pound, system is used in the United States. The term "customary" refers to what is used or is "customary" in your area. So "customary" in

the United States is the inch-pound system, while the "customary" system in Europe would be the metric system. The metric system is used in most other counties.

Intended Learning Outcomes

1. Make mathematical connections.
2. Communicate mathematically.

Instructional Procedures

Invitation to Learn

Read and share the book *Twelve Snails to One Lizard* by Susan Hightower.

Ask the children to visualize how difficult it would be to have to use non-standard units of measurement to measure things.

Instructional Procedures

After reading the book and sharing the need for a standard unit of measurement, pass out rulers to the class. Go over the attributes of a foot. Show the students that a foot has 12 inches. Show the students the markings on the ruler for inches, half inches, and quarter inches. Show the students a yardstick. Go over the attributes of a yard. Show the students that a yard is made up of three feet or 36 inches.

Pass out large pieces of butcher paper. Inform them that they are going to make a model of their own body.

Break the students into partner groups. Have the students take turns lying on their own piece of butcher paper, and tracing their partner on paper.

After the tracings are complete, have the students draw in their own features (their faces, their clothing, the details of their hands, etc.)

After the students are drawn, have them cut out their "self."

Explain that their "other self" is not an exact measurement of their body. The outline would actually be larger than their exact body, and also, the person tracing them might not have been exact at all times.

Give each student a blackline master entitled *My Other Self* .

Have the students measure the different parts of their "other self" that are listed on their paper.

Make up some interesting awards for the "longest legs," the "longest fingers," etc. Be careful to make sure the awards could not be used in a derogatory manner.

As an extension, hand out copies of *My Other Self*, and have the students pick out a nonstandard unit to measure themselves with. Students could use paperclips, crayons, etc.

Make sure the students list the number and unit (e.g., my "other self's" arm is 22 crayons long.)

Hang these lifelike "students" in the hall before parent teacher conference for the parents to view. Students could also cut out another copy of their body, staple the two together and stuff to place at their desk before their parents come to conference.

Assessment Suggestions

Have the students turn in their individual papers with body measurements on them. You could check one or two attributes to make sure they are correct.

Journal entry - Have the students create their own alternatives to use in place of an inch, a foot, and a yard that they could use as suggestions to the beaver. Then have the students tell what complications the beaver might encounter as he tried to use your suggestions.

Journal entry - Use the copy of the journal entry of the boy or girl on the blackline master. Have the students record any surprises they might have encountered while measuring their other "self."

Invitation to Learn

Read and share the book *Me and the Measure of Things* by Joan Sweeney.

Instructional Procedures

Remind the students that in measurement, we always have a number and a unit. Review some of the measurement units we use. (e.g., feet, inches, yards, miles, meters, etc.)

Discuss times when students would need to measure "capacity." Review that capacity is the amount that something can hold.

List on the board the following customary measurement units. 1 Cup=16 Tablespoons=8 ounces 1 Quart=2 pints=4 cups=32 ounces

As each word is introduced on the board, show an example of each word (e.g., After writing cup on the board, show the students a cup and also the graphic of a cup).

Explain to the students that a cup and a quart can also be made up of other customary measurement units. Show the students a half-pint carton (the kind they get with their lunch tray), and explain that half of a pint is equal to a cup. Explain to the students that four quarts equal a gallon, like the gallon of milk they buy from the grocery store. Write the following measurements on the board and show the graphics and real examples of each. (Note: cups and quarts are the only two measurement units for capacity listed in the Core Curriculum.) Teaspoon Tablespoon=3 teaspoons Pint=2 cups=16 ounces Gallon=4 quarts=128 ounces

Split your class into small groups. Provide each group with an assortment of containers and cups. Have the students estimate the number of cups needed to fill each container. Have the students record their estimates on the blackline handout, *Container Capacity*.

Pass out large containers of water. Have the groups then record how many cups it actually took to fill each large container.

Monitor the class as they work in their groups. Make sure each child is contributing to his/her group's discussion.

Have the small groups record their findings on the blackline handout, *Container Capacity*.

Have the students order their containers from smallest to largest.

Assessment Suggestions

Have the students turn in their group's blackline handout, *Container Capacity*.

As a class, generate examples of two or three riddles you could write about units of capacity. (e.g., I am made up of two cups and equal 16 ounces. What unit am I? Answer: A pint) Have the students write at least two of their own riddles. Put the students in partner groups, and have them exchange their riddles and answer them. Have the students turn in their answered riddles.

Journal entry - Have the students write a short paragraph describing their small group's work. Have them list any surprises or correct assumptions they had in their work. You could ask them to list two "Ah-Has" they experienced, and one question they have.

After reviewing the units of capacity repeatedly, have the students play "Capacity Bingo". Copy a blackline master of *Capacity Bingo* on cardstock for each student. List the words: teaspoon, tablespoon, cup, pint, quart, gallon, eight ounces, two cups, two pints, and four quarts on the board. Have the students pick nine of these words to write in individual boxes on their bingo paper. Tell them to mix them up! Using the blackline master *Capacity Bingo Clues*, cut the clues out and mix up for use during the play of bingo. Read a clue to the class and have them place a marker on the correct answer. As an extra challenge, when someone gets bingo, you could make the student read back their square that was covered, and then have them recall the clue it matched. (e.g., Cup: It is made up of eight ounces.)

Invitation to Learn

Read and share the book *Me Counting Time* by Joan Sweeney.

Instructional Procedures

Ask the students to think about measurement. Review the units of measurement that have already been discussed (e.g., inches, feet, yards, teaspoons, tablespoons, cups, pints, quarts, gallons). Ask if they ever considered that time is a measurement.

Have the students brainstorm a list of units of measurement that we use when measuring time.

They can refer back to the book *Me Counting Time*.
Pass out a piece of adding machine tape to each student in your class. They should get a strip of tape that correlates with how old they are. If they are nine, they get nine feet of adding machine tape.
Have the students use a ruler and make a mark on their tape where each foot occurs. Have them write on the first foot mark the year they turned one-year-old, the next mark would have the next year, etc.
After they have written in the years on their timeline, have them now mark off in inch increments each foot. Each of the inch increments will be labeled with a month (the first inch January, the second inch February, etc.).
Monitor the class as they work on their timelines, helping to make sure their measurements are accurate (you might want to use some parent volunteers during this activity).
Remind the students of the timelines you have already seen and used in social studies.
Help the students brainstorm any events they might be able to include on their timeline. You could include things that have happened during the school year (e.g., in September the class went on a field trip to the fire station, etc.). If they have recollections of the age their parents told them they first walked, they could include that on their timeline. If their family went on a vacation last June to Disneyland, they could include that on their timeline. The possibilities are endless!
You can send home this timeline as a homework assignment, and have the parents help their child come up with more things they could include on their timeline. 10. Display the timelines as they are returned to class.

Assessment Suggestions

Have the students share their timelines with the class. They could discuss the major events of their timeline. If this is too lengthy, you could have them share five or six events each.
Using a clock stamp, make up your own worksheet. In centers or as a class, put times on the board using word format (e.g., a quarter after three) and then have the students put in the hands on the clocks and the numbers on the digital clock.
Gather three small bells (the smaller the better)
Pick four children to be the timekeepers of the day. Each child gets to be in charge of a bell. One student is in charge of the hour, one the half hour, one the quarter hour, and one the quarter to hour. Their job is to ring their bell to let the class know which time is occurring.
Using the stamp of the clock, assign times out to individual students, or to pairs. Have the students draw in the time assigned, and then illustrate what they are doing at that time of the day. Put the pages in order and bind as a class book.
End of the unit assessment - Use the cards entitled *I Have Who Has* to review quickly the units of measurement that have been covered.

Extensions

Curriculum Extensions/Adaptations/ Integration

ELL Connections - the use of pictures showing representations of the units for capacity (cup, quart, etc.) and the use of real life objects showing an example of each of these units.
Math/Length/Graphing - Split your class into small groups. Give each group a spool of ribbon or a ball of yarn. Have each child cut a length of yarn or ribbon the size of their wrist. Make a class pile of wrist pieces. Have each child cut a length of yarn or ribbon the size of their ankle. Make a class pile of ankle pieces. Have each child cut a length of ribbon or yarn the length of their neck, etc. After collecting the piles, tape the lengths to a graph on butcher paper. Have one section of your graph for wrists, one for ankles, one for necks, etc. You could also have the students find something in the room that is close in measurement to their string piece and record the findings in their math journals before adding them to the piles.

Art - Measure out one meter of string with the meter stick. Cut off the string. Spend a few moments talking about meters. "Are you taller or shorter than one meter? What can you think of that's about one meter wide? Do you know any other measurement words that contain the word meter?" Lay the string on your construction paper. Move the sting around to create a picture. You must use the whole length of string in your picture. After you have decided on a picture, glue your string down in that shape. Display the pictures together so that everyone can see how many different ways a line of the same length can appear.

Penmanship - Use the same above concept mentioned for art, but instead of any design, have the students create their name in cursive with the meter of string.

P.E. - Purchase a 'design your own parachute'. Paint on the blank parachute the numbers of a clock face. For P.E., split your class in pairs. Give each pair a time (e.g., 3:30), and have the pairs each show their time on the parachute with their bodies. You might want to avoid times like quarter after three, so that the students do not have to lie on each other!

Center or Bulletin board idea - Watch the time! A giant wristwatch is made for the bulletin board with movable hands attached with a paper fastener. Write your own class schedule on sentence strips and let the children move the hands to show what's happening next.

Center or Bulletin board idea - Measure the circumference of the students' heads with different colored yarn, ribbon, or other material. Cut the "snake" to size. Let the students decorate with eyes, tongue, etc. Display the snakes on a table in a center, or on a bulletin board. Let the students measure items in the classroom with their "snakes" to find things the same size, things longer, and things shorter.

Social Studies - Have the students construct a timeline of their early childhood as a homework assignment. They could include their date of birth, when they crawled, when they walked, their first tooth, etc.

Social Studies & Science - Explain to the students: "Because Earth turns, it is daytime in part of the world when it is nighttime on the other side of the world. In 1884, delegates from 25 countries met and agreed to divide the world into time zones. If you draw a line around the middle of the Earth, it is a circle (equator). The delegates divided the 360 degrees of the circle into 24 zones, each 15 degrees (24 x 15=360). They decided to start counting from Greenwich (pronounced GREN-ich), England, which is 0 degrees longitude. In the continental Untied States, there are four time zones: Eastern, Central, Mountain, and Pacific. Each time zone varies by one hour, so when it is 7 p.m. in the Eastern time zone, it is 6 p.m. in the Central time zone, 5 p.m. in the Mountain time zone, and 4 p.m. in the Pacific time zone". After explaining these concepts, and showing the children a map of the world, make up some of your own problems. Give the students a map of the U.S., and have them convert times. (e.g., If it is 3 p.m. in New York, what time is it in Utah?)

Art - List the months of the year on chart paper and have the students brainstorm their favorite activities for each month. Split your class into teams assigning each team a month. Give the teams a copy of a blank calendar page to fill in the dates and illustrate. Bind the pages to make a class calendar.

Art - Give the students each a strip of adding machine tape (either one yard or meter in length--depending on if you are discussing the customary or metric system at this time). Have the students complete a timeline for their day on the strip.

Science - Measure time using sundials.

Family Connections

Make up your own homework assignment ditto asking students and parents to find objects in their home or neighborhood that are a specific length. (e.g., What three items can you find in your home or neighborhood that are approximately one foot in length each?)

Send home a homework assignment to have the child be responsible to let the parents know

when a predetermined event will take place. For example, the child knows their bedtime is at 9:00 and supper is at 6:00. They are to watch the clock and tell their parents when supper should be taking place, or when it is time for bed.
Ask the parent to let their child be the 'measurement expert' for dinner one night during the week. Their child would be responsible for measuring out any ingredients that are to be used in that night's meal.
Send home a note to parents asking them to let their child go to the grocery store with them during the week. Have the child record weights of any produce that is purchased. They could also record weights for meat purchases, or any boxed items that list their weight on the packaging.

Assessment Plan

Included with Instructional Procedures for this activity.

Bibliography

Cain-Caston, M. (1996). Manipulative Queen. *Journal of Instructional Psychology*, Volume 23.4, p 270.
Mulrvan, C. (1995). Involvement and participation in cooperative small groups in mathematics. *Elementary School Journal*. Volume 95.4 p. 297.
Students do not fully understand math concepts if they cannot relate it to something in their own experiences. The use of manipulatives and a hands-on learning technique help make mathematics a pleasure rather than a chore. Students understand mathematics and have greater gains when manipulatives are used. Students are more active learners and are more motivated when they work in cooperative groups.

Authors

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