NCSC Sample Instructional Unit

Mathematics:
Measurement
Elementary

Area and Perimeter

National Center and State Collaborative

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The National Center and State Collaborative (NCSC) is applying the lessons learned from the past decade of research on alternate assessments based on alternate achievement standards (AA-AAS) to develop a multi-state comprehensive assessment system for students with significant cognitive disabilities. The project draws on a strong research base to develop an AA-AAS that is built from the ground up on powerful validity arguments linked to clear learning outcomes and defensible assessment results, to complement the work of the Race to the Top Common State Assessment Program (RTTA) consortia.

Our long-term goal is to ensure that students with significant cognitive disabilities achieve increasingly higher academic outcomes and leave high school ready for post-secondary options. A well-designed summative assessment alone is insufficient to achieve that goal. Thus, NCSC is developing a full system intended to support educators, which includes formative assessment tools and strategies, professional development on appropriate interim uses of data for progress monitoring, and management systems to ease the burdens of administration and documentation. All partners share a commitment to the research-to-practice focus of the project and the development of a comprehensive model of curriculum, instruction, assessment, and supportive professional development. These supports will improve the alignment of the entire system and strengthen the validity of inferences of the system of assessments.

This work was developed as part of the National Center and State Collaborative and supported by a grant from the Department of Education (PR/Award #: H373X100002, Project Officer, Susan.Weigert@Ed.gov). The contents do not necessarily represent the policy of the U.S. Department of Education, and no assumption of endorsement by the Federal government should be made.

These materials and documents were developed under the National Center and State Collaborative (NCSC) General Supervision Enhancement Grant and are consistent with its goals and foundations. Any changes to these materials are to be consistent with their intended purpose and use as defined by NCSC.

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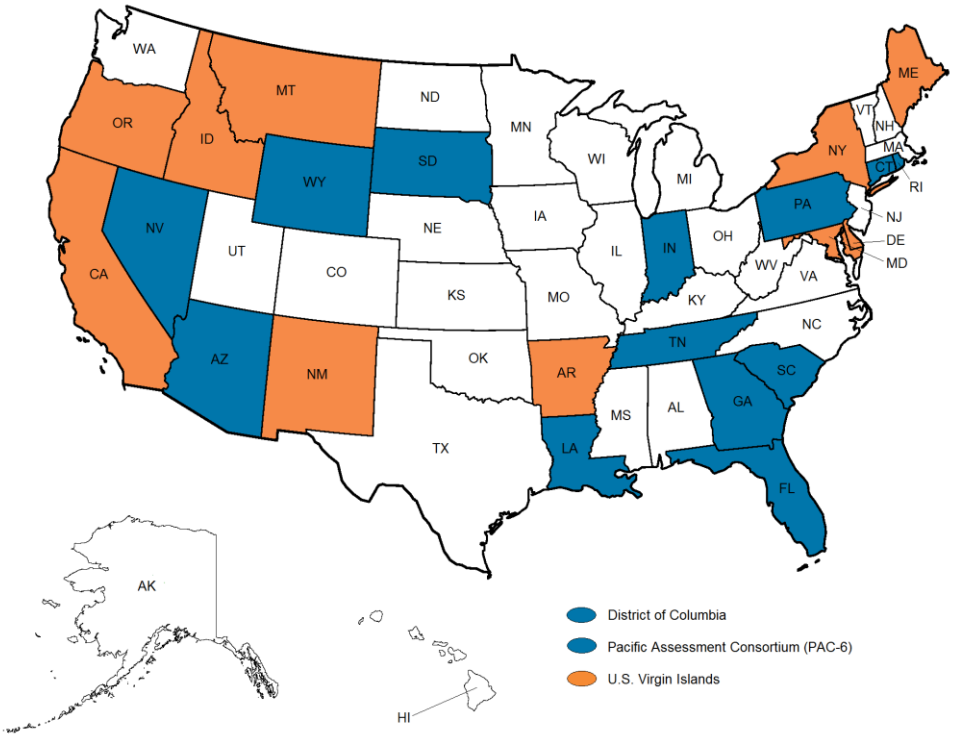
National Center and State Collaborative

NCSC is a collaborative of 15 states and five organizations.

The states include (shown in blue on map): Arizona, Connecticut, District of Columbia, Florida, Georgia, Indiana, Louisiana, Nevada, Pacific Assessment Consortium (PAC-6)[1], Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, and Wyoming.

Tier II states are partners in curriculum, instruction, and professional development implementation but are not part of the assessment development work. They are (shown in orange on map): Arkansas, California, Delaware, Idaho, Maine, Maryland, Montana, New Mexico, New York, Oregon, and U.S. Virgin Islands.



*Core partner states are blue in color and Tier II states are orange in color.

[1] The Pacific Assessment Consortium (including the entities of American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Republic of Palau, and Republic of the Marshall Islands) partner with NCSC as one state, led by the University of Guam Center for Excellence in Developmental Disabilities Education, Research, and Service (CEDDERS).

The five partner organizations include: The National Center on Educational Outcomes (NCEO) at the University of Minnesota, The National Center for the Improvement of Educational Assessment (Center for Assessment), The University of North Carolina at Charlotte, The University of Kentucky, and edCount, LLC.

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National Center and State Collaborative

Universal Design for Learning (UDL) Sample Instructional Unit – Area and Perimeter

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October 2013

The UDL Instructional Units clarify the academic content and provide examples on how to make grade level content accessible for all students, utilizing the principles of Universal Design for Learning. The units are general education lessons that have been developed by educators who have the knowledge and skills to address particular concerns for this population of learners.

Table of Contents

Unit Key Vocabulary

Area – The space that covers a two dimensional figure which is measured in square units.

Centimeter – a standard unit of length in the metric system equal to 1/100 of a meter (may be mentioned in Lesson 1 but not defined until Lesson 3)

Convert – to change

Distance – the amount of space between two things, places, or people

Foot – a standard unit of length in the US Customary system equal to 12 inches

Height – the vertical (up and down) distance from the top of an object or figure to its base

Inch – a standard unit of length in the US Customary system equal to 1/12 of a foot

Length – a measurement of the distance from one point to another

Measure – to determine a quantity/amount

Measurement – a determined quantity/amount

Meter – a standard unit of length in the metric system equal to 100 centimeters (may be mentioned in Lesson 1 but not defined until Lesson 3)

Meter Stick – a usually wooden tool used to measure lengths of up to 1 meter

Nonstandard – not the same (e.g., the width of your thumb versus the width of my thumb) or not marked (e.g., a piece of string used to measure length)

Perimeter – the distance around a figure along its edges

Quantity – an amount of something

Rectangle – a 4-sided figure in which opposite sides are equal and angles measure 90º

Ruler – a wooden or plastic tool used to measure lengths up to 12 inches

Square – a figure that has four equal sides and angles that measure 90º

Standardized – the same

Tape Measure – a tool consisting of a flexible ribbon of cloth or metal used to measure lengths up to several feet

Unit – a set amount used to consistently determine quantities

US Customary System of Measurement – a system of measurement that includes units such as inches, feet, yards and miles (for length); also referred to as imperial units or English units; this system is not commonly used outside of the United States

Width – measurement of the distance from one side or edge to the opposite side or edge

Yard Stick – a usually wooden tool used to measure lengths up to 3 feet (1 yard)

Unit Standards Overview

Common Core State Standard:
4.MD Measurement and Data **4.MD.A** Solve problems involving measurement and conversion of measurements.. **4.MD.A.1** Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36), ... **4.MD.A.3** Apply the area and perimeter formulas for rectangles in real world and mathematical problems. For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.
3.MD Measurement and Data **3.MD.C** – Geometric measurement: understand concepts of area and relate area to multiplication and to addition. **3.MD.C.5** Recognize area as an attribute of plane figures and understand concepts of area measurement. **3.MD.C.5a** A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area. **3.MD.C.5b** A plane figure which can be covered without gaps or overlaps by n unit squares is said to have an area of n square units. **3.MD.C.6** Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units). **3.MD.C.7** Relate area to the operations of multiplication and addition. **3.MD.C.7a** Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths. **3.MD.C.7b** Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning. **3.MD.C.7c** Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths a and b + c is the sum of a × b and a × c. Use area models to represent the distributive property in mathematical reasoning. **3.MD.C.7d** Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems **3.MD.C** – Geometric measurement: recognize perimeter. **3.MD.D.8** Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

Common Core State Standard: Standards for Mathematical Practice
CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them. **CCSS.Math.Practice.MP2** Reason abstractly and quantitatively. **CCSS.Math.Practice.MP3** Construct viable arguments and critique the reasoning of others. **CCSS.Math.Practice.MP4** Model with mathematics. **CCSS.Math.Practice.MP5** Use appropriate tools strategically. **CCSS.Math.Practice.MP6** Attend to precision. **CCSS.Math.Practice.MP7** Look for and make use of structure. **CCSS.Math.Practice.MP8** Look for and express regularity in repeated reasoning.
Learning Progressions Frameworks Progress Indicator
E.ME.1a recognizing, identifying, and describing the measurable attributes of objects **E.ME.1b** comparing and ordering objects/events according to their specified attributes (using standard or non-standard units of measure), including indirectly by using a third object, or using common referents to estimate or compare **E.ME.1c** recognizing that the smaller the unit, the more units are needed to measure an object ; and that units can be decomposed/partitioned into smaller units **E.ME.1d** describing and demonstrating: unit attributes, iterating, tiling, identical units, number line intervals, standardization, proportionality, additivity, and origin **E.ME.2e** selecting and applying appropriate customary or metric units and tools to measure or estimate (liquid volume, mass, perimeter, area, time, and angles) **E.ME.2f** recognizing relative sizes of units of measure and making simple conversions within systems when solving problems (e.g., 12 in. = 1 ft) **E.ME.2h** using a variety of strategies (decomposing complex shapes, using counting strategies, arrays, formulas) to estimate or measure area and perimeter (including irregular shapes/objects)
Instructional Family: Sorting and Classifying
Core Content Connectors (CCCs) addressed: • **4.ME.2e4** Select appropriate tool for measurement: mass, length, angles • **2.ME.1a3** Select appropriate unit of measurement to measure an object (ruler or yard stick; inches or feet)
Instructional Family: Measuring Using Tools
CCCs addressed: • **4.ME.1d3** Use tiling and multiplication to determine area • **3.ME.1d1** Use tiling and addition to determine area • **3.ME.1d2** Measure area of rectilinear figures by counting squares • **2.ME.1c2** Measure the attributes (length, width, height) of an object using 2 different size units • **2.ME.1c3** Recognize that units can be decomposed into smaller units • **2.ME.2b2** Select appropriate tools and demonstrate or identify appropriate measuring techniques

Instructional Family: Problem solving using measurement process.
Core Content Connectors (CCCs) addressed: • **3.ME.2e3** Measure to solve problems using number lines and ruler to 1 inch, ½ inch, or ¼ of an inch • **2.ME.1a3** Select appropriate unit of measurement to measure an object (ruler or yard stick; inches or feet) • **2.ME.1b5** Solve word problems involving the difference in standard length units
Instructional Family: Perimeter, Area, Volume
CCCs addressed: • **4.ME.2h1** Apply the formulas for area and perimeter to solve real world problems • **3.ME.2h** Use addition to find the perimeter of a rectangle
Instructional Family: Scaling and Unit conversion
CCCs addressed: • **4.ME.2f1** Complete a conversion table for length and mass within a single system

Measurement Unit
Lesson #1

Objectives

- Students will be able to choose the appropriate tool to measure various lengths.
- Students will be able to correctly measure various objects using inches and feet.
- Students will be able to explain why using standardized units is important and how measuring is practical in real life situations.

Essential Questions

- What are standard units of measure?
- Why is it important to use appropriate standard units of measure?
- How are standard units of measure important to our everyday lives?

Vocabulary

Centimeter – a standard unit of length in the metric system equal to 1/100 of a meter (may be mentioned in Lesson 1 but not defined until Lesson 3)

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Ruler – a wooden or plastic tool used to measure lengths up to 12 inches

Standardized – the same

Tape Measure – a tool consisting of a flexible ribbon of cloth or metal used to measure lengths up to several feet

Unit – a set amount used to consistently determine quantities

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Width – measurement of the distance from one side or edge to the opposite side or edge

Yard Stick – a usually wooden tool used to measure lengths up to 3 feet (1 yard)

Materials

- Masking tape or painter's tape
- Math journals
- Chart paper
- *How Big is a Foot?* storybook
- A piece of blank paper (just to demonstrate how to measure using a ruler)
- Rulers (enough for each student)
- Tape measure (ideally, at least one for each pair of students and one for each of the 8 stations in the Practice section)
- Yard sticks (ideally, at least one for each pair of students and one for each of the 8 stations in the Practice section)
- Classroom supplies/features
    - Stapler
    - Bookshelf
    - Doorway
    - Window
    - Filing cabinet
    - Computer screen
    - Hardcover book
    - Picture frame
- One blank sheet of paper (or could use grid paper)

Introduction

a. Activate Previous Knowledge

1) Using masking or painter's tape, tape a 5- to 10- foot line on the floor, depending on the amount of floor space you have. *(This could be done in the gym or other room if you want a longer length than you have room for in your classroom. This same line will be used again in Lesson 3.)*
2) Ask students to take turns "measuring" the taped line using just their feet (heel-toe-heel-toe-heel-toe). As each student takes his/her turn, the other students should help count and record each "measurement" in their math journals, or each student can record his/her "measurements" on chart paper displayed in the classroom.
3) After all students have measured the line with their feet, you, the teacher, should do the activity as well and have the student(s) record your measurement.
4) Have the students look at and compare all of the "measurements".
   –Guiding questions should include:
   - "Are all of the measurements the same?"
   - "Why aren't all of the measurements the same?"
   - "How could the line be measured so that no matter who measures it, the same measurement will be determined?"
5) Ask the students to verbally list the kinds of tools they have used to measure things (e.g., string, rulers, and tape measures). Have them add this list to their math journals or to a new piece of chart paper displayed in the classroom.

Additional Considerations for Emerging Readers and Emerging Communicators

If the student has had little to no experience with the concept of length or the skill of measuring length, it might be helpful to provide instruction using the ***Lesson 1 Concept Reinforcement Activity (CRA)*** *prior to teaching the Introduction to Lesson 1.*

a. 1) Attach a tactile support alongside the tape, such as a rope or stick.

Place corresponding tape (with or without the additional tactile support) on the wall. (This does not take the place of the tape on the floor, which will be used by most students and allows easier access for students whose gross motor skills do not allow them to access the floor measurement activity.)

2) As the student walks the tape:
   - Have a partner place a dot (removable) or other marker for each step along the tape, which the student can then count at the end.
   - Have the student or peer place a cube, token, or other manipulative for each step in a container.

- Have the student place a tick mark or tally or write the numeral for each step in his/her math journal.
- Have the student enter each step into a calculator using the "+1" function.

If the student cannot access the floor tape, trace his/her foot and use any of the above suggestions as he/she "walks" his/her foot outline along the tape on the wall.

On the chart paper or in the journal (these could have the "measurers'" pictures as well as the names) for his/her own measurement, peers' measurements, and the teacher's measurement, the student can:

i. writes his/her measurement;
ii. trace the numeral (if the student is working on fine motor skills);
iii. paste on a sticky note with the numeral on it (if the student is working on number recognition, he/she can select the correct number from two or more options); and/or
iv. access and work in a digital journal using assistive technology.

3) As the teacher measures using his/her own foot, the student can use any of the methods in step 2) above to count and record the teacher's measurement.

4) Allow the student to answer the teacher's questions by using his/her preferred mode of communication (e.g., verbal, sign, written, speech generating device). Student might select from multiple options by using touch, eye-gaze, assistive technology, etc. Options may be presented as text, symbols, pictures, tactile representations, concrete objects, etc., or any combination of those.

(Pre-teach concepts such as "same" that may not be consistently demonstrated using systematic instructional techniques, such as time delay, shaping, prompt hierarchy, etc.)

5) Allow the student to answer the teacher's questions by using his/her preferred mode of communication (e.g., verbal, sign, written, speech generating device). Student might select from multiple options by using touch, eye-gaze, assistive technology, etc. Options may be presented as text, symbols, pictures, tactile representations, etc., or any combination of those.
Provide a premade list for students of tools and what each tool measures as headings; have students participate by selecting the appropriate tool and what the tool measures when asked/prompted.

The student can record these measuring tools in his/her journal by:
i. writing, tracing (if the student is working on fine motor skills), or keyboarding;
ii. drawing;
iii. cutting and/or pasting pictures, symbols, icons, text, or any combination of those;
iv. selecting pictures, symbols, icons, text, tactile representations, concrete objects or any combination of those which a partner scribes; and
v. saving symbols, icons, pictures, etc. into a digital journal using assistive technology.

b. Establish Goals/Objectives for the Lesson

1) Share with the students that in this lesson they will learn about why "standardized" units of measure are important. Verbally define "standardized units" for the students. For each "tool" listed on the chart made in step 5 of part a, have the students decide if it uses standardized units or if it is "nonstandardized."
2) Share with the students that they will be asked to measure a variety of things throughout this unit of study and that they will be using various tools, such as the ones they listed in Step 5 of part a.

Additional Considerations for Emerging Readers and Emerging Communicators

1) In the journal, have the student categorize the measurement tools from the list collected in the previous activity, into standardized vs. non-standardized (e.g., concrete objects may be placed into "standardized" or "non-standardized" containers, such as boxes, baskets, etc.). Pre-teach these concepts as necessary.

2) No accommodations

Body

1) Read aloud to the students the story- *How big is a foot?* Question the students about the issue related to the story. – Guiding questions should include:
   - How did the lack of a standard unit of measure impact the main character?
   - What tools would have been better for measurement? *(Refer back to the list of tools created in the Introduction of this lesson.)*
2) Model for the students how to measure the length of a piece of paper with your thumb (nonstandard) and then with a ruler (standardized, in inches). Then model how to measure the distance from a desk to the doorway with a tape measure and a yardstick (in inches and feet). Be sure to point out the units of measure and the

reasons for using a ruler vs. a yardstick. Be sure to point out the unit named on the tool, especially if using a ruler that has metric as well as US Customary units, and for now, specify that they should use the US Customary units. Also, for now, stick to whole number measurements.

3) Lead the students in a discussion about what tools would be necessary to measure the length of various objects (e.g., a pencil vs. the line on the floor used in the Introduction). In fact, demonstrate how to use a ruler to measure the length of a pencil, but do not demonstrate measuring the line on the floor because the students will do that later in the lesson. Remind students that the US Customary System uses inches and feet. Ask students to name all of the units of which they may have heard or used pertaining to length/distance (US Customary and/or metric). Using chart paper, make a list of all of the tools used, referring back to the list devised in the Introduction, adding to it if necessary (e.g., ruler, yardstick, tape measure, odometer, etc.) and then a list of all of the units named (e.g., inches, feet, yards, miles, centimeters, meters, kilometers). *(It is OK if the students do not name them all. This is just to get an idea of what tools and units with which they are already familiar.)*

Additional Considerations for Emerging Readers and Emerging Communicators

1) Provide a personal copy of the book for the student to follow as the teacher reads aloud. Options include:

- text supplemented with symbols;
- text with sentences or words affixed with hook-and-loop tape so the student can manipulate the text as the teacher reads;
- text (or supplement) with Braille and/or tactile representations [resources such as Standard Tactile Symbol List available from the Texas School for the Blind www.tsbvi.edu/tactile-symbols may be useful in determining representations; some representations may need to be pre-taught (Rowland, 2012), but use of the same representations/symbols (or the system) during this and other lessons will reduce the need for pre-teaching]; or
- illustrations in the text with -
    - hook-and-loop tape so the student can manipulate the illustrations
    - tactile qualities added such as outlining with glue, puffy paint, yarn, etc.

Allow the student to answer the teacher's questions by using his/her preferred mode of communication (e.g., verbal, sign, written, speech generating device). Student might select from multiple options by using touch, eye-gaze, assistive

technology, etc. Options may be presented as text, symbols, pictures, tactile representations, concrete objects, etc., or any combination of those.

2) Provide the same materials that the teacher is using:

   - adapted materials such as a ruler with tactile qualities;
   - a piece of paper laminated on card stock; and/or
   - other rulers that accommodate the student more effectively such as digital rulers, bendable/foldable rulers, tactile rulers, transparent/translucent rulers, simplified rulers with only inches marked)

   This may allow the student to mirror what the teacher is demonstrating. Provide adaptations, such as hook-and-loop tape or a "handle" to the ruler if the student's fine motor skills do not allow him/her to manipulate the tool(s); provide decreasing physical assistance to help the student manipulate the materials and mirror the skill.

   Allow student to move closer to the teacher during modeling or have a nearby classmate model with the student by measuring a piece of paper using your thumb and then using a ruler.

   Pre-teach concepts and skills the teacher is modeling (include systematic instruction techniques, such as task analysis, prompting, shaping, time delay, etc.).

3) Preplan by finding out what tools and objects will be used as examples; then provide those tools and objects for the student to interact with during the discussion (make adaptations to the materials such as those described in 2) above so the student can meaningfully interact with them).

   The student should participate in the discussion by using his/her preferred mode of communication (e.g., verbal, sign, written, speech generating device).

   - Student might contribute to the discussion from multiple options by using touch, eye-gaze, assistive technology, etc.
   - Options may be presented as text, symbols, pictures, tactile representations, concrete objects, etc., or any combination of those.
   - Preplan at least one contribution for the student to make to the classroom discussion, at least one measurement tool, and at least one unit of measure.

Practice

1) Have students work in pairs to find the actual measurement of the tape on the floor used in the Introduction. Each student pair should first select a tool to use then measure the length of the tape and record their measurement in their math journals. Instruct the student pairs not to share their measurement with anyone else. As each pair selects a tool and measures the line, the other students should observe but not try to direct or interrupt the pair.

2) Once all pairs have taken their turn measuring the line, record each pair's measurement on chart paper. Discuss any differences.
   - Guiding questions should include:
     • Are any of the measurements different this time?
     • Why might they be different? (e.g., different tools used, different units, an error in measuring, etc.)
     • How did you decide which tool to use?
     • Why would it be helpful to use one tool over another?
     • Why would it be helpful to use one kind of unit over another?

3) Divide the class into two groups. The first group will take turns at 8 stations where they will choose from a selection of tools and then measure a given object at each station:
   - Station 1 – the length of a stapler
   - Station 2 – the height and/or width of a bookshelf
   - Station 3 – the height of a doorway
   - Station 4 – the width of a window
   - Station 5 – the height and/or width of a filing cabinet
   - Station 6 – the height and/or width of a computer screen
   - Station 7 – the length of the spine of a book
   - Station 8 – the length and/or width of a picture frame)

   Note: Since we are still working with whole number measurements at this point, have the students round to the nearest whole number measurement if the objects do not measure right at the whole number mark.
   In their math journals, the remaining students should brainstorm and list 5 instances in which they might need to measure things in real life as well as identify the tool they would need to measure each thing named. When everyone in the first group has been to each of the 8 stations, they should switch places and activities with the second group.

4) Once all students have visited each station, as a class, go over each station and the correct measurement of each object. Model how to correctly measure each object. Using chart paper, chart the students' answers concerning real life situations in which measuring objects would be useful.

Additional Considerations for Emerging Readers and Emerging Communicators

1) Allow the student to participate in the tool selection within his/her pair by using his/her preferred mode of communication (e.g., verbal, sign, written, speech generating device). Student might select from multiple options by using touch, eye-gaze, assistive technology, etc.

   When the measurement activity occurs, one student could do the actual measurement by moving the selected measurement tool along the tape while the other student records each measurement through:

   a) moving the tool – adapt the tool with hook-and-loop tape, a "handle", etc. so the student can more effectively and independently maneuvers the tool;

   b) recording the measurement -

   - place a dot (removable) or other marker for each measurement along the tape or on a note card, which the students can then count at the end;
   - place a tick mark or tally or write the numeral for each measurement on a note card;
   - enter each measurement into a calculator using the "+1" function;
   - place a manipulative (cube, token, etc.) in a container so they can be counted for the final measurement;
   - write the final measurement;
   - trace the numeral;
   - paste on a sticky note with the numeral on it; and
   - access and work in a digital journal using assistive technology.

   c) Paste card with tick marks and total counted by student into math journal or paste picture of tool used and circle correct measurement in math journal.

2) Allow the student to answer the teacher's questions by using his/her preferred mode of communication (e.g., verbal, sign, written, speech generating device). Student might select from multiple options by using touch, eye-gaze, assistive technology, etc.

   Preplan at least one answer to one of the guiding questions.

3) Stations:
   Allow student to select, using his/her preferred mode of communication (eye-gaze, verbal, touch, sign, written, speech generating device, assistive technology, etc.), a measuring tool at each station. Depending on the student's skill at selecting an appropriate tool, the number of tools offered could vary:
   - two tools for a student who has difficulty with selection;
   - several tools for a student who can make a selection; or
   - the "appropriateness" could vary from widely discrepant (e.g., Station 3 – six inch ruler vs. yardstick) to more discreet differences (e.g., Station 6 – six inch ruler vs. 12-inch ruler).

Use the station activities as opportunities to instruct and practice performance. Provide effective accommodations to the materials such as those found in Lesson 1 – Body, 2), adapted materials:

- a ruler with tactile qualities or a piece of paper;
- digital rulers;
- bendable/foldable rulers;
- tactile rulers;
- transparent/translucent rulers;
- simplified rulers with only inches marked; and
- rulers adapted with hook-and-loop tape or a "handle".

Other effective adaptations include laminated card. He/she should be allowed to manipulate the tool(s) with the provision of decreasing physical assistance and to mirror the skill (similar to those found in Lesson 1 – Introduction a. 2 -place a manipulative in a container every time the tool moves, place a tick/tally mark on paper every time the tool moves, etc.)

Journals:
The student can record instances where he/she might need to measure and corresponding measuring tools selected in his/her journal using his/her preferred mode of communication (verbal, sign, written, speech generating device to select (by touch, eye-gaze, assistive technology, etc.) from multiple options (presented by text, symbols, pictures, tactile representations, concrete objects, or any combination of these, etc.)].
The student can record these measuring tools in his/her journal by:

- writing,
- tracing (if the student is working on fine motor skills),
- keyboarding (in a digital journal),
- drawing, cutting and/or pasting pictures, symbols, icons, text, or any combination of those.

The student selects pictures, symbols, icons, text, tactile representations, concrete objects, or any combination of these which a partner scribes, saving symbols, icons, pictures, etc. into a digital journal using assistive technology.

Be consistent in the supports the student uses for journaling; refer back to the accommodations the student used in Lesson 1 – Introduction a. 5).

4) As the teacher models correctly measuring the objects at each station, quietly remind the student how he/she measured them. (Because the station activity was instructional practice, the student should have received guidance, possibly through

errorless learning techniques, at each station resulting in correctly measuring each object.)

Allow the student to participate in the math journal discussion by using his/her preferred mode of communication (e.g., verbal, sign, written, speech generating device). Student might select from multiple options by using touch, eye-gaze, assistive technology, etc. Preplan at least one contribution to the discussion.

Closure

a. Revisit/Review Lesson and Objectives –

1) Ask the students to, as a class, verbally explain what "standardized unit" means and why using standardized units is important/helpful. Remind the students that, that was one of the goals of this lesson—to learn about how and why standardized units of measure are used.
2) Ask students to brainstorm and suggest alternative ways to measure that would still be standardized (i.e., if you were creating your own standardized system of measurement, what would you use?)
3) Optional activity - Share with students a bit of the history behind the development of the United States Customary System, also called empirical units or the English System of Measurement (i.e., barleycorns, digits, fingers, hands, inches, nails, palms, shaftments, links, spans, feet, cubits, yards, etc. – *The purpose of this is just to show the students that this system of measure was devised to help people, particularly farmers, measure/judge lengths and distances and that it was, at first, nonstandardized*. *They do not need to add these words to their working vocabulary.*) Share with students that there are, indeed, other systems of measurement, such as the metric system, which they will be learning about later in the unit.

Additional Considerations for Emerging Readers and Emerging Communicators:.

1) Allow the student to participate in the class discussion by using his/her preferred mode of communication (e.g., verbal, sign, written, speech generating device). Student might select from multiple options by using touch, eye-gaze, assistive technology, etc. Preplan at least one contribution to the discussion.
2) Allow the student to participate in the brainstorming using his/her preferred mode of communication e.g., verbal, sign, written, speech generating device). Student might select from multiple options by using touch, eye-gaze, assistive technology, etc. Preplan at least one contribution to the brainstorming.
3) Provide engagement supports as necessary, which may include pictures of key concepts being presented, concrete objects to manipulate, and/or positive behavioral supports.

b. Exit Assessment –

1) Have each student draw one line of any length on a piece of blank paper using a ruler (could use grid paper). Tell the students to use their rulers to measure the line they drew but not to write the measurement down.
2) Group the students in threes. Each trio should take turns measuring each group mate's line. Each trio should compare their measurements to make sure they came up with the same measurement. They should resolve any inconsistencies by re-measuring the lines together.

Additional Considerations for Emerging Readers and Emerging Communicators:

1) The student could draw his/her line digitally using assistive technology, choosing a straw, pipe cleaner, etc. to measure, or placing two dots on the paper and have someone draw the line. Allow the student to use (if necessary) any of the adapted materials he/she used in Lesson 1 – Body 2), such as a ruler with tactile qualities, low vision ruler, audio measuring tape, or a piece of paper laminated on card stock which support student needs. Other rulers may accommodate the student more effectively, such as digital rulers, bendable/foldable rulers, tactile rulers, transparent/translucent rulers, simplified rulers with only inches marked) or a ruler adapted with hook-and-loop tape or a "handle" if the student's fine motor skills do not allow him/her to manipulate the tool(s).
2) Allow the student to use (if necessary) any of the adapted materials he/she used in Lesson 1 – Body 2). These include rulers which may accommodate the student needs more effectively such as:
    - rulers with tactile qualities;
    - digital rulers;
    - bendable/foldable rulers;
    - transparent/translucent rulers;
    - simplified rulers with only inches marked; and
    - a ruler adapted with hook-and-loop tape or a "handle" if the student's fine motor skills do not allow him/her to manipulate the tool(s).

    As this is now assessment as opposed to all previous activities in this lesson, the student's first independent attempt at measuring the three lines should be observed and recorded for accuracy.

Measurement Unit
Lesson #2

Objectives

- Students will be able to convert inches to feet and feet to inches.

Essential Questions

- How can a measurement expressed in one unit be expressed in another unit without changing the quantity?
- How is expressing equal quantities in different units practical/useful in real world situations?

Vocabulary

Convert – to change

Foot – a standard unit of length in the US Customary system equal to 12 inches

Inch – a standard unit of length in the US Customary system equal to 1/12 of a foot

Length – a measurement of the distance from one point to another

Measure – to determine a quantity/amount

Measurement – a determined quantity/amount

Quantity – an amount of something

Ruler – a wooden or plastic tool used to measure lengths up to 12 inches

Standardized – the same

Tape Measure – a tool consisting of a flexible ribbon of cloth or metal used to measure lengths up to several feet

Unit – a set amount used to consistently determine quantities

US Customary System of Measurement – a system of measurement that includes units such as inches, feet, yards and miles (for length); also referred to as imperial units or English units; This system is not commonly used outside of the United States.

Width – measurement of the distance from one side or edge to the opposite side or edge

Yard Stick – a usually wooden tool used to measure lengths up to 3 feet (1 yard)

Materials

- Charts from lesson 1
- Two 8-packs of juice boxes
- Individual whiteboards (one per student) and dry erase markers
- Lesson 2 Conversions PowerPoint presentation (print out slides for students)
- Lesson 2 Practice Conversions PowerPoint (do not need to print out the slides for the students, but if you do remove the answers from the slides)

Introduction

1) Activate Previous Knowledge

1) Review the chart used in Lesson 1 whereby units of length were listed (inches, feet, yards, and miles) as well as the tools used to measure length (ruler, tape measure, yardstick, odometer, etc.). Remind the students how in Lesson 1 they were asked to decide which tool and which unit was most appropriate given what they were measuring.
2) Show the students an 8-pack of juice boxes. Open the pack and have the students count aloud each box as you remove each from the pack.
3) Ask the students, “How many boxes of juice are there in 1 pack?” Then ask the students, “What if I had 2 packs of juice? How many boxes of juice would I have all together?”
4) Ask the students, “Is there a difference between saying that I have 1 pack of juice or that I have 8 boxes of juice? Is there a difference between saying that I have 2 packs of juice or that I have 16 boxes of juice? Is there the same amount either way I say it?”
5) Finally, ask the students, “Why might I want to say that I have 2 packs of juice rather than saying that I have 16 boxes of juice? Or, why might I want to say that I have 16 boxes of juice rather than saying that I have 2 packs?” Remind them of how in Lesson 1 it was determined, for example, that using feet to measure the line of the floor was better than using inches, although it is certainly possible to measure the line in inches—it would just likely take a little longer and involve larger numbers. Remind them also of how this is the same principle they learned about when they learned why multiplication is handy even though it is actually nothing more than repeated addition.

Additional Considerations for Emerging Readers and Emerging Communicators

1) Provide reminders in the form of accommodations used in Lesson 1- Practice. Refer student to math journal information recorded in Lesson 1.
2) Provide 2-dimensional copies (enhanced with tactile qualities such as glue or puffy paint outlines) of the juice, boxes (or a set of actual juice boxes) to count as the teacher demonstrates. The copies or actual juice boxes may be supplemented with hook-and-loop tape if necessary. Mark the copies or the actual boxes with numerals 1-8. Add tactile qualities as necessary including touch math dots, sets of textured dots corresponding to the numerals, outlined numerals, etc. Provide a grid or number line for the student to use when counting. It may have tactile qualities added.
3) Allow the student to answer using his/her preferred mode of communication. Provide answer options from which the student can choose. Provide a second set of copies or actual boxes so the student can come up with the answer. Provide an equation (either addition or multiplication) the student can use to come up with the answer. The student may use a calculator if necessary.
4) Have the student compare the individual copies or the actual boxes to unopened packs to answer the questions. Allow the student to answer using his/her preferred mode of communication.
5) Allow student to answer using his/her preferred mode of communication. Provide options of answers from which to choose. Depending on the student's skills at this point, you may or may not include distractors or "wrong" answers. However, since this is still learning and not being assessed, "errorless learning" is still an option, so giving all appropriate choices is acceptable. Preplan a question and answer so the student can contribute to the discussion.

b. Establish Goals/Objectives for the Lesson

1) Tell the students that in this lesson, they will be using inches and feet and that, like the packs of juice and the juice boxes, they will learn how to use those two units to express the same amount/quantity.

Additional Considerations for Emerging Readers and Emerging Communicators

1) As the teacher explains the goals to the class, provide access to the same measuring tools (with any supports necessary) that he/she used in previous activities in this unit (once a student demonstrates that a support of any kind is successful in helping him/her learn, it is important to use that same support whenever appropriate; consistency is important). Provide a digital or graphic representation of inches compared to feet.

Body

1) Provide students with handouts of the Lesson 2 Conversions PowerPoint.
2) Guide students through the PowerPoint. *(The PowerPoint is very short and is scripted. You will need to print out the speaker's notes or at least read them ahead of time so that you know when to click for each narration.)* The PowerPoint shows students that:
    a. 12 inches = 1 foot and 1 foot = 12 inches
    b. To convert feet to inches, multiply by 12
    c. To convert inches to feet, divide by 12
    d. Reference charts (12's times table and basic division by 12) are included in the presentation.

Additional Considerations for Emerging Readers and Emerging Communicators

1) Provide a digital or graphic representation of inches compared to feet in addition to the PowerPoint. Manipulative models, such as connecting one inch cubes, may also be used.
2) Allow student to use a calculator (talking calculator, large button calculator, digital calculator, etc.) to practice multiplying and dividing by 12.

    Pre-teach any concepts (multiplication, division, calculator use, etc.) that the student may not have learned completely.

Practice

1) Present the students with the Lesson 2 Practice Conversions PowerPoint presentation. *(You do not necessarily need to give handouts of this one. If you do, remember to remove the answers from the slides before printing.)*
    a. Each slide presents the students with a conversion problem.
    b. Students are asked to decide whether they would need to multiply or divide in order to find the equivalent measurement. (Remind students they may refer to their PowerPoint notes.)
2) Students are asked to write and complete each problem on their whiteboards.

3) The final slide tasks the students to complete a chart whereby they must convert inches to feet and feet to inches. Again, students should write the problems and their answers on their whiteboards.

Additional Considerations for Emerging Readers and Emerging Communicators

1) As the practice conversion PowerPoint is being presented

a. Provide models for the problems that the student can use to copy on the whiteboard.

b. Provide options of math function for the student to choose. Allow him/her to choose using the preferred mode of communication.

2) Provide prewritten cards with the numbers and functions that the student can use to "write" the problems (touching, moving, selecting by eye-gaze, etc.).

a. Prewrite the problems on the whiteboard.

b. Provide the problems digitally and allow the student to solve the problems digitally. Allow the student access to the digital problems using assistive technology.

c. Provide options of math function for the student to choose. Allow him/her to choose using the preferred mode of communication.

d. Allow the student to use a calculator (traditional or digital, talking, large button, etc.) to solve the problems.

e. Provide number cards that the student can use as answers for the problems, process cards, and math function cards instead of writing them.

f. Reduce the number of problems that the student must solve.

g. Reduce the difficulty of the problems. For example, only give the student problems that have feet in single digits (1-9).

3) Use the same supports as in step 2

Closure

a. Revisit/Review Lesson and Objectives –

1. Remind students that the goal for this lesson was to learn how to convert inches to feet and feet to inches.
2. Ask students to verbally explain how to convert feet to inches.
3. Ask students to verbally explain how to convert inches to feet.

Additional Considerations for Emerging Readers and Emerging Communicators

1. During the review, provide access to the same measuring tools (with any supports necessary) that he/she used in previous activities in this unit (once a student demonstrates that a support of any kind is successful in helping him/her learn, it is important to use that same support whenever appropriate; consistency is important).
2. Allow the student to answer the questions using his/her preferred mode of communication (including AAC and AT).
    - Allow the student to create the formulas for conversion (feet to inches and inches to feet) by writing, manipulating prewritten labels, numbers, and functions, etc. and use those formulas to answer the questions.
    - Provide formulas and allow the student to select them as answers to the teacher's questions.
3. Use the same supports as in step 2

b. Exit Assessment –

1) Group the students in pairs.
2) Have each student come up with a conversion problem and write it on his/her whiteboard.
3) Have students exchange whiteboards with their partners and solve their partners' problem.
4) Have each pair present both of their problems and of answers to the class and explain how they solved them.

Additional Considerations for Emerging Readers and Emerging Communicators

2) Allow the student to write a conversion problem using any of the supports or accommodations that he/she used in previous activities in this unit (once a student demonstrates that a support of any kind is successful in helping him/her learn, it is important to use that same support whenever appropriate; consistency is important).
    - Give the student a chance to do this independently (this is assessment, so it is important to determine the accuracy of the student's independent performance).
        - If the student cannot do this step independently, assist as necessary so the other student has a correct problem to solve.
3) Allow the student to solve the partner's conversion problem using any of the supports or accommodations that he/she used in previous activities in this unit (once a student demonstrates that a support of any kind is successful in helping him/her learn, it is important to use that same support whenever appropriate; consistency is important).
    - Give the student a chance to do this independently (this is assessment, so it is important to determine the accuracy of the student's independent performance).
        - If the student cannot do this step independently, make a note of this and assist as necessary so the problem is solved correctly.
4) Have the student point to each step of the equation sequentially. Have the student present his/her solution digitally using AT.

Measurement Unit
Lesson #3

Objectives

- Students will be able to measure objects using centimeters and meters.
- Students will be able to convert measurements within the metric system.

Essential Questions

- How is the metric system like/unlike the US Customary System?
- What are the most commonly used units of measure within the metric system?
- How do the metric units compare to one another?

Vocabulary

Centimeter – a standard unit of length in the metric system equal to 1/100 of a meter

Convert – to change

Foot – a standard unit of length in the US Customary system equal to 12 inches

Inch – a standard unit of length in the US Customary system equal to 1/12 of a foot

Length – a measurement of the distance from one point to another

Measure – to determine a quantity/amount

Measurement – a determined quantity/amount

Meter – a standard unit of length in the metric system equal to 100 centimeters

Meter Stick – a usually wooden tool used to measure lengths of up to 1 meter

Quantity – an amount of something

Ruler – a wooden or plastic tool used to measure lengths up to 12 inches

Standardized – the same

Tape Measure – a tool consisting of a flexible ribbon of cloth or metal used to measure lengths up to several feet

Unit – a set amount used to consistently determine quantities

US Customary System of Measurement – a system of measurement that includes units such as inches, feet, yards and miles (for length); also referred to as imperial units or English units; this system is not commonly used outside of the United States.

Width – measurement of the distance from one side or edge to the opposite side or edge

Yard Stick – a usually wooden tool used to measure lengths up to 3 feet (1 yard)

Materials

- Chart paper
- Rulers (one for each student)
- Meter sticks (ideally, at least one for each of the 8 stations in the Practice section)
- Charts from lesson 1
- Taped line on the floor from Lesson 1
- Classroom supplies/features from Lesson 1
    - Stapler
    - Bookshelf
    - Doorway
    - Window
    - Filing cabinet
    - Computer screen
    - Hardcover book
    - Picture frame
- Lesson 3 Metric Conversions PowerPoint presentation (print out slides for students)
- Lesson 3 Practice Metric Conversions PowerPoint (do not need to print out the slides for the students, but if you do remove the answers from the slides)
- Individual whiteboards (one per student) and dry erase markers

Introduction

a. Activate Previous Knowledge

1) Have students name all of the ways they know of to say, "Hello" (e.g., Hi! Hey! Bonjour! Hola!, Konnichiwa!, Ciao!, Aloha!, etc.). *If no one knows "Hello!" in any other language than English, you can just write the words on the chart paper and tell him or her which language each is.*
2) Ask students to think about how each of these words communicates the same thought (a greeting) just in a different way.
3) Show students a ruler and a meter stick.
4) Have students recall how in Lesson 1 they practiced measuring various objects using inches and feet.
5) Explain that in this lesson, they will learn about the metric system, which is like another language people can use to measure objects. Explain that the metric system does not use inches and feet but does use different standardized units, just as if different languages use different words to communicate the same idea, such as "hello".
6) Review the chart made in Lesson 1 whereby different units of measure were listed. Point out which ones, if any, is part of the metric system. *(Recall how in Lesson 1 students were asked to list all of the different units of which they had heard. If no one listed any metric units, that's OK. Just point out that the ones on the chart are from the US Customary System and that in this lesson, they'll be learning about metric units.)*

Additional Considerations for Emerging Readers and Emerging Communicators

1) Pre-teach a small number of words for the student to contribute. Allow the student to contribute using the preferred mode of communication. Provide pre-recorded (either digital or with assistive technology) contributions for the student to activate.
2) No accommodations.
3) Provide a ruler and meter stick.
4) Provide the (accommodated) tools to measure inches and feet that the student used in Lesson 1.

5) Provide the ruler and meter stick. Provide a graphic representation (symbolic and/or concrete) of basic metric measurements (meters, centimeters, decimeters, etc.) which the student may be familiar.

6) Provide the information previously developed in Lesson 1-Body 3).

b. Establish Goals/Objectives for the Lesson

1) Continuing with numbers 5 and 6 in section a., let the students know that in this lesson they will measure objects in centimeters and meters, which are basic units of the metric system, and they will learn how to convert units within the metric system, just like they did for inches and feet in the US Customary System. *(Note: Students will NOT be asked to convert between systems.)*

Additional Considerations for Emerging Readers and Emerging Communicators

1) Provide a graphic or 3-dimensional representation of basic metric measurements (meters, centimeters, decimeters, etc.). Enhance the representations with texture, color, etc.

Body

1) Demonstrate how to measure objects using centimeters and meters with a ruler and meter stick. (Measure the length of a pencil in centimeters, and measure the taped line on the floor from Lesson 1 in meters.) Relate to the students that just as sometimes measuring in feet is more practical/useful than measuring in inches; the same is true for centimeters and meters.

   Note: For now, stick to whole number measurements.

2) Using the same 8 objects that were used in the Practice section for Lesson 1, pair the students and have each pair practice measuring the 8 objects in centimeters or meters, depending on the object. Once all students have been to each of the 8 stations, go over the actual measurements of each object.

   Note: For now, have students round to the nearest whole number if/when they are measuring objects that do not measure right at the whole number mark.

   - Station 1 – the length of a stapler
   - Station 2 – the height and/or width of a bookshelf
   - Station 3 – the height of a doorway
   - Station 4 – the width of a window
   - Station 5 – the height and/or width of a filing cabinet

- Station 6 – the height and/or width of a computer screen
- Station 7 – the length of the spine of a book
- Station presentation.8 – the length and/or width of a picture frame

3) Provide students with handouts of the Lesson 3 Metric Conversions PowerPoint
4) Guide students through the presentation. *(The PowerPoint is very short and is scripted. You will need to print out the speaker's notes or at least read them ahead of time so that you know when to click for each narration.)* The PowerPoint shows students that:
    a. 100 centimeters = 1 meter and 1 meter = 100 inches
    b. To convert meters to centimeters, multiply by 100
    c. To convert centimeters to meters, divide by 100
    d. Reference charts (100's times table and basic division by 100) are included in the presentation.
    e. The last slide is a summary of how to convert meters to centimeters (and vice versa) and how to convert feet to inches (and vice versa).

Additional Considerations for Emerging Readers and Emerging Communicators

1) Provide a centimeter ruler and a pencil exactly the same length as the teacher's so the student can practice by mirroring what the teacher is demonstrating.

    Other rulers that accommodate the student more effectively can be used, such as: digital rulers,

    - a ruler with tactile qualities
    - or a piece of paper laminated on card stock may be substituted;
    - digital rulers,
    - bendable/foldable rulers,
    - tactile rulers,
    - transparent/translucent rulers,
    - simplified rulers with only centimeters marked.

    Provide adaptations such as hook-and-loop tape or a "handle" to the ruler if the student's fine motor skills do not allow him/her to manipulate the tool(s).

    Provide decreasing physical assistance to help the student manipulate the materials and mirror the skill. As the teacher measures the tape:

- place a dot (removable) or other marker for each centimeter/meter along a number line, which the student can then use for counting at the end.
- place a manipulative in a container for each centimeter/meter
- have the student place a tick mark, tally, or write the numeral for each centimeter/meter in his /her math journal.
- have the student enter each centimeter/meter into a calculator (or talking calculator, large button calculator, etc.) using the "+1" function.

Pre-teach concepts and skills the teacher is modeling (include systematic instruction techniques, such as task analysis, prompting, shaping, time delay, etc.).

2) Use the station activities as opportunities to instruct and practice performance. Provide accommodations to the materials such as those described in step 1.

   As the teacher models how to correctly measure the objects at each station, quietly remind the student how he/she will measure them.

   Since the station activity is instructional practice, the student can receive guidance at each station, possibly through errorless learning techniques, resulting in correctly measuring each object.

3) Provide a copy of the PowerPoint.
   - Enhance with tactile qualities as necessary.
   - Provide the PowerPoint digitally with animations and sound.

4) Guide the student through his/her personal PowerPoint copy.
   - Present graphic or tactile representations of salient vocabulary as needed.
   - Provide a model or template of the conversion formulas as they are discussed on the slides.

Practice

1) Present the students with the Lesson 3 Practice Metric Conversions PowerPoint presentation. *(You do not necessarily need to give handouts of this one. If you do, remember to remove the answers from the slides before printing.)*
   a. Each slide presents the students with a conversion problem.
   b. Students are asked to decide whether they would need to multiply or divide in order to find the equivalent measurement. (Remind students they may refer to their PowerPoint notes.)

c. Students are asked to write and complete each problem on their whiteboards.

d. The final slide tasks the students to complete a chart whereby they must convert meters to centimeters and centimeters to meters. Again, students should write the problems and their answers on their whiteboards.

Additional Considerations for Emerging Readers and Emerging Communicators

a. Provide models for the problems that the student can use to copy on the whiteboard. Provide prewritten cards with the numbers and functions that the student can use to "write" the problems (touching, moving, selecting by eye-gaze, etc.). Prewrite the problems on the whiteboard. Provide the problems digitally and allow the student to solve the problems digitally.

b. Provide math function options for the student to choose from. Allow him/her to choose using the preferred mode of communication.

c. Allow the student to use a calculator (traditional or digital, talking, large buttons, etc.) to solve the problems. Provide number cards that the student can use as answers for the problems, process cards, and math function cards instead of writing them. Reduce the difficulty of the problems. For example, only give the student problems that have meters in single digits (1-9).

d. Continue with the same supports used in the previous steps.

Closure

a. Revisit/Review Lesson and Objectives –

1) Remind students that the goal for this lesson was to learn how to convert meters to centimeters and centimeters to meters.

2) Ask students to explain how to convert meters to centimeters.

3) Ask students to explain how to convert centimeters to meters.

4) Ask students to compare the units of the US Customary System and the metric system:

- Which metric unit is similar to feet?
- Which metric unit is similar to centimeter?
- Are the US Customary units and the metric units the same?
- What did you notice about converting metric units versus converting US Customary units?

Additional Considerations for Emerging Readers and Emerging Communicators

1. During the review, provide access to the same measuring tools (with any supports necessary) that he/she used in previous activities in this unit (once a student demonstrates that a support of any kind is successful in helping him/her learn, it is important to use that same support whenever appropriate; consistency is important).
2. Allow the student to answer the questions using his/her preferred mode of communication (including AAC and AT).
    - Allow the student to create the formulas for conversion (meters to centimeters and centimeters to meters) by writing, manipulating prewritten labels, numbers, and functions, etc., and use those formulas to answer the questions.
    - Provide formulas and allow the student to select them as answers to the teacher's questions.
3. Allow the student to answer the questions using his/her preferred mode of communication (including AAC and AT).
    - Allow the student to create the formulas for conversion (meters to centimeters and centimeters to meters) by writing, manipulating prewritten labels, numbers, and functions, etc., and use those formulas to answer the questions.
    - Provide formulas and allow the student to select them as answers to the teacher's questions.
4. Allow the student to answer the questions using his/her preferred mode of communication. Pre-teach any concepts that the student may not yet fully understand (big/little, same/different, etc.). Preplan a piece of information for the student to contribute.
    - Provide the tools the student used to measure feet, inches, meters, and centimeters.
    - Have the student physically or digitally compare the sizes of the units in each set and categorize each unit as either "bigger" or "smaller" (longer/shorter).

    Have him/her use that categorization to determine that feet are similar to meters and inches are similar to centimeters.
    - Allow the student to look at both the metric and customary conversion charts and formulas and point out that when converting "big" to "little", you must multiply and when converting "little" to "big", you must divide.

- Pre-teach any concepts that the student may not yet fully understand (big/little, same/different, etc.). Preplan a piece of information for the student to contribute.

b. Exit Assessment –

1) Group the students in pairs.
2) Have each student come up with a (metric) conversion problem and write it on his/her whiteboard.
3) Have students exchange whiteboards with their partners and solve their partners' problem.
4) Have each pair present both of their problems and answers to the class and explain how they solved them.

Additional Considerations for Emerging Readers and Emerging Communicators

2) Allow the student to write a conversion problem using any of the supports or accommodations that he/she used in previous activities in this unit (once a student demonstrates that a support of any kind is successful in helping him/her learn, it is important to use that same support whenever appropriate; consistency is important).
   - Give the student a chance to do this independently (this is assessment, so it is important to determine the accuracy of the student's independent performance).
     - If the student cannot do this step independently, assist as necessary so the other student has a correct problem to solve.
3) Allow the student to solve the partner's conversion problem using any of the supports or accommodations that he/she used in previous activities in this unit (once a student demonstrates that a support of any kind is successful in helping him/her learn, it is important to use that same support whenever appropriate; consistency is important).
   - Give the student a chance to do this independently (this is assessment, so it is important to determine the accuracy of the student's independent performance).
     - If the student cannot do this step independently, make a note of this and assist as necessary so the problem is solved correctly.
4) Have the student point to each step of the equation sequentially. Have the student present his/her solution digitally using AT.

Measurement Unit

Lesson #4

Objectives

- Students will be able to distinguish between perimeter and area.
- Students will be able to calculate perimeter and area.
- Students will be able to relate the concepts of area and perimeter to real life situations.

Essential Questions

- What is perimeter, and how is it calculated?
- What is area, and how is it calculated?
- How could perimeter and area be used in real life situations?

Vocabulary

Area – the amount of space an object occupies

Centimeter – a standard unit of length in the metric system equal to 1/100 of a meter

Foot – a standard unit of length in the US Customary system equal to 12 inches

Inch – a standard unit of length in the US Customary system equal to 1/12 of a foot

Length – a measurement of the distance from one point to another

Measure – to determine a quantity/amount

Measurement – a determined quantity/amount

Meter – a standard unit of length in the metric system equal to 100 centimeters

Perimeter – the distance around a figure along its edges

Quantity – an amount of something

Rectangle – a 4-sided figure in which opposite sides are equal and angles measure 90º

Ruler – a wooden or plastic tool used to measure lengths up to 12 inches

Square – a figure that has four equal sides and angles that measure 90º

Standardized – the same

Tape Measure – a tool consisting of a flexible ribbon of cloth or metal used to measure lengths up to several feet

Unit – a set amount used to consistently determine quantities

US Customary System of Measurement – a system of measurement that includes units such as inches, feet, yards and miles (for length); also referred to as imperial units or English units; This system is not commonly used outside of the United States.

Width – measurement of the distance from one side or edge to the opposite side or edge

Yard Stick – a usually wooden tool used to measure lengths up to 3 feet (1 yard)

Materials

- Masking or painter's tape
- Math journals
- Index cards (Each student will get one card. Some cards should have a "P" on them, while others should have an "A" on them. It is recommended that you have more "A" cards than "P" cards.)
- Chart paper
- Lesson 4 Perimeter Area PowerPoint presentation (print out slides for the students)
- Lesson 4 Practice Perimeter Area PowerPoint presentation (do not need to print out the slides for the students, but if you do remove the answers from the slides)
- Whiteboards and dry erase markers
- Lesson 4 Practice Worksheet document printed for each student
- Grid paper
- Lesson 4 Word Problem document printed for each student

Introduction

a. Activate Previous Knowledge

1) Using masking or painter's tape, tape off a large rectangle on the classroom floor. *(If you still have the tape on the floor from Lessons 1 and 2, you could just use that initial line as one of the sides of the rectangle. If you need more space than you have available in your classroom, you could do this activity in the cafeteria or gym.)*
2) Divide the class into two groups. Give each student in the first group an index card with the letter "P" written on it. Give each student in the second group an index card with the letter "A" written on it. *(It is a good idea to have more students in the "A" group than in the "P" group.)*
3) Have the students in the "P" group get up and walk along/on the taped edges of the rectangle while the students in the "A" group watch.
4) Have the students in the "A" group get up and fill the inside space of the rectangle while the students in the "P" group watch.
5) Ask the students, "What is the difference between the "P" group and the "A" group?
6) Explain to the students that the "P" group demonstrated the word perimeter whereas the "A" group demonstrated the word area.
7) Have the students verbally come up with definitions for perimeter and area, and write those definitions on chart paper to be displayed in the classroom.

Additional Considerations for Emerging Readers and Emerging Communicators

If the student has had little to no experience with the concepts of perimeter and area or the skill of calculating perimeter and area, it might be helpful to provide instruction using the ***Lesson 4 Concept Reinforcement Activity (CRA)*** *prior to teaching the Introduction to Lesson 4.*

1) Provide a graphic representation, enhanced with tactile (e.g. outlined with glue, rough and smooth textures) and color qualities (e.g. perimeter in pink, area in blue) as appropriate, of the area and perimeter of the taped off section of the floor. A picture frame with a think frame could be used as a model of perimeter and area.
2) No accommodations.
3) No accommodations.

4) No accommodations.
5) Provide vocabulary options (word bank) for the student to choose from ("perimeter"", area"", outside", "inside", "more", "less", etc.). Put them in a format that allows the student to use his/her preferred mode of communication, including AAC and/or AT.
6) As the teacher explains, show the student the concepts on his/her graphic representation.
7) Have the student put the class definitions of perimeter and area in his/her math journal. The student can enter the definitions by writing, tracing (if the student is working on fine motor skills), keyboarding, drawing, cutting and/or pasting pictures, symbols, icons, text, selecting pictures, symbols, icons, text, tactile representations, concrete objects or any combination of those which a partner scribes, or saving symbols, icons, pictures, etc. into a digital journal using assistive technology.

Body

1) Present the students with the Lesson 4 Perimeter Area PowerPoint presentation. (The presentation is scripted, so be sure to consult the speaker's notes before you begin for information concerning how the animations are sequenced as you explain each step.) Provide the students with handouts of the PowerPoint. The presentation guides students in:
    a. finding perimeter of a square given the lengths of all four sides
    b. finding perimeter of a square given only one length
    c. finding area of a square using tiles and the formula for area (length x width)
    d. finding perimeter of a rectangle given the lengths of all four sides
    e. finding perimeter of a rectangle given one length and one width
    f. finding area of a rectangle using tiles and the formula for area (length x width)
2) As you go through the part of the presentation concerning rectangles, you will need to point out the difference/similarity of "length" and "width". Up until now, students have primarily been dealing with length only, so they will need to add "width" to their vocabulary.
3) Be sure to note the importance of including the appropriate units when providing answers to perimeter and area problems (i.e., perimeter = in vs. area = in^2).

Additional Considerations for Emerging Readers and Emerging Communicators

1) Provide a copy of the PowerPoint.
    - Enhance with tactile qualities as necessary.
    - Provide the PowerPoint digitally with animations and sound.
    - Guide the student through his/her PowerPoint copy, presenting graphic or tactile representations of salient vocabulary (e.g., perimeter, area, names of shapes, length, width) as needed. Provide a model or template of the formulas as they are discussed on the slides
    - Provide a 3-dimensional representation that the student can manipulate during the presentation, such as a geoboard or pegboard that can be altered to reflect the shapes in the PowerPoint where pegs can be used to count perimeter and the grid cells to count area. Cubes or tiles might also be used to fill in the area.
    - Provide a personal digital device that can be programmed with the shapes from the PowerPoint, and have the student manipulate the perimeter and area measurements, with or without AT.
    - Allow student to use a calculator (talking, large button, etc.) to mirror the calculations during the PowerPoint.
    - Have the student place tiles or cubes used in the perimeter/area demonstrations on a number line to count to the correct answer.
2) Have the student put the definitions of length and width in his/her math journal. The student can enter the definitions by writing, tracing (if the student is working on fine motor skills), keyboarding, drawing, cutting and/or pasting pictures, symbols, icons, text, selecting pictures, symbols, tactile representations, concrete objects, or any combination of these which a partner scribes, or saving symbols, icons, pictures, etc. into a digital journal using assistive technology.
3) Have the student add to the definition of area that area is always stated as square units and that exponent of 2 is used to when recording area. Have the student use the same strategy as in 2) above to add this information to the math journal.

Practice

1) Present the students with the Lesson 4 Practice Perimeter Area PowerPoint presentation. *(You do not necessarily need to give handouts of this one. If you do, remember to remove the answers from the slides before printing.)*
    a. Each slide presents the students with a perimeter and/or area problem.
    b. Students are asked to use the information provided to find the perimeter and/or area as shown. (Remind students they may refer to their PowerPoint notes. You should point out that the figures shown on screen are to scale drawings.)
    c. Students are asked to write and complete each problem on their whiteboards.
2) Have students complete the Lesson 4 Practice Worksheet individually.
    a. There are only 4 problems on the worksheet.
    b. Remind the students that they may refer to their PowerPoint notes if needed.
    c. Students may show their work in the blank space on the worksheet or on a separate sheet of paper.
    d. Remind students to include the appropriate units in each of their answers.

Additional Considerations for Emerging Readers and Emerging Communicators

1) Provide models for the problems that the student can use to find perimeter and area.
    - Provide templates with the formulas for area and perimeter, which the student can use to "write the problems". Students may also choose which formula is needed to solve for area/perimeter (touching, moving, selecting, etc.).
    - Prewrite the problems on the whiteboard.
    - Provide the problems digitally and allow the student to solve the problems digitally. Allow the student access to the digital problems using assistive technology.

- Provide math function options for the student to choose from. Allow the student to use a calculator (traditional or digital, talking, large button, etc.) to solve the problems.
- Provide number cards that the student can use as answers for the problems instead of writing them.

2) Adapt the worksheet to include needed supports.

- Provide a formula template for the student to complete.
- Provide the shapes drawn on grid paper so that the student may count versus calculate.
- Provide cutouts of grid units or other manipulatives that the student can use to solve for area and perimeter.
- Provide number cards that the student can use as answers for the problems instead of writing them.
- Provide visual cues to help the student distinguish between length and width (i.e., graphic representation with arrow up to indicate length and arrow right indicating width).
- Allow the student to use a calculator (traditional or digital) to solve the problems.
- Reduce the number of problems to solve, remembering that the student may need extra practice at a later time.
- As this is still instructional, not assessment, provide guidance so that the student completes the worksheet correctly. Techniques such as errorless learning and systematic instruction could be used.

Closure

a. Revisit/Review Lesson and Objectives –

1) Remind students that the goal for this lesson was to learn the difference between perimeter and area as well as how to "find" perimeter and area of squares and rectangles.

2) Review the definitions of perimeter and area that were charted at the beginning of the lesson. Ask the students to verbally explain any additional information they learned about perimeter and area throughout the lesson (e.g., perimeter is calculated in units, area in squared units; when calculating perimeter and area of a square, you really only need to know the length of one side since

all four sides are the same; when calculating the perimeter and area of a rectangle, you really only need to know the length of one side and the width of one side since opposite sides are the same, etc.)

Additional Considerations for Emerging Readers and Emerging Communicators

1) - 2) Provide access to math journal and PowerPoint presentations. Assist the student in finding the review information as the teacher goes over it and the class discusses. Provide answer options to the questions. Have the student select an answer(s) and use his/her preferred mode of communication to contribute to the review. Pre-plan a question and answer for the student to contribute.

b. Exit Assessment

1) Have each student draw a square or a rectangle on a sheet of grid paper and illustrate the difference between perimeter and area (e.g., outline the figure in one color to demonstrate perimeter, and shade the inside of the figure in another color to demonstrate area).

2) Provide each student with a copy of the Lesson 4 Word Problem document. Read the problem to the students, and have the students solve the problem in their math journals. (You'll go over the problem and its answer at the beginning of the next and final lesson in this unit.)

Jane and Luis are in charge of the 4th grade booth at their school's Spring Festival, which will be held on the school's parking lot. Space on the parking lot is very limited, and so the parking lot has been divided so that each grade will have a section that measures only 2 feet by 3 feet. Jane and Luis want to make sure they will have room for their popcorn popper and snow cone machine as well as the serving table.

A) What is the perimeter of class' section of the parking lot?

B) Convert the perimeter of the class' section into inches.

C) What is the area of the class' section of the parking lot?

D) Which is likely more helpful to Jane and Luis in determining whether or not they have enough space for all of their equipment—knowing the perimeter of their section or knowing the area of their section? Why?

E) Based on your calculations, do you think Jane and Luis will have enough room for the popcorn popper, the snow cone machine, and the table? How do you know?

Additional Considerations for Emerging Readers and Emerging Communicators

1) Provide grid paper (enlarged or raised line if either of those has been used successfully by the student during instruction) on which the student should draw a square or rectangle.

    - Allow the student to trace the square or rectangle (shape and size should be the student's choice).
    - Allow the student to create or select shape, digitally using AAC and/or AT.

    Have the student indicate where the perimeter and area would be found or measured.

    - This could be done verbally/vocally, by touch, selection from an indicated choice (e.g., "Is this the perimeter or is this the perimeter?"), outlining, coloring, digitally, etc.
    - Allow the student to use the method of performance that will give him/her the most success. For instance, if the student has difficulty with fine motor skills, he/she might indicate more successfully by answering questions (including use of AAC/AT) rather than coloring. After a successful response, the student may want to color or highlight as well, but the accuracy of the response would be on the answer given, not the ability to highlight or color.
    - Since this is now assessment and not instruction, it is important to assess the student's independent performance. If the answer is incorrect, he/she can be prompted to give a correct performance, but the data should reflect the student's independent (incorrect) response.

2) Provide an adapted story problem worksheet:

    a. read the problem to the student
    b. simply/summarize text of story problem
    c. highlight the important information
    d. provide a graphic or 3-dimensional representation of the problem (with manipulatives if necessary)
    e. provide formulas for perimeter and area
    f. provide visual cues for determining perimeter and area

g. provide answer selections for the student to choose from (these should include plausible distractors or incorrect answers, the number of which could vary from student to student)

h. provide a number line

i. provide a conversion chart

Provide and allow the student to use any of the accommodations or supports he/she used in this lesson (Lesson 4), Practice 2) to solve the problem. Reduce number of questions required for assessment. Since this is now assessment and not instruction, it is important to assess the student's independent performance. If the answer is incorrect, he/she can be prompted to give a correct performance, but the data should reflect the student's independent (incorrect) response.

Measurement Unit
Culminating Activity

Materials

- Math journals
- Lesson 4 Word Problem document (just for reference)
- Unit Review PowerPoint presentation
- Whiteboards and dry erase markers
- 10 Activity Stations (may use sidewalk chalk, tape, poster board, bulletin board paper, etc. to present the squares and rectangles to the students)
- Rulers with inches on one side and centimeters on the other (one for each student)
- Tape measure, yard stick, meter stick (ideally, one for each of the 10 stations)
- Culminating Assessment Worksheet
- 1 ft^2 pieces of poster board (one for each student) *This is only if you have the students do the final mural activity.*

Introduction

b. Activate Previous Knowledge

1) Have students open their math journals to their answers for the Lesson 4 Word Problem they were to complete as an exit assessment for Lesson 4. Reread the word problem to the students, and then go through each question, polling the class to see what their answers were and why. Have students correct any mistakes.
2) Have students play the Unit Review PowerPoint game. (They can write their answers, which will all be either True or False, on their whiteboards.)
3) As the students play the game, be sure to take time to review each concept pertaining to each slide. Refer students to their PowerPoint notes from the previous lessons.

Additional Considerations for Emerging Readers and Emerging Communicators

1) Provide math journal, Lesson 4 Word Problem worksheet (adapted version used in Lesson 4, Exit Assessment 2), and any supports or accommodations the student used in completing the worksheet. Go through each section of the problem and solution as the teacher reviews.
2) Provide a copy of the PowerPoint with or without text-based symbols. Provide interactive graphics on the PowerPoint as appropriate. For instance, slide 2 could have scaled representations of an inch and a foot that wobble when clicked. Provide true and false text cards (with or without symbols for the student to choose from). Rephrase the questions as appropriate (and provide different answers to choose from if the rephrased questions require those). For example, Slide 2 could be rephrased as, "Which is bigger - an inch or a foot?" requiring the answer choices to be "inch" and "foot"; or it could be rephrased as, "Is an inch bigger than a foot?" requiring the answer choices to be "yes" and "no". Allow the student to answer using his/her preferred mode of communication.
3) Provide PowerPoint notes from previous lessons. Provide any supports previously used in those lessons so the student can use them again as the teacher reviews the concepts.

b. Establish Goals/Objectives for the Activity

1) Explain to the students that they are going to complete some problems involving all of the skills they have learned throughout this unit:
    - measuring in US Customary Units (inches/feet)
    - converting US Customary Units (inches/feet)
    - measuring in metric units (centimeters/meters)
    - converting metric units (centimeters/meters)
    - calculating perimeter of squares and rectangles
    - calculating area of squares and rectangles

Additional Considerations for Emerging Readers and Emerging Communicators

1) Provide any supports including definitions, examples, and materials or tools regarding the concepts of inches, feet, centimeters, meters, perimeter, area, squares, and rectangles to remind the student of these during the review.

Body

1) Set up 10 stations (considering the amount of space you have available, this could be done outside using sidewalk chalk, inside using tape on the floor, or you could cut out squares and rectangles using poster board and post them on the wall/bulletin board, etc. You could also cut out the squares and rectangles using bulletin board paper then set up the stations along the wall in a hallway or in a room that has enough space for the figures and the students).
    - Station #1 – a 5 cm square
    - Station #2 – rectangle that is 5 ft. by 7 ft.
    - Station #3 – rectangle that is 3 in by 1 in
    - Station #4 – a 4 in square
    - Station #5 – a 2 m square
    - Station #6 – a rectangle that is 2 m by 4 m
    - Station #7 – an 8 in square
    - Station #8 – a rectangle that is 11 cm by 10 cm
    - Station #9 – a 7 cm square
    - Station #10 – a rectangle that is 11 in by 9 in
2) At each station, each student will be tasked to
    a. choose an appropriate measurement tool (ruler marked in inches on one side and centimeters on the other, yard stick/meter stick, tape measure);
    b. measure the given figure (length and width);
    c. calculate the perimeter of the figure;
    d. calculate the area of the figure

    Students should record their work and answers in their math journals. They may refer back to their PowerPoint notes from previous lessons.
3) Students should circulate until they have each been to all 10 of the stations and have recorded their answers in their math journals.
4) As a class, go to each station, have a student demonstrate how he/she measured the figure and explain how he/she calculated the perimeter and area of the figure. (Select a different student for each station.)

Additional Considerations for Emerging Readers and Emerging Communicators

1) Provide tactile qualities and color to shapes as appropriate.
2) Stations: (Follow the same instructional procedures as used in Lesson 1-Practice,3)

   a. Allow student to select, using his/her preferred mode of communication (eye-gaze, verbal, touch, sign, written, speech generating device, assistive technology, etc.), a measuring tool at each station. Depending on the student's skill at selecting an appropriate tool, the number of tools offered could vary:

      - two tools for a student who has difficulty with selection;
      - several tools for a student who can make a selection; or
      - the "appropriateness" could vary from widely discrepant (e.g., six inch ruler vs. yardstick) to more discreet differences (e.g., six inch ruler vs. 12-inch ruler).

   Provide effective accommodations to the materials such as those found in Lesson 1-Body 2), adapted materials:

      - a ruler with tactile qualities or a piece of paper;
      - digital rulers;
      - bendable/foldable rulers;
      - tactile rulers;
      - transparent/translucent rulers;
      - simplified rulers with only inches marked; and
      - rulers adapted with hook-and-loop tape or a "handle".

   b. Other effective adaptations include laminated card. He/she should be allowed to manipulate the tool(s) with the provision of decreasing physical assistance and to mirror the skill (similar to those found in Lesson 1 – Introduction a. 2 -place a manipulative in a container every time the tool moves, place a tick/tally mark on paper every time the tool moves, etc.)

   c. and d. When solving for area and perimeter, provide the student with the same, consistent supports as used in previous lessons.

- Provide a formula template for the student to complete.
- Provide the shapes drawn on grid paper so that the student may count versus calculate.
- Provide cutouts of grid units or other manipulatives that the student can use to solve for area and perimeter.
- Provide number cards that the student can use as answers for the problems instead of writing them.
- Provide visual cues to help the student distinguish between length and width (i.e., graphic representation with arrow up to indicate length and arrow right indicating width).
- Allow the student to use a calculator (traditional or digital) to solve the problems.

Journals:

The student can record instances where he/she might need to measure and corresponding measuring tools selected in his/her journal using his/her preferred mode of communication (verbal, sign, written, speech generating device to select (by touch, eye-gaze, assistive technology, etc.) from multiple options (presented by text, symbols, pictures, tactile representations, concrete objects, or any combination of these, etc.)].

The student can record these measuring tools in his/her journal by:

- writing,
- tracing (if the student is working on fine motor skills),
- keyboarding (in a digital journal),
- drawing, cutting and/or pasting pictures, symbols, icons, text, or any combination of those.

The student selects pictures, symbols, icons, text, tactile representations, concrete objects, or any combination of these which a partner scribes, saving symbols, icons, pictures, etc. into a digital journal using assistive technology.

Be consistent in the supports the student uses for journaling; refer back to the accommodations the student used in Lesson 1 – Introduction a. 5).

3) Follow the same instructional procedures and provide supports throughout each station.

4) Student should demonstrate by utilizing the same procedures and supports used throughout this activity and unit. Students should use their communication system and any new vocabulary from this unit, to explain how they solved for area and/or perimeter.

Final Assessment

1) Students will individually complete an assessment worksheet whereby they will utilize the skills learned throughout this unit. *See Culminating Assessment Worksheet document.*

2) The worksheet contains three sections: a section whereby students must convert units, a section whereby the students must measure a rectangle and find its perimeter and area (then convert the perimeter from inches to feet), and a final section that presents the students with a story problem.

   • After solving the story problem, you could have the students do the activity described in the problem. Provide each student with a 1-square foot piece of paper and instruct each student to draw a picture of himself/herself. Collect the finished drawings as they turn in their finished worksheets, and piece the drawings together to make either a large square or rectangle, depending on the number of students in the class. If you have an odd number of students in the class, complete a block for yourself so that the completed mural will be a square or a rectangle. Once the mural is complete, have the students calculate the perimeter and area of the mural by counting the individual blocks.

Additional Considerations for Emerging Readers and Emerging Communicators

1) Provide adapted worksheet:
   - with or without symbol-based text
   - fewer problems
   - less difficult problems selected

2) Follow the same procedures as found in
   - (for worksheet section on conversions) Lesson 3- Practice 1)
   - (for worksheet section on perimeter/area) Lesson 4- Practice 2)
   - (for worksheet section on solving word problems) Lesson 4- b. Exit Assessment 2)