

Graphic Representation of Data
Grade 3

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Activity/Lesson Title: Seasons Picture Graphs/Bar Graphs (Lesson 1)

Learning Goals for Students:

- Students will organize data in either a picture graph or a bar graph based on their favorite seasons.
- Students will create a picture graph or bar graph, making straight columns with equal spacing and labeling the axes (attending to precision).
- Students will collect the data based on favorite seasons to create either a picture graph or bar graph.
- Students will construct viable arguments and critique the reasoning of others (MP3).
- Students will attend to precision (MP 6).

Description: The chosen concept was Graphic Representations of Data, specifically for the third grade. In 3rd grade, this learning experience allows students to identify two ways of drawing a scaled picture graph and a scaled bar graph to represent a data set with several categories and solving one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. This learning experience, also, allows students to show the data by making a graph, where the horizontal and vertical scales are marked off in appropriate units and correct labels.

In this learning experience, students are connecting the concept to their everyday lives through sharing their favorite seasons. The students are taking an active role in the data collection and creation of the graph. They are, also, given the opportunity to critique and provide feedback to other groups within the classroom setting.

CCSSM Grade-Level Standards:

CCSS.MATH.CONTENT.3.MD.B.3: Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. For example, draw a bar graph in which each square in the bar graph might represent 5 pets.

CCSS.MATH.CONTENT.3.MD.B.4: Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.

Justification: The two most relevant Mathematics Practice(s) in the Learning Experience are: *constructing viable arguments and critiquing the reasoning of others* (MP3) and *attending to precision* (MP6).

Mathematical Practice 3 states that students will construct viable arguments and critique the reasoning of others. "The students will justify their conclusions, communicate them to others, and respond to the arguments to others. Elementary students can construct arguments using concrete referents

such as objects, drawings, diagrams, and actions." (Common Core, <http://www.corestandards.org/Math/Practice/>). Within this activity, as a whole group, students will practice these expectations.

Mathematical Practice 6 states that students will attend to precision. Students will be "careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. In the elementary grades, students give carefully formulated explanations to each other." (Common Core, <http://www.corestandards.org/Math/Practice/>)." In this activity, as a whole group, students will be labeling axes and titling the graph, and explaining where to place the data in relation to each other.

Materials/Handouts: Post-it Notes, chart paper/poster board, markers, pencils, magnets or tape, pictures of the seasons (multiple copies of each), rulers/yard sticks, The Great Graph Contest by Loreen Leedy

Procedure/Guiding Questions:

- As students come into class, have them write down their favorite season on a Post-It note and place it somewhere on the whiteboard/chalkboard.
- Read The Great Graph Contest by Loreen Leedy.
- Based on the information from the book, ask them how each response should be organized or grouped.
- Organize/group the Post-Its by favorite seasons.
- Discuss the difference between a picture graph and a bar graph. Also, discuss the importance of equal spacing, titling, and labeling.
- As a class, generate an example of each graph, using the favorite season data. Have students come up and assist in the creation of the graphs. Use the season pictures to help create the picture graph. Ask questions regarding one more and one less.
- Discuss different types of data that is represented in each graph.
- *Exit Ticket:* Have students journal 3 things they learned about picture graphs and bar graphs, 2 questions they would like to have answered based on the two graphs, and 1 possible graphing idea or 1 question they could ask their peers.

Adaptations:

- Have a pictograph and a bar graph from another class as an example for the students to see.
- *Assessment Idea:* Have students write a letter to someone else (i.e., peers, principal, parents, etc.) explaining picture graphs and bar graphs.
- *Assessment Idea:* Summarize the lesson in at least 3 sentences.

Learning Experience Assessment Plan: Have students journal 3 things they learned about picture graphs and bar graphs, 2 questions they would like to have answered based on the two graphs, and 1 possible graphing idea or 1 question they could ask their peers

Activity Source: Jennifer and Jenni

Activity/Lesson Title: What is your favorite pizza topping? (Lesson 2)

Learning Goals for Students:

- Students will organize data in either a picture graph or a bar graph based on their favorite pizza toppings.
- Students will create a picture graph or bar graph, making straight columns with equal spacing and labeling the axes (attending to precision).
- Students will collect the data of favorite pizza toppings to create either a picture graph or bar graph.
- Students will construct viable arguments and critique the reasoning of others (MP3).
- Students will attend to precision (MP6).

Description: The chosen concept was Graphic Representations of Data, specifically for the third grade. In 3rd grade, this learning experience allows students to identify two ways of drawing a scaled picture graph and a scaled bar graph to represent a data set with several categories and solving one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. This learning experience, also, allows students to show the data by making a graph, where the horizontal and vertical scales are marked off in appropriate units and correct labels.

In this learning experience, students are connecting the concept to their everyday lives in that pizza is a meal at school. The students are taking an active role in the data collection and creation of the graph. They are, also, given the opportunity to critique and provide feedback to other groups within the classroom setting.

CCSSM Grade-Level Standards:

CCSS.MATH.CONTENT.3.MD.B.3: Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. For example, draw a bar graph in which each square in the bar graph might represent 5 pets.

CCSS.MATH.CONTENT.3.MD.B.4: Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.

Justification: The two most relevant Mathematics Practice(s) in the Learning Experience are: *constructing viable arguments and critiquing the reasoning of others* (MP3) and *attending to precision* (MP6).

Mathematical Practice 3 states that students will construct viable arguments and critique the reasoning of others. "The students will justify their conclusions, communicate them to others, and respond to the arguments to others. Elementary students can construct arguments using concrete referents

such as objects, drawings, diagrams, and actions." (Common Core, <http://www.corestandards.org/Math/Practice/>). Within this activity, students will practice these expectations.

Mathematical Practice 6 states that students will attend to precision. Students will be "careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. In the elementary grades, students give carefully formulated explanations to each other." (Common Core, <http://www.corestandards.org/Math/Practice/>)." In this activity, students will be labeling axes and titling the graph, and explaining where to place the data in relation to each other.

Materials/Handouts: poster board/chart paper, markers, pencils, rulers/yard sticks, magnets

Procedure/Guiding Questions:

- As students come into the classroom, have the students write down their favorite pizza toppings on chart paper.
- Group students into 4 or 5 different small groups.
- Assign each group a way to represent the pizza toppings (bar graph or picture graph, 2 or 3 groups of each).
- Provide each group with chart paper/poster board, markers, pencils, rulers/yard sticks. Allow students to create the graphs for approximately 20-30 minutes. During this time, teacher will walk around the room asking guiding questions, monitoring progress, and clarifying any confusion. Prompt students by asking one more or one less.
- Once the graphs have been completed, have students hang them on the whiteboard/chalkboard. Each group needs to share about their graph and the process they took to create it. Other groups can provide feedback to each graph; ask the students if they agree or disagree with each representation.
- Answer some questions students may have from their journaling activity from Lesson 1.
- *Exit Ticket:* Individually, journal comparisons between each graph in at least 3 sentences or have at least 3 comparisons.

Adaptations:

- Do this activity as a class. Then, give each group a different set of data with pizza toppings and have them create what graph may be the best representation.

Learning Experience Assessment Plan: journal comparisons between each graph in at least 3 sentences or have at least 3 comparisons.

Activity Source: Jennifer and Jenni

Activity/Lesson Title: Create-a-Graph (Lesson 3)

Learning Goals for Students:

- Students will organize data in either a picture graph or a bar graph based on their given set of data.
- Students will create a picture graph or bar graph, making straight columns with equal spacing and labeling the axes (attending to precision).
- Students will construct viable arguments and critique the reasoning of others.
- Students will model with mathematics.

Description: The chosen concept was Graphic Representations of Data, specifically for the third grade. In 3rd grade, this learning experience allows students to identify two ways of drawing a scaled picture graph and a scaled bar graph to represent a data set with several categories and solving one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. This learning experience, also, allows students to show the data by making a graph, where the horizontal and vertical scales are marked off in appropriate units and correct labels.

In this learning experience, students are applying their knowledge of picture graph and bar graphs to a given situation. The students are taking an active role in the creation of the graph. They are, also, given the opportunity to critique and provide feedback to other groups within the classroom setting.

CCSSM Grade-Level Standards:

CCSS.MATH.CONTENT.3.MD.B.3: Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. For example, draw a bar graph in which each square in the bar graph might represent 5 pets.

CCSS.MATH.CONTENT.3.MD.B.4: Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.

Justification: The two most relevant Mathematics Practice(s) in the Learning Experience are: *constructing viable arguments and critiquing the reasoning of others* (MP3) and *attending to precision* (MP6).

Mathematical Practice 3 states that students will construct viable arguments and critique the reasoning of others. "The students will justify their conclusions, communicate them to others, and respond to the arguments to others. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions." (Common Core, <http://www.corestandards.org/Math/Practice/>). Within this activity, in small groups with provided data, students will practice these expectations.

Mathematical Practice 6 states that students will attend to precision. Students will be "careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. In the elementary grades, students give carefully formulated explanations to each other." (Common Core, <http://www.corestandards.org/Math/Practice/>)." In this activity, in small groups with provided data, students will be labeling axes and titling the graph, and explaining where to place the data in relation to each other.

Materials/Handouts: chart paper/poster board, markers, pencils, rulers/yard sticks, sets of data

Procedure/Guiding Questions:

- Separate students into 4 or 5 groups. Distribute 1 set of data (different data sets for each team) to each team to create their graph and data chart.
- Give students 20-30 minutes to display their given data in either a picture graph or bar graph. Monitor students, clarify any questions, and ask guided questions. Prompting one more, one less with monitoring.
- Once the graphs have been completed, have students hang them on the whiteboard/chalkboard. Each group needs to share about their graph and the process they took to create it. Other groups can provide feedback to each graph; ask the students if they agree or disagree with each representation.
- *Assessment Plan:* Have each group represent their data in a different format than their original graph (keeping it either as a picture graph or bar graph).

Adaptations:

- Students could create their graphs using the adjusted increments (bars or pictures represent different units).
- Provide students with a pre-made graph with an error in it. Require them to identify the error and how to correct the error that was made.

Learning Experience Assessment Plan: Have each group represent their data in a different format than their original graph (keeping it either as a picture graph or bar graph).

Activity Source: Jennifer and Jenni

Activity/Lesson Title: Prove it! (Lesson 4)

Learning Goals for Students:

- Students will organize data in either a picture graph or a bar graph based on their favorite seasons.
- Students will create a picture graph or bar graph, making straight columns with equal spacing and labeling the axes (attending to precision).
- Students will collect the data based on favorite seasons to create either a picture graph or bar graph.
- Students will attend to precision (MP6).
- Students will model with mathematics (MP4).

Description: The chosen concept was Graphic Representations of Data, specifically for the third grade. In 3rd grade, this learning experience allows students to identify two ways of drawing a scaled picture graph and a scaled bar graph to represent a data set with several categories and solving one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. This learning experience, also, allows students to show the data by making a graph, where the horizontal and vertical scales are marked off in appropriate units and correct labels.

In this learning experience, students are applying their knowledge of picture graph and bar graphs to a given situation. The students are taking an active role in the data collection and creation of the graph. They are, also, given the opportunity to showcase their knowledge of surveying or collecting data and picture graphs and bar graphs.

CCSSM Grade-Level Standards:

CCSS.MATH.CONTENT.3.MD.B.3: Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. For example, draw a bar graph in which each square in the bar graph might represent 5 pets.

CCSS.MATH.CONTENT.3.MD.B.4: Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.

Justification: The two most relevant Mathematics Practice(s) in the Learning Experience are: *modeling with mathematics* (MP4) , and *attending to precision* (MP6).

Mathematical Practice 4 states that students will model with mathematics. The students will "are able to identify important quantities in a practical situation and map the relationships using tools, such as diagrams, tables, and graph. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of

the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose." (Common Core, <http://www.corestandards.org/Math/Practice/>). Within this activity, students will practice these expectations independently.

Mathematical Practice 6 states that students will attend to precision. Students will be "careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. In the elementary grades, students give carefully formulated explanations to each other." (Common Core, <http://www.corestandards.org/Math/Practice/>)." In this activity, students will independently be labeling axes and titling the graph, and explaining where to place the data in relation to each other.

Materials/Handouts: paper (graph paper), rulers, pencils, colored pencils, markers, crayons

Procedure/Guiding Questions (*This activity is meant to be the assessment for the unit*):

- Provide students with many different topics (i.e., favorite singer, favorite subject, favorite food, favorite sport) and have them survey 10-15 peers.
- Once they have their data, allow students to choose between a picture graph or a bar graph. Monitor students by moving around the room, clarifying questions, and asking guided questions. Prompting one more, one less with monitoring.
- Students will hand in finished product for grading.

Adaptations:

- Have students create the other graph (either picture graph or bar graph) for homework or if they finish early based on their survey.
- For students who would like a challenge, have them create one of the graphs showing different increments.

Learning Experience Assessment Plan: Entire Lesson and Finished Product

Activity Source: Jennifer and Jenni

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4th Grade Math - Divisibility Rules
MTI July 2015

Objectives OTES: FOCUS FOR LEARNING [Standard 4: Instruction]	Students will be able to: • 4.OA.B.4 Students will be able to identify the factors which can be used to divide a given number. • 4.OA.C.5 Generate and analyze patterns in justifying factors used in division. • MP7 Look for and make use of structure • MP8 Look for and express regularity in repeated reasoning. I can statement here: • I can use my knowledge of factors to divide a given number.
Standards and/or Competencies	• 4.OA.B.4 Students will be able to identify the factors which can be used to divide a given number. • 4.OA.C.5 Generate and analyze patterns in justifying factors used in division. • MP7 Look for and make use of structure • MP8 Look for and express regularity in repeated reasoning.
Materials Needed	<i>Activity 1: Uncover the Rules</i> • 100 number boards • Sieve of Eratosthenes - book, video etc. • Counters • counting beans • Students can access any resource materials in the room (math book, dictionary, vocabulary books) - no calculators • chart paper • markers <i>Activity 2: Locker Game (illustrativemathematics.org)</i> • lockers or paper to represent lockers • Grid on desk with two colored counters <i>Activity 3: Make me Smaller</i> • die (or cards 1-9) • slate and marker • hundreds board from first activity visible in the room <i>Activity 4: Pirate Game</i> http://www.math4childrenplus.com/divisibility-classroom-

	<u>pirate-game/</u> • <i>online practice - there are two teams. A number comes up, which the student must decide if that number is divisible by a given number to score a point. Goes up to thousands.</i> <i>The following web site has similar activities and resources you can pull for the</i> <i>above:</i> <u>https://www.nsa.gov/academia/files/collected_learning/elementary/arithmetic/march_dividing_ant.pdf</u> <i>Extension resources:</i> • <i>book - Remainder of One by Elinor Pinczes</i>
Procedure	Activity 1 • <i>Present learning objective - Today we will be exploring how factors and multiples relate to division.</i> • <i>Divide students into groups of 2-4. Give each group a hundreds board and colored stickers (1 for each factor). Have students put a sticker on each number that is a multiple of that factor; eg. blue sticker = 2 and would be placed on all numbers that are multiples of 2. Have students look for patterns that they see in the stickers on the board.</i> • <i>Come back together whole group and discuss the patterns that groups discovered. Use to make up chart of divisibility rules.</i> • <i>Roll two die and have students test their rules - may use counters at tables if needed.</i> Activity 2 • <i>see the websites for detailed instructions for the game (recommend increasing to 50 lockers for 4th grade) <u>https://www.illustrativemathematics.org/content-standards/tasks/938</u></i> Activity 3 • <i>Pair up students and give each group 2-4 die (allows for differentiation) and dry erase boards. Students roll die and make a make a number of their choosing. On white board they write down all the numbers that the number could be divided by. If the number is prime, write prime and then see if the numbers could be rearranged to a composite number.</i> Activity 4 • <i>online game</i>

	http://www.math4childrenplus.com/divisibility-classroom-pirate-game/
Assessment OTES: ASSESSMENT DATA [Standard 3: Assessment]	How will you assess student learning for this specific lesson? • <i>formative assessment through observations and class discussions</i> • <i>Summative Assessment - March of the Ants question -</i>

4th Grade Team

Rationale including Knowledge of Students OTES: KNOWLEDGE OF STUDENTS [Standard 1: Students]	Why are you teaching this? Explain the importance of the lesson, what the students will learn and why you want them to learn this. Daneine Fields: dsf126@gmail.com Allison Shepherd: ShepherdA@louisville.k12.in.us Allison Spears: spears@nobledacademy.org Robin Miley: rmiley@ridgedaleschools.org Brandon Chung: brandoncchung@gmail.com <i>See the following:</i> • 4.OA.B.4 • 4.OA.C.5
Before & After the Lesson OTES: PRIOR CONTENT KNOWLEDGE/ SEQUENCE/ CONNECTIONS DATA [Standard 1: Students; Standard 2: Content; Standard 4: Instruction]	What came before this lesson? How does this lesson connect to previous lessons? • <i>Prior and Post lessons will vary based on the district's instructional calendar and the student population.</i> What will come next? How will this lesson lead into the next one?

Angles and their Measures

Activities

1. Book Talk
2. Angle Aerobics
 - a. Split into groups (vary by class size)
 - b. Give each group a measurement
 - c. Take picture of their estimation to use as a comparison to the actual measurement.
3. My Daily Angles (4.GA.1 and GA 2)
 - a. Provide pre made daily schedules for students to fill out. (Students will fill them out as a HW assignment)
 - b. Next Day: Partner up students to discuss their schedules and have a share out afterwards.
 - c. 4 Corners game: acute, right obtuse, straight (See attached for rules of the game)
 - i. Morning: 6:00 am – 11:59 am
 - ii. Afternoon – 12:00 pm – 5:29 pm
 - iii. Evening – 5:30 pm – 11:59 pm
 - d. Cut schedule into strips to put on angle wall.
4. Goals
 - a. For students to be able to identify angles into 4 categories
5. Mathematical Practices
 - a. Make sense of problems
 - b. Persevere in solving them
 - c. Use appropriate tools strategically
6. Materials
 - a. Schedule worksheet

- b. Clocks
- c. Scissors
- d. Glue
- e. Labels for the game

7. Procedures

- a. Students fill out daily schedule with time
- b. Students collaborate with each other about what angles the times on their schedules are.
- c. Play 4 corners to compare with whole class based off of time of day.
- d. Students place each daily time activity in the appropriate sections off the angle wall

8. Guiding Questions

- a. What is your most common type of angle?
- b. Do you notice any patterns with the types of angles throughout your day?

9. Angle Scavenger Hunt (4.MD.5 and 5a)

- a. Directions
 - i. Choose a partner in this activity you will be given the options to take pictures on a device, find pictures in magazines, books, etc., or draw your own pictures of the angles you are asked to find. You will be given 30 minutes to find 10 of the 15 items. You are free to move around the classroom. You may not travel outside of the room. Remember to use a protractor to justify your discovery.
- b. Questions
 - i. Discover or illustrate:

1. A math manipulative (right)
2. A door (acute)
3. A clock (obtuse)
4. Playground equipment (acute)
5. Graphic t-shirt (obtuse)
6. Poster (right)
7. Letter from the alphabet (acute)
8. A number (straight)
9. Two angles that will equal the measure of a right angle
10. Two angles that will equal the measure of a straight angle
11. An angle that is greater than 5 degrees
12. An angle that is less than 180 degrees
13. An angle that is exactly 90 degrees
14. An angle that is more than 30 degrees but less than 90 degrees
15. An angle that is more than 90 degrees but less than 180 degrees
16. An angle that is about 45 degrees.

c. Mathematical Practices

- i. Construct viable arguments and critique the reasoning of others
- ii. Attend to precision.

d. Materials

- i. Protractor
- ii. Hunt Handout

e. Goals

- i. Students will be able to:

1. Measure angles in whole number degrees using estimation
2. Measure angles in whole number degrees using a protractor
3. Identify acute, obtuse, right and straight angles.

f. Assessment

- i. Students will create a 4 page picture book using acute, obtuse, right, and straight angle from the scavenger hunt. Students must write a description of each angle to justify each selection.
- ii. What are the different angles you have observed so far?

g. Procedures and Guiding Questions

- i. Procedures – See Directions
 1. Students are working in partners
 2. Teacher is walking around making observations and listening to conversations.
- ii. Guiding Questions
 1. What are the different angle you have observed so far?
 2. Has anyone observed any angles that are 360 degrees?

Angle Arena

- Students will demonstrate their understanding of angles and their measurement.
- Students will demonstrate their knowledge of using a protractor.

This activity was specifically chosen as an assessment tool for an angle and their measurements unit. It incorporates angle names, angle measurements, and angles in triangles. It allows students to use their own personal experiences to complete a learning task.

This task specifically connects to the CCSSM standards and the target concept of Angles and their Measurements. It engages all students and allows students to demonstrate their knowledge without limiting them to teacher imposed restrictions.

*CCSSM- 4.GA.1 4.GA.2

One of the two most relevant Mathematical Practices is USE APPROPRIATE TOOLS STRATEGICALLY. Students must correctly use protractors to explore and demonstrate their knowledge of angles and their measurements.

The second of the relevant Mathematical practices is MAKE SENSE OF PROBLEM AND PERSEVERE IN SOLVING. Students must read directions, come up with a plan and then use angle knowledge to complete the task.

Materials needed—Page protectors, dry erase markers, arena/stadium floor plans, directions, graph paper, and protractors.

Procedure—Place a variety of floor plans in protectors. Have individuals, partners, or small groups complete activity A. Teacher will be observing and asking guided questions. Students will be working and discussing their decisions.

Then have groups/individuals display floor plans. Students must justify their decisions and be critical friends to others. Students will be critiquing each other. Teacher questions students only when needed.

During part B, students work individually. The teacher may adjust Angle Key to meet the needs of all learners.

Part B will be put in their Math Portfolio.

Angle Arena

Part A

You may work individually, with a partner, or with a team of three or four.

*Choose a floor plan. Use dry erase markers to trace the geometric figures as directed in the ANGLE KEY. Write the measurement of identified angles using a pink marker. You must be able to justify the color you used, along with the name and measurement of the figures.

Angle Key

Red---right angle

Black --- straight angle

Blue ---acute angle

Brown --- 360* angle

Yellow ---- obtuse angle

Purple --- Obtuse

Green --- acute ▲

Orange ---right ▲

After sharing your part A arena, you will be asked to complete Part B.

Part B

Individually, use grid paper to create your own arena. Your arena must include six geometric figures from the key. You must then add four other geometric figures to your angle key and arena. Please remember to name your arena.

You will be asked to share and justify your design.

Sir Cumference and the Great Knight of Angleland Activity

Learning Goals

- Introduce students to using a protractor.
- Increase awareness of angles in everyday life.
- Using angles as directions and combining angles to follow a set of directions to arrive at a destination.
- Discussing use of angles in story and the contributions this makes to the overall plot of the story.

CCS Standards for Math:

- 4.MD.5. Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement.
- 4.MD.6. Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.

Connections of Learning Experience to Concept (Angles and their Measures)

- Activity exposes students to use of angles and measurements to problem-solve. The character must use angle measures to complete the quest safely.
- Students will learn the necessity of using precise angle vocabulary and measurement to affect an outcome. The character learns the value of this through the story as will the students.

Mathematical Practices of Learning Experience

- 4. Model with Mathematics/5. Use appropriate tools strategically: The adventure the character goes on in this story must use angle directions and a protractor to solve the mystery. This application brings meaning to these procedures. This story also allows students to see angle relationships and using the relationships to problem-solve. The activity allows students to make predictions, try them out, reflect on them, and revise as needed. The story also allows students to use math to represent the events of the story.
- 6. Attend to precision: The main character of the story must be precise in his angle measures to complete his quest. The progression of the story demonstrates a need to be precise. The use of angle vocabulary must also be precise, which is demonstrated through the story as well.

Materials for Learning Experience

- Sir Cumference and the Great Knight of Angleland by Cindy Neuschwander
- Whiteboard/markers (or Smartboard)
- Document Camera if possible
- White paper and pencils for students (could use graph paper too)

Procedures

- Introduce book to students. Discuss what they remember about learning angles so far.
- Read through the first part of the story under doc camera or show pictures manually.
- Stop at page 8 and point students to the picture of the protractor. Ask them if it looks familiar at all and what they think the tool will be used for.
- Keep reading until page 9/10. Ask the students about the name of the town and the name of the mountains. Why are they named that way? Discuss the pun the author uses to name the "cute" town and the "obtuse" mountains. Relate back to pictures.

- Keep reading until page 13: read through Radius' directions poem.. Write poem on. The board. Discuss these directions with the students and through their discussion, have them draw the directions that Radius might take based on his clues (prediction).
- Read through remainder of the story and discuss Radius' moves as the story unfolds. Allow the students to revise their predictions as the story goes - discuss along the way.
- Read until page 30. Before this page, allow students to discuss the revisions they made while in groups and then have them write down their thinking progressions about the revisions. Have groups report out to class and discuss.
- Read remainder of the story. Have students journal at the bottom of their pages to the prompt: What parts of Radius' directions did. You find to be the most tricky? Did you have to revision your original picture? If yes, what did you discover you needed to change? If no, then how did you come to the conclusion that you did?

Adaptations for All Students

- For lower level students, have them complete the prediction activity in pairs or groups. Provide more scaffolding as needed by modeling the first part of the predictions activity on the board for the students.
- For higher level students, do this earlier in the unit before they have had more exposure to practice with angles to allow for more discovery.

Learning Experience Assessment Plan

- Observation based on student predictions and classroom discussion
- Assess use of thinking processes by reading journal entries after class.

Sources

- Sir Cumference and the Great Knight of Angleland by Cindy Neuschwander
- All activity ideas original to creator of this lesson

Team 1: Skycrapers, Highrises and Numbers!

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Learning Experience Concept: Factors, Multiples, Primes and Composites

Target Grade Level: 5

Activity 1: Arrays

Learning Goals:

- Create models of arrays using math tools of their choice.
- Connect vocabulary to the visual and develop/refine meanings.

How learning experience connects to the chosen concept:

Students have used arrays in third and fourth grade to represent multiplication. Connecting to their prior knowledge, arrays can be used to describe number relationships and number properties. Arrays give a clear visual to help students differentiate between factors and multiples, terms often confused. There is a difference between memorizing the definitions and actually understanding the mathematical ideas. Arrays can also help students see prime and composite numbers, rather than just rattling off the definition without thinking of the meaning.

CCSSM Grade-level Standards:

(4.OA.B.4)
5.OA.1
5.OA.2
5.NBT.5

Relevant Mathematical Practices:

MP4 ~ Model with Mathematics is relevant in that students will apply making arrays by using a picture of a building as a springboard. They will also use math tools of their choice to create arrays to help them see the connections between the vocabulary and the mathematical meaning.

MP7 ~ Look for and make use of structure applies in that students will find patterns used in multiplication and how it is related to the structure of an array.

Materials:

- color tiles or other manipulatives
- graph paper (cm)
- picture of a building with windows representing an array

Procedures/Guiding Questions:

- Present the picture of a building and ask what kids notice (lead into array).
- Talk about the array in the picture and talk about the factors and multiple. Would there be any other ways to make an array using the same multiple?
- Using math tools of their choice, students will work in groups to create arrays and share using mathematical language.
- Optional homework: find or draw a picture of an array in their environment and show how it represents multiplication, factors, multiples.

Adaptations:

Built into task with choice.

Assessment:

Observation

Sources: Investigations in Number, Data, and Space, Pearson, 2008

Activity 2: Factors of 1-100

Learning Goals:

- Create models of arrays using math tools of their choice.
- Connect vocabulary to the visual and develop/refine meanings.

How learning experience connects to the chosen concept:

Students have used arrays in third and fourth grade to represent multiplication. Connecting to their prior knowledge, arrays can be used to describe number relationships and number properties. Arrays give a clear visual to help students differentiate between factors and multiples, terms often confused. There is a difference between memorizing the definitions and actually understanding the mathematical ideas. Arrays can also help students see prime and composite numbers, rather than just rattling off the definition without thinking of the meaning.

CCSSM Grade-level Standards:

(4.OA.B.4)

5.OA.1

5.OA.2

5.NBT.5

Relevant Mathematical Practices:

MP8 ~ Look for and express regularity in repeated reasoning. Students will look for the patterns in their arrays, solidify their understanding of the commutative property, and will look for patterns among the various multiples.

MP3 ~ Construct viable arguments and critique the reasoning of others. Students will justifying why they chose their number and also defending the factor pairs and determining if they've actually found all of the factor pairs.

Materials:

- color tiles or other manipulatives (geoboards)
- graph paper (cm)
- plain paper
- the numbers 1-100 (you determine how you want students to choose a number!)

Procedures/Guiding Questions:

- Refer to the picture of a building and discuss previous work with arrays.
- Present the task: Student groups will choose a number from 1-100 that they think will have the most factors. Students will use tools of their choice to work through the task/represent their answers and thinking.
- Share findings!
- Optional homework: students are encouraged to explore the numbers not chosen to add to our knowledge!

Adaptations:

Built into task with choice.

Assessment:

Their task representations.

Sources:

Project M3: "Factors, Multiples and Leftovers", Kendall Hunt

Activity 3: Sieve of Eratosthenes

Learning Goals:

- Establish which numbers are prime and composite.
- Relate prime and composite to factors and multiples.

How learning experience connects to the chosen concept:

By using what they know about multiples students create a visual and discover/reinforce their understanding of prime and composite numbers.

CCSSM Grade-level Standards:

(4.OA.B.4)

5.OA.1

5.OA.2

5.NBT.5

Relevant Mathematical Practices:

MP6 ~ Attend to precision. Students must be precise in finding the multiples of each number in order to complete the task (find the prime numbers).

MP7 ~ Look for and make use of structure. Students will be looking for patterns in multiples and how the resulting numbers (prime) relate.

Materials:

- 100 chart
- colored pencils, markers, crayons
- chart listing directions or YouTube video (pause as needed), Khan Academy directions

Procedures/Guiding Questions:

- Follow directions per chart, or videos.
- Follow up discussion on patterns students noticed. Create an anchor chart of prime numbers.

Adaptations:

To extend: What would be the next prime number (beyond the 100's chart)? The next 5 prime numbers?

Assessment:

Exit Ticket: What did you learn about prime numbers today?

Sources:

History! Multiple ~ do a Google search!

Activity 4: I Have Factors, Multiples, Primes and Composites ~ Do You?

Learning Goals:

- Apply the concepts of factors, multiples, primes and composites.
- Engage in problem solving.

How learning experience connects to the chosen concept:

Students need a good understanding of factors, multiples, primes and composites and knowledge of arrays to solve the problem. I Have, Who has will be a review and springboard into this problem; will help solidify the math vocabulary.

CCSSM Grade-level Standards:

(4.OA.B.4)
5.OA.1
5.OA.2
5.NBT.5
5.NBT.6

Relevant Mathematical Practices:

MP1 ~ Make sense of problems and persevere in solving them. Students will need to determine what information they will need and may need to try multiple approaches, therefore requiring perseverance!

MP2 ~ Reason abstractly and quantitatively. Students will need to be able flexibly use the number relationships and properties and also will need to be able reason with their calculations.

Materials:

- picture of a building with windows representing an array
- I Have, Who Has game (with factors, multiples, primes and composites)
- paper
- graph paper
- manipulatives
- chart paper

Procedures/Guiding Questions:

- Play I Have, Who Has game.
- Revisit the picture of the building and pose the problem: How many stairs could be in this building? What do you know? What do you need to know? How will you get there? How does the array help you?

Adaptations:

To extend: What would be the next prime number (beyond the 100's chart)? The next 5 prime numbers?

Assessment:

After a gallery walk, have students respond mathematically to another group's work.

Sources:

[38 Interactive Card Games, Grades 5-6](#), reallygoodstuff.com

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Decimals and Decimal Notation-Fifth Grade

#1 Lesson Title: Exploration with Base Ten Blocks

Learning Goals for Students:

- Building with manipulatives and using words to show and represent decimals

The learning experience specifically connects to the concept of decimals and decimal notation by having students explore base ten blocks and what each represents. Students are often introduced to base ten blocks in younger grades using whole number representations. In this activity, students are encouraged to find new representations for the base ten block using decimals.

CCSSM Grade-Level Standards:

5 NBT 1 Understand and explain and value of digits

5 NBT 3 I can read, write and compare decimals to thousandths

Mathematical practices:

- #2 Reason abstractly and quantitatively
- #3 Construct viable arguments and critique the reasoning of others
- #4 Model with mathematics

Constructing viable arguments and critiquing the reason of others is important to this learning experience because the students are given the chance to explore their own representations of the base ten blocks and they may come up with different representations. Then they will be given a chance to defend their representations to each other.

Model with mathematics is also important to this learning experience so that students can model their decimal representations and realize that not all models always represent the same amount. The can change depending on what unit you assign to each base ten block.

Materials: Base 10 blocks, blank decimal place value chart, cut and paste representations of cube, flat, rod, and unit

Procedures:

1. Give students the flat, rod, the unit and ask them to find ways to represent decimals with these manipulatives
2. Then use the guiding questions to get feedback from the students
3. Give students number to model 1.23
4. Ask students to compare results on how many flats, tens, and ones
5. Now give another representation of 1.23 without using your first representation
6. Can you justify your representations - use trading or regrouping
7. Discuss with others
8. Have students get into small groups
9. Give each group their own number with value to the thousandths and the group shows three different ways to use the cube, flat, rod & unit to represent that number

Guided Questions

What strategies did you use to build a different model?

How did the Base 10 blocks help you build your number?

How did it change when you created a number into the thousandths?

How does this relate to whole number place value placement?

When you determine your unit or decimal, what value would you assign to each of the others? Why?

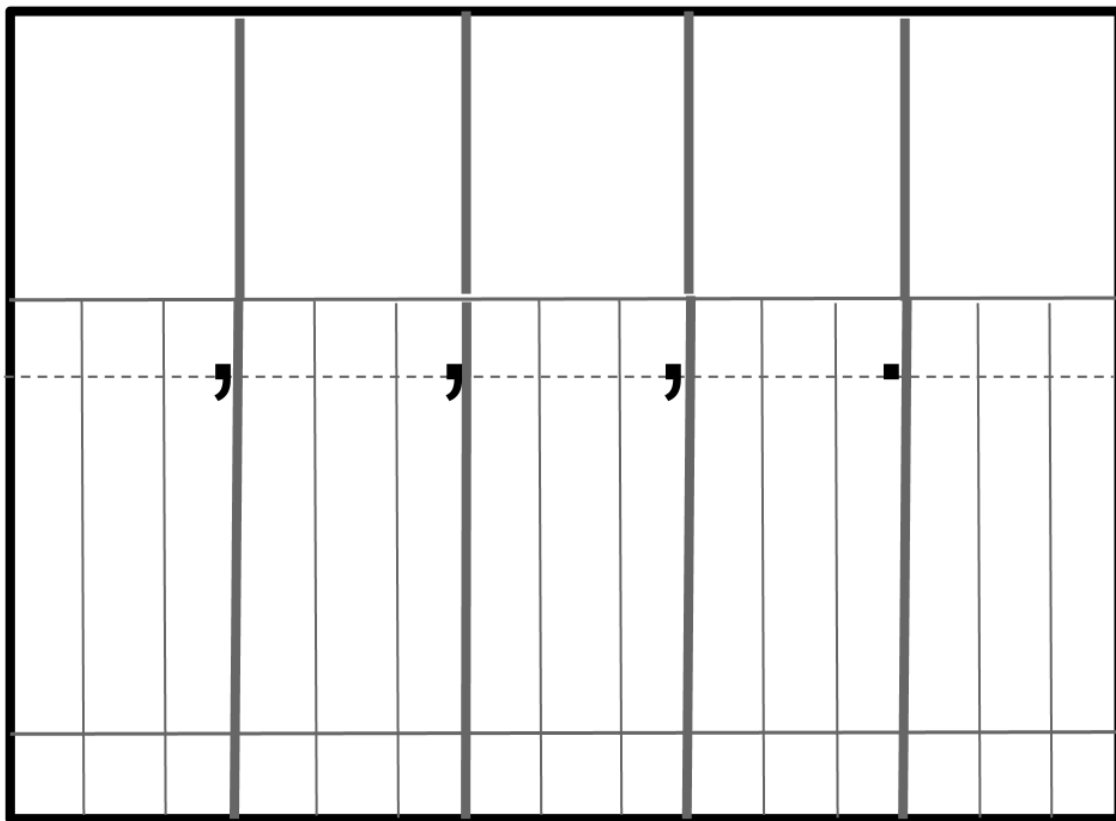
Formative Task: Build a number: Build 2.435 in two different ways. Use base ten blocks and words to describe each way. NOTE: They need to use a thousand cube to represent the unit of 1

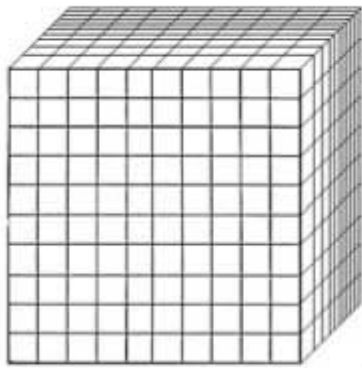
(Learnzillion) Students will be provided pre-cut base ten blocks to glue or tape onto a sheet to show their two different representations.

Sources:

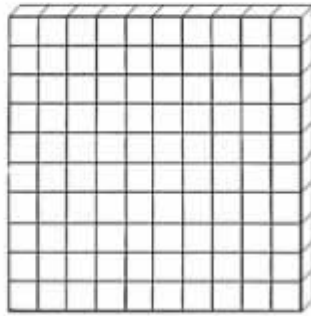
Learnzillion

www.fortheloveofteachingmath.com





Cube
Thousand



Flat
Hundred



Rod
Ten



Cube
Unit

#2 Lesson Title: Running through Decimals

Learning Goals for Students:

- Representing decimals on a 10 x 10 area model
- Reading, writing & identifying decimals in the tenths, hundredths & thousandths
- Rounding to a specific place value

The learning experience specifically connects to the concept of decimals and decimal notation by having students use real life experiences to connect to decimals. Students will explore how to represent their times on 10 x 10 area models and then expand on their times on how to order, compare and round them.

CCSSM Grade-Level Standards:

5 NBT 1 Understand and explain and value of digits

5 NBT 3 I can read, write and compare decimals to thousandths

5 NBT 4 I can use place value understanding to round decimals to any place

Mathematical practices:

- #4 Model with mathematics
- #5 Use appropriate tools strategically
- #6 Attend to precision

Using appropriate tools strategically and attending to precision are important to this learning experience because students need to use their timers accurately and understand how recording their times incorrectly can effect their data results.

Materials: 10 x 10 area models, cones, stop watches, recording paper, clipboards, baton

Procedures:

1. Set up a course where 3 students will run a relay race with equal distances in order to collect data
2. Record the team's times and represent them on the 10 x 10 area models
3. Then lead a discussion using the guiding questions

Guided Questions

How did you figure out how much of the grid was shaded?

What does the 6 in .65 mean?

What does the 5 .65 mean?

How would you represent these decimals as a fraction?

How many thousandths are in are in one tenth?

How many hundredths are in in one tenth?

What does this data tell you?

How could you compare the times?

How could you order the times?

How could you round the times?

What could this information be useful for?

Formative Task: Given a shaded portion on the 10 x 10 area model, students can identify each shaded portion. Students can correctly shade a 10 x 10 area model given a specific decimal.

Sources:

Investigations in Number Data and Space Unit 6 (Fifth Grade)

#3 Lesson Title: Mindful Metric Measurements

Learning Goals for Students:

- Students will be able to use a meter stick to discover the patterns of equivalent values in base ten.

The learning experience specifically connects to the concept of decimals and decimal notation because students discover that the metric system is based on base ten as well as our number system.

CCSSM Grade-Level Standards:

5 NBT 1 Understand and explain and value of digits

5 NBT 2 I can explain patterns when multiplying a number by powers of 10; I can explain patterns when a decimal is multiplied or divided by a power of 10

5 NBT 3 I can read, write and compare decimals to thousandths

5.MD.1 Convert like measurement units within a given measurement system

Mathematical practices:

#5 Use appropriate tools strategically

#8 Look for and express regularity in repeated reasoning

Use tools strategically is important so that students see that the meter stick is a tool they can use to relate to base ten system. Look for the patterns in the metric system is also important so the students can make connections to other number systems.

Materials: meter stick, recording sheet

Procedures & Guiding Questions:

1. Using the meter stick, explore the relationship between the different metric prefixes.
2. Given a specific measurement, students will convert to a different metric prefix. .
3. If I have 82mm, how many cm do I have? If I have 34 cm, how many dm?
4. How can you justify your answer?
5. How might we use fractions to help describe the relationship?
6. What patterns are you finding in your exploration?
7. Can you apply your understanding of expanded form of whole numbers to decimals?

Formative Task: Given a 1.52 m, students will be able to use the pattern they have discovered to convert the measurement into all the other metric prefixes.

Sources:

Learnzillion

kilometer	hectometer	decameter	meter	decimeter	centimeter	millimeter

#4 Lesson Title: We've Got the Power

Learning Goals for Students:

- Students will be able to recognize that a digit to the direct right is smaller than the ones place and that the digit to the left is one-tenth smaller

The learning experience specifically connects to the concept of decimals and decimal notation by helping students with their understanding of multiplying numbers by powers of ten.

CCSSM Grade-Level Standards:

5 NBT 1 Understand and explain the value of digits

5 NBT 2 I can explain patterns when multiplying a number by powers of 10; I can explain patterns when a decimal is multiplied or divided by a power of 10

Mathematical practices:

- #5 Use appropriate tools strategically
- #7 Look for and make use of structure
- #8 Look for and express regularity in repeated reasoning

Using tools is important because the place value slider will help the students visualize multiply and dividing by powers of ten. Students will recognize the patterns when multiply and/or dividing by 10, 100 etc.

Materials: tag board, number sliders (Pinterest: Multiply and Divide by Powers of Ten activity)
www.gototeach.com

Procedures & Guiding Questions:

1. Create Number Sliders using the PDF
2. Encourage students to "play around" with shifting patterns to discover how the place value is changing
3. Students will discover that movement recorded in the above objective
4. Students will also be highly encouraged to record their patterns down on paper to better analyze their created pattern
5. What do you notice with you slide your number to the left/right one time and so on

Formative Task: Online Game: www.numeracyhelper.com/pvslider/

Sources:

www.gototeach.com

Learning Experience Concept: Multiplication and Division of Fractions

Target Grade Level: 5

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ACTIVITY 1:

Title: Three Times Two-Fifths (original)

Learning Goals for students:

Through discovery, students will determine that, as with whole numbers, multiplication of fractions also can be performed via repeated addition.

Learning Experience Connection:

This learning experience relates to both elements of the chosen concept, but focuses more explicitly on the multiplication of fractions. When students receive either of the two prompts, and begin to perform process thinking, they are blazing a trail toward multiplication of fractions based on the structure set in place by powerful questions: *How many groups? How many in each group? How many total?* These questions are discussed in a student-centered fashion as each of the two groups in the class explain in their own words the processes they went through to formulate and solve the prompt they received. Specifically, the prompt regarding pizza requires multiplication/repeated addition of a part of the pizza to account for three pizzas purchased, and the recipe prompt uses the same whole number and fraction to respond to a scenario in which a recipe is tripled. Subtly different framing may lead to an a-ha! moment for the whole class when solutions to each prompt are presented.

CCSSM Grade-level Standards for the Learning Experience:

5.NFA.1 Add fractions

5.NFB.4 Multiply fractions

5.NFB.4a Divide fractions into parts

5.NFB.6 Real-world

Most Relevant Mathematical Practices:

MP4: Model created via personal choice

MP7: Repeated addition is discernible as a structure

Activity Justification:

Practice four, modeling with mathematics, holds relevance for several reasons. This procedurally open-ended activity relates to everyday life and does not specifically prescribe multiplication as a strategy; it does not overtly instruct the learner to multiply. Students are provided an opportunity to explore the process of identifying important quantities and map their relationship using a model, perhaps performing repeated addition, then finding an answer and reflecting on whether the results make sense.

Practice seven relates to this task because mathematically proficient students notice that repeating addition three times comprises a structure. In this case, repeated addition is multiplication. By asking students to determine “groups,” “how many in each group,” and the “total,” learners will have the opportunity to establish an understanding that also will be important in division of fractions.

Necessary Materials/Handouts:

Printed prompt (one of two)

Paper and pencil

Any tools or materials requested by students as they work through the prompts

Procedures and Guiding Questions:

Split the class into two groups.

To group 1, pose the following question:

Your family purchased 3 pizzas for dinner. You had $\frac{2}{5}$ of the pizza. How much pizza did you eat?

Create a model and write the expression.

To group 2, pose the following question:

A one-serving recipe calls for $\frac{2}{5}$ cup of sugar, but you must make 3 servings. How much sugar do you need? Create a model and write the expression.

Guiding Questions:

What do you notice about the answers from each group?

How did you solve this problem?

How many groups are there in problem 1? Problem 2?

How many are in each group in problem 1? Problem 2?

What is the total in problem 1? Problem 2?

Adaptations:

Extension/Remediation: Give more complicated structures (e.g., “if pizzas contained 8 slices each, would the existing slices be workable, or would some other step be required?”) or less complicated fraction-whole number combinations.

Early Finishers: Add more combinations and/or thought steps.

Learning Experience Assessment:

Informal assessment including class discussion, exit slip, entrance slip (on next day), HW, additional practice

ACTIVITY 2:

Title: Mmmmm, Math! (original)

Learning Goals for students:

Students will determine how they can multiply the number of servings in a recipe, while using the smallest number of measuring cups to yield the correct quantity of each ingredient.

Learning Experience Connection:

Students can enter this problem from several points and can use repeated addition so they would eventually recognize that multiplication would be more efficient. With multiplication of fractions as the chosen concept, a recipe containing fractional portions of a common volume (one cup) lends itself perfectly to teaching the concept from a practical and hands-on standpoint.

Every student might have experienced a poorly made dish in his or her past and might be able to think about the necessity of correctly measuring ingredients. The incentive of being able to make and share a tasty snack after correctly calculating ingredient quantities and most efficient measuring methods (largest measures for use to result in the smallest number of measurements to be made) also serves as motivation to work persistently and accurately.

CCSSM Grade-level Standards for the Learning Experience:

5.MDA.1 Conversions

5.NFA.1 Add fractions

5.NFB.4 Multiply fractions

5.NFB.5 Scaling

5.NFB.6 Real-world

Highly Relevant Mathematical Practices:

MP2: Abstract reasoning with measurements

MP5: Use appropriate tools strategically

Activity Justification:

Mathematical practice two is represented by the students' making sense of relationships between different measurements and the quantities they represent. Quantitative reasoning appears within the task as students consider the units involved, the meaning of each quantity, and the method for measuring ingredients in the recipe. It is particularly relevant because students may respond to the prompt by simply repeating the measures at first, then realizing that a multiple of some measures might be equal to a different measuring cup's volume. This trial and error is represented in the remedial adaptation.

Mathematical practice five is represented by the refinement of learners' thinking as they simplify the measured quantities of ingredients in order to use the minimum number of measuring cups. This requires strategic thinking using common mathematical tools, along with measuring cups. The relevance of this stems from the learning occurring as relationships between quantities become clearer, and as the students begin to notice classmates being able to start making their snack mix, creating a sense of urgency and (please forgive me!) a hunger for problem-solving.

Necessary Materials/Handouts:

Copy of recipe

Ingredients (along with popcorn kernels for enrichment)

Measuring cups

Paper and pencil

Recipe

Snack Mixture – serves 2

1/8 cup chocolate chips

1/2 cup pretzels

2/3 cup marshmallows

3/4 cup cereal

1/4 cup teddy grahams

1/3 cup M & M's

Measure all ingredients and place in a large mixing bowl. Stir.

There are six people in your group. How much of each ingredient do you need now?

Procedures and Guiding Questions:

1. Teacher groups the students in groups of six and distributes copy of the recipe to each student.
2. Good cooks measure each ingredient the fewest number of times. Rather than measuring $\frac{1}{2}$ cup twice, a cook would measure one cup once. This is how the recipe is expected to be formulated.
3. Student groups work together to rewrite the recipe for six, ensuring that they are using the fewest number of measuring cups possible.
4. Groups check with teacher for accuracy before moving on to making the recipe.

Guiding Questions:

What would you need to do so every person in your group has a serving?

How could you be sure that each item is measured in the smallest possible number of measuring cups?

Adaptations:

Remediation: Give students a set of measuring cups and a bowl of popcorn kernels for students who need help with simplifying, so they may practice measuring and re-measuring ingredients and comparing volumes.

Extension: Make the number of snack servings larger, or make the number of group members different to make the computation more challenging.

Learning Experience Assessment:

Must produce a corrected converted recipe before they can actually make the recipe.

How many groups?

How many in each group?

How many total?

What is the relevance of this activity?

Get out the measuring cups

Multiplication for a larger recipe (making cookies to take to a music concert)

Want to make enough of the cookies to make sure everyone has three cookies each and there are 50 left to sell

Division of the travel setting vans and 4-seat convertible

Garden

Festival in a stadium

This fraction is here to see this person

This fraction is here to see XXX

The stadium capacity is

It is $\frac{3}{4}$ full

Practical situations in which fractions would be multiplied

Baking

Candy bars and division

Pizza as present

Dividing

Take the recipe and divide

Multiplying

Actually measure

Also maps

Horses need 1 acre of land to live legally