

Planning Guide

Kindergarten *Attributes/Measurement*

Shape and Space (Measurement) Specific Outcome 1

This Planning Guide can be accessed online at:

http://www.learnalberta.ca/content/mepgk/html/pgk_attributesmeasurement/index.html

Table of Contents

Curriculum Focus	2
What Is a Planning Guide?	2
Planning Steps	2
Step 1: Identify Outcomes to Address	3
Big Ideas	3
Sequence of Outcomes from the Program of Studies	3
Step 2: Determine Evidence of Student Learning	4
Using Achievement Indicators	4
Step 3: Plan for Instruction	5
A. Assessing Prior Knowledge and Skills	5
Sample Structured Interview: Assessing Prior Knowledge and Skills	6
B. Choosing Instructional Strategies	7
C. Choosing Learning Activities	7
Sample Activity 1: Teaching Shape and Space	8
Step 4: Assess Student Learning	10
A. Whole Class/Group Assessment	10
B. One-on-one Assessment	10
C. Applied Learning	11
Step 5: Follow-up on Assessment	12
A. Addressing Gaps in Learning	12
B. Reinforcing and Extending Learning	12
Bibliography	13

Planning Guide: Kindergarten Attributes/Measurement

Strand: Shape and Space (Measurement)

Specific Outcome: 1

This *Planning Guide* addresses the following outcomes from the Program of Studies:

Strand: Shape and Space (Measurement)

Specific Outcome: 1. Use direct comparison to compare two objects based on a single attribute, such as length (height), mass (weight) and volume (capacity).

Curriculum Focus

This sample focuses on:

- developing a basic understanding of measurement.

What Is a Planning Guide?

Planning Guides are a tool for teachers to use in designing instruction and assessment that focuses on developing and deepening students' understanding of mathematical concepts. This tool is based on the process outlined in *Understanding by Design* by Grant Wiggins and Jay McTighe.

Planning Steps

The following steps will help you through the Planning Guide:

- **Step 1: Identify Outcomes to Address** (p. 3)
- **Step 2: Determine Evidence of Student Learning** (p. 4)
- **Step 3: Plan for Instruction** (p. 5)
- **Step 4: Assess Student Learning** (p. 10)
- **Step 5: Follow-up on Assessment** (p. 12)

Step 1: Identify Outcomes to Address

Guiding Questions

- What do I want my students to learn?
- What can my students currently understand and do?
- What do I want my students to understand and be able to do based on the Big Ideas and specific outcomes in the program of studies?

Big Ideas

Measurement activities provide opportunities for students to link their understandings of number and geometry. Students have intuitive understandings that should be built upon as they continue to recognize attributes common to objects and use these attributes to make direct comparisons. Students should make direct comparisons by looking at or handling the objects. For example, they can compare heights by standing back to back. Given two objects, they can predict which is heavier and then check by picking them up. Given two containers, students can predict which one holds more and then check by filling them with a material, such as rice or water.

Students need to identify which attributes they can use to describe objects and make comparisons. These attributes are best recognized in students' everyday conversations; e.g., when they say, "That person is very tall." or "We need a large container for this."

In Kindergarten, students should have conversations about finding objects in the class that are shorter than their foot, about the same length as their foot and longer than their foot. They should be encouraged to experiment with the concept of volume as they first predict and then count how many scoops or cups it takes to fill various containers. Similarly, when using a balance, students might predict which of two objects is heavier and then compare. In Kindergarten, students will use a variety of nonstandard units. Estimation is also important as it is an application of number sense. It contributes to students' development of spatial sense.

Sequence of Outcomes from the Program of Studies

See <http://education.alberta.ca/teachers/core/math/programs.aspx> for the complete program of studies.

Kindergarten

Specific Outcomes

1. Use direct comparison to compare two objects based on a single attribute, such as length (height), mass (weight) and volume (capacity).



Grade 1

Specific Outcomes

1. Demonstrate an understanding of measurement as a process of comparing by:
 - identifying attributes that can be compared
 - ordering objects
 - making statements of comparison
 - filling, covering or matching.

Step 2: Determine Evidence of Student Learning

Guiding Questions

- What evidence will I look for to know that learning has occurred?
- What should students demonstrate to show their understanding of the mathematical concepts, skills and Big Ideas?

Using Achievement Indicators

As you begin planning lessons and learning activities, keep in mind ongoing ways to monitor and assess student learning. One starting point for this planning is to consider the achievement indicators listed in the *Mathematics Kindergarten to Grade 9 Program of Studies with Achievement Indicators*. You may also generate your own indicators and use them to guide your observation of the students.

The following achievement indicators may be used to determine whether students have met this specific outcome.

- Compare the length (height) of two given objects and explain the comparison, using the words shorter, longer (taller) or almost the same.
- Compare the mass (weight) of two given objects and explain the comparison, using the words lighter, heavier or almost the same.
- Compare the volume (capacity) of two given objects and explain the comparison, using the words less, more, bigger, smaller or almost the same.

Some sample behaviours to look for in relation to these indicators are suggested for many of the instructional activities in **Step 3, Section C, Choosing Learning Activities** (p. 7).

Step 3: Plan for Instruction

Guiding Questions

- What learning opportunities and experiences should I provide to promote learning of the outcomes and permit students to demonstrate their learning?
- What teaching strategies and resources should I use?
- How will I meet the diverse learning needs of my students?

A. Assessing Prior Knowledge and Skills

Before introducing new material, consider ways to assess and build on students' knowledge and skills related to measurement. For example:

- Show students two trains and ask which is longer. Ask them to explain how they know.
- Ask two students to stand up and have the others tell you who is taller, who is shorter and how they know.
- Give two objects to students; e.g., a can of soup and a pencil. Which is lighter and which is heavier?
- Show students two items; e.g., a garbage can and a glass. Ask them which holds more.

If a student appears to have difficulty with these tasks, consider further individual assessment, such as a structured interview, to determine the student's level of skill and understanding. See **Sample Structured Interview: Assessing Prior Knowledge and Skills** (p. 6).

Sample Structured Interview: Assessing Prior Knowledge and Skills

Directions	Date:	
	Not Quite There	Ready to Apply
Show students two trains and ask them which is longer. Ask them to explain how they know.	<ul style="list-style-type: none"> • Selects the longer train but is unable to explain the answer. • Selects the shorter train. 	<ul style="list-style-type: none"> • Selects the longer train and is able to explain the answer.
Ask two students to stand up and have the others tell you who is taller, who is shorter and how they know.	<ul style="list-style-type: none"> • Identifies, incorrectly, the taller or shorter student. • Identifies the taller or shorter student but cannot explain the answer. 	<ul style="list-style-type: none"> • Identifies the taller or shorter student and can explain the answer.
Give two objects to students; e.g., a can of soup and a pencil. Which is lighter and which is heavier?	<ul style="list-style-type: none"> • Identifies, incorrectly, the lighter or heavier object. • Identifies the correct object but cannot explain the answer. 	<ul style="list-style-type: none"> • Identifies the correct object and can explain the answer.
Show students two items; e.g., a garbage can and a glass. Ask them which holds more.	<ul style="list-style-type: none"> • Is unable to select the object that holds more. • Makes the correct selection but cannot explain the answer. 	<ul style="list-style-type: none"> • Makes the correct selection and can explain the answer.

B. Choosing Instructional Strategies

Consider the following strategies when planning lessons.

- Whenever possible, the measurement activities should involve some physical materials.
- Students should communicate their understanding of measurement in various ways.
- To motivate students, use familiar objects as consistent units of measurement.
- Encourage students to develop intuitive notions for length, mass and volume, using direct comparison with consistent units, not standard units (e.g., metre stick).
- Expect students to explain, verbally, how they determined their measurements.
- Provide opportunities for students to make estimates and then check their predictions whenever possible.
- In making a measurement, students must begin by deciding what attribute of an object they are going to measure, select a unit to measure that attribute with and measure the attribute by comparing the units with the attribute.

C. Choosing Learning Activities

The following learning activities are examples of activities that could be used to develop student understanding of the concepts identified in Step 1.

Sample Activities:

1. **Teaching Shape and Space** (p. 8)

Sample Activity 1: Teaching Shape and Space

1. Scavenger Hunt

Do a scavenger hunt where students have to find pairs of items where one is taller than them and one is shorter than them. Have them look for something heavier than their shoe and lighter than their shoe. Have them find something that holds more than their juice box and less than their juice box.

Look For ...

Do students:

- identify, correctly, a taller item and a shorter item?
- identify, correctly, a heavier item and a lighter item?

2. Length, Mass and Volume

Create a small group activity where you place five items (e.g., pieces of rope or ribbon) on a table and have students tell the helper (a parent or older student) which is the longest, which is the shortest and which are almost the same. Have the helper ask them to explain how they know this. It is critical that when students are comparing lengths, they must align end points. Ensure the helpers are aware of this.

At another small group activity, have five cans of different sizes where students tell which is the heaviest, which is the lightest and which are almost the same. Have the helper ask them to explain how they know this. Cover the labels and letter the cans A, B, C, D, E. It is fun to empty a large can and tape the cover back on so that the large can might be lighter than one of the smaller cans. This way students must lift the cans to decide their answer (rather than depending on size only).

At a third table, you can do the same activity with volume, placing five containers and having students tell a helper which container holds the most, the least and which ones hold almost the same. Have the helper ask them to explain how they know this. Provide a bag of dry beans for them to use in measuring the volume if they so desire. Do not tell them how to use the beans but draw their attention to the beans. If they need further assistance, encourage students to pour the beans into the container they think is the smallest and then pour those beans into the larger container to see if they are correct. This third activity could take place in either the sandbox or water table to determine volume.

3. Rope Measurements

Show students a piece of string or rope that is one metre long. Ask them if they think they are taller than the rope without allowing them to stand beside it. Demonstrate how you would compare the height of a student with the length of the rope. After making a prediction, they can measure themselves against the rope. Look for items in the classroom that are longer and shorter than the rope; e.g., the height of a chair, the height of the door, the length of a book, the length of a pencil, the length of a classroom carpet.

Look For ...

Do students:

- predict accurately the length of various items?
- make appropriate comparisons?

4. Estimating Volume

Using a small plastic cup (e.g., a coffee cup), ask students to estimate how many cupfuls it might take to fill a variety of containers, including a margarine container, a milk container and an ice cream container. Before they actually measure, have them tell which container they think will hold the most. Ask students, "How could we prove this?" Proceed to measure out the cupfuls of sand or water that it takes to fill the larger containers.

5. Classroom Balances

Using small classroom balances, have small groups of students balance a variety of small items by comparing the weights. What happens to the balance? Why does one side go down further than the other side? What is happening when both sides of the balance stay the same? To extend this activity, have students compare small items (e.g., eraser, pencil, crayon, plastic insect, button) to pennies or unifix cubes as fixed weights of comparison. A helper can ask, "How many pennies did your eraser weigh?" or "How many pennies did your plastic insect weigh?" Then, "Which one is heavier, the eraser or the insect?" or "Which one will make the balance go down lower, the eraser or the insect?" Then have them test their answer. Have the helper ask, "Can you tell me two things that almost weigh the same?" Have students demonstrate how they know this is true.

Step 4: Assess Student Learning

Guiding Questions

- Look back at what you determined as acceptable evidence in Step 2.
- What are the most appropriate methods and activities for assessing student learning?
- How will I align my assessment strategies with my teaching strategies?

Sample Assessment Tasks

In addition to ongoing assessment throughout the lessons, consider the following sample activities to evaluate students' learning at key milestones. Suggestions are given for assessing all students as a class or in groups, individual students in need of further evaluation, and individual or groups of students in a variety of contexts.

A. Whole Class/Group Assessment

Note: Performance-based assessment tasks are under development.

1. Give students a piece of string that is approximately 25 centimetres in length. Ask them to find two objects that are longer than the string, two objects that are shorter than the string and two objects that are almost the same length as the string. Each student has three pieces of paper that are marked shorter, same and longer. On the paper, they draw pictures of the objects they found for each category.
2. Ask students to take off one of their shoes and then find two objects in the classroom that are heavier than the shoe, lighter than the shoe and almost the same weight as the shoe. Give each student three pieces of paper marked heavier, same and lighter. On the paper, they draw pictures of the objects they found for each category.
3. Bring to class a box, about the size of a carton of 12 pop cans, and have students find two containers that would hold more than the box, two containers that would hold almost the same and two containers that would hold less. Give each student three pieces of paper marked more, same and less. On the paper, they draw pictures of the objects they found for each category.

B. One-on-one Assessment

Assessment activities can be used with individual students, especially students who may be having difficulty with the outcome.

1. Give the student five objects (e.g., crayon, paper clip, pencil, ruler, eraser). Ask the student to arrange the items from the shortest to the longest. The student should be able to answer when asked, "Explain to me how you decided on this order."

2. Give the student five objects (e.g., crayon, paper clip, large book, ruler, stapler). Ask the student to arrange the items from the lightest to the heaviest. The student should be able to answer when asked, "Explain to me how you decided on this order."
3. Give the student five containers (e.g., one-litre milk container, empty tuna can, individual milk container, two-litre milk container, thimble). Ask the student to arrange the items from the smallest to the biggest. The student should be able to answer when asked, "Explain to me how you decided on this order."
4. For each of the following statements, have the student tell you if it is possible or impossible:
 - A cat is heavier than my mom.
 - When I'm thirsty, I could drink a whole swimming pool.
 - A dog and a small child could weigh the same amount.
 - A tall man could touch the ceiling.
 - A bird is lighter than an eraser.
 - A bathtub holds less than a jug of milk.
 - My arm is longer than my foot.
 - My leg is shorter than my arm.

C. Applied Learning

Provide opportunities for students to use measurement in a practical situation and notice whether or not the strategies transfer.

1. Have students draw a picture of five objects they can see in front of their house or apartment building. Then have them put the five objects in order from smallest to largest and from largest to smallest.
2. Ask students, "How many kinds of trees grow on your block? Find the three tallest trees and draw a picture of a leaf from each tree."
3. Have parent helpers trace students' full bodies onto large sheets of paper. Colour in and cut out the figure. Use new pencils to measure legs, arms, fingers, etc. Students can also measure each other's paper figures.

Step 5: Follow-up on Assessment

Guiding Questions

- What conclusions can be made from assessment information?
- How effective have instructional approaches been?
- What are the next steps in instruction?

A. Addressing Gaps in Learning

If a student is having difficulty learning to measure, work on what the attribute "length" means. Start with coloured rectangles and ask which one is longer, which one is shorter and which ones are almost the same. The next step is to introduce a nonstandard unit of measure. Students need many opportunities to measure with crayons, paper clips, their shoes, etc. This applies to mass and volume as well, which should be approached slowly in the same manner.

B. Reinforcing and Extending Learning

Students who have achieved or exceeded the outcomes will benefit from ongoing opportunities to apply and extend their learning.

Consider strategies, such as the following.

- Ask students which one is farther: the distance from the classroom to the office or the distance from the classroom to the gym. Have them measure the distances, allowing them to select a nonstandard unit of measurement. Have students justify the appropriateness of the nonstandard unit of measurement they select.
- Have students create different rulers to measure things in the classroom. Some may use paper clip chains, some may use a crayon ruler, etc. Have them create the ruler by attaching their chosen units to a strip of paper.
- Challenge students to find two objects where one is small and one is large but where the smaller item is the heavier of the two (e.g., a large bag of potato chips and a can of soup). Ask them to explain how this can happen.
- Ask students if it is always true that a taller container holds more than a shorter container. Have a series of containers on display when you ask this question, including a variation of shapes; e.g., tall thin graduated cylinders, short wide containers, large tall containers. Ask them how you could find out the answer to your question.

Bibliography

Step 2 References

Alberta Education. *The Alberta K–9 Mathematics Program of Studies with Achievement Indicators*. Edmonton, AB: Alberta Education, 2007.

Other References

Wiggins, Grant and Jay McTighe. *Understanding by Design*. Alexandria, VA: Association for Supervision and Curriculum Development, 1998.