

Planning Guide

Kindergarten *3-D Objects/2-D Shapes*

Shape and Space (3-D Objects and 2-D Shapes) Specific Outcomes 2, 3

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Planning Guide: Kindergarten 3-D Objects/2-D Shapes

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Specific Outcomes: 2, 3

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

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Specific Outcomes: 2. Sort 3-D objects, using a single attribute.
 3. Build and describe 3-D objects.

Curriculum Focus

This sample focuses on:

- the characteristics of 3-D objects and 2-D shapes
- analyzing the relationships among 3-D objects and 2-D shapes.

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. 5)
- **Step 3: Plan for Instruction** (p. 6)
- **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

Spatial sense involves visualization, mental imagery and spatial reasoning. These skills are central to the understanding of mathematics. Spatial sense enables students to reason and interpret among and between 3-D and 2-D representations, and to identify relationships to mathematical strands.

Spatial sense is developed through a variety of experiences and interactions within the environment. The development of spatial sense enables students to solve problems involving 3-D objects and 2-D shapes. Spatial sense offers a way to interpret and reflect on the physical environment and its 3-D or 2-D representations.

The study of two-dimensional shapes and three-dimensional objects is essential as we strive to describe, analyze and understand the world we live in. The study of geometry also complements the work done in other areas of mathematics, such as measure and number.

In studying two-dimensional shapes, students must build their understanding of the attributes or characteristics of the shape. They should focus on the number of sides and vertices and how shapes can be put together and taken apart to make other shapes. It is very important for students to use accurate language when naming shapes. Students should be able to distinguish between shapes such as squares and rectangles and also to see that the squares are rectangles.

Students need many opportunities to manipulate three-dimensional objects. They should be encouraged to identify how these objects are alike and how they differ. They may study how many faces and edges the object has. They may identify how some have sides that come to a point or how some might slide while others can roll.

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

2. Sort 3-D objects, using a single attribute.
3. Build and describe 3-D objects.



Grade 1

Specific Outcomes

2. Sort 3-D objects and 2-D shapes, using one attribute, and explain the sorting rule.
3. Replicate composite 2-D shapes and 3-D objects.

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.

- Sort a given set of familiar 3-D objects using a single attribute, such as size or shape, and explain the sorting rule.
- Determine the difference between two given pre-sorted sets by explaining a sorting rule used to sort them.
- Create a representation of a given 3-D object, using materials such as modelling clay and building blocks, and compare the representation to the original 3-D object.
- Describe a given 3-D object, using words such as big, little, round, like a box and like a can.

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. 8).

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 shape and space. For example:

- Have students find 2-D shapes in the classroom by asking, "Can you show me something that is shaped like this?" and holding up an example of a circle, square, rectangle or triangle. You may need to ensure there are examples of all these in view.
- Have students demonstrate 2-D shapes with their arms or other body parts. They may work with a partner.
- Have students identify 3-D objects in the classroom by asking, "Can you show me something that is shaped like this?" and holding up a sphere, cube, rectangular solid, cone, cylinder or pyramid (reminder to teacher that there are square pyramids and triangular pyramids).

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. 7).

Sample Structured Interview: Assessing Prior Knowledge and Skills

Directions	Date:	
	Not Quite There	Ready to Apply
Have students find 2-D shapes in the classroom by asking, "Can you show me something that is shaped like this?" and then hold up an example of a circle, square, rectangle and triangle. You may need to ensure there are examples of all these in view.	Is unable to find, accurately, a similar shape for any of these shapes.	Is able to find, accurately, a similar shape for all of these shapes.
Have students demonstrate 2-D shapes with their arms or other body parts. They may work with a partner.	Is not able to demonstrate accurately all four shapes.	Is able to demonstrate accurately all four shapes.
Have students identify 3-D objects in the classroom by asking, "Can you show me something that is shaped like this?" and then hold up a sphere, cube, rectangular solid, cone, cylinder or pyramid.	Is unable to find most of the 3-D shapes shown in the classroom.	Is able to find most of the 3-D shapes shown in the classroom.

B. Choosing Instructional Strategies

Consider the following strategies when planning lessons.

- Use many manipulatives that are common objects for students to identify as 2-D or 3-D items.
- Starting with a 3-D object, have students identify the 2-D shapes needed to make the object.
- Ask students to bring 3-D objects from home to share with the class. Have them tell one or two things that they find interesting about what they have brought from home.
- Use the names of the 2-D shapes when talking about them and slowly introduce the names of the 3-D objects.
- Use 2-D shapes around the room to help you divide students into groups. Tape on the floor a large triangle, a large circle, a large square and a large rectangle and divide students so that they know which group (e.g., triangle) they are sorted into. This can be one way to assign classroom tasks.

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 2-D Shapes and 3-D Objects (p. 9)

Sample Activity 1: Teaching 2-D Shapes and 3-D Objects

1. Show students three cans of food and three boxes of food to sort according to shape (cylinder or rectangular solid) and then by size (large or small). Do the same with other 3-D shapes, such as spheres (basketball, rubber ball, marble) or cones (ice cream cone, party hat, large paper cone made out of cardboard).

Look For ...

Do students:

 - ☐ sort the objects according to a single attribute?
2. Show students some items you have sorted and ask how you sorted them; e.g., place a cylinder, a cone and a sphere in one group. In another group, show a cube, a rectangular solid and a pyramid. These two groups can be classified as 3-D objects that can roll and 3-D objects that cannot roll. Ask students to determine how you sorted the objects. You may need to guide this inquiry.
3. Place four 3-D shapes on the table and ask students which shape does not belong; e.g., you might have three rectangular solids and a cylinder. Have students justify why one does not belong.
4. Have students listen to a riddle and select the solid from a set of objects being displayed; e.g., I am a solid with two circles. I can roll. What am I? (cylinder) I have one circle and one point. I can roll. What am I? (cone) I have six sides that look exactly the same. All my sides are squares. What am I? (cube)

Look For ...

Do students:

 - ☐ relate the given clues to known facts about 3-D objects?

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 each student a series of photographs or illustrations of common objects and ask them to sort and glue the objects onto pages that have at the top the related 2-D shape.
2. Give each student enough modelling clay to build one or two objects. Ask them to build 3-D objects with the clay based on models you show; e.g., sphere, cylinder, cube.

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 a student a series of 3-D shapes and ask him or her to sort the shapes into two groups, telling you how he or she decided to sort them. Make sure the objects are clearly related in at least two ways so that the student has some obvious choices; e.g., objects with rounded parts and objects with straight edges only, or very large objects and very small objects.
2. Ask the student to look at a series of 2-D shapes and 3-D objects. Ask him or her to place the 3-D object on top of the 2-D shape that it is related to and then ask him or her to explain why; e.g., use circle and sphere, cone and cylinder, triangle and pyramid, square and cube, rectangle and rectangular solid as examples.

C. Applied Learning

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

1. Have students create a shape book by drawing, cutting out magazine photographs or photographing 3-D objects with a digital camera. Include a page with the name of the object and an illustration of each object as a title, then have students fill the pages with objects they find.
2. Have students create mosaic artwork, using only 2-D shapes. You may purchase stickers in basic 2-D shapes or you may cut out brightly coloured shapes.
3. Have the class create a mathematics walk in their community. They will identify 2-D shapes and 3-D objects during the walk. Students can take digital pictures and construct a math poster.

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 about 3-D objects, make sure you start with 2-D shapes first. Start with pattern blocks and use these as 2-D shapes, having the student identify the common shapes. Use many common-place items to help students see these shapes in their everyday world. Compare for them the relationship between 2-D shapes and 3-D objects; e.g., how a square and a cube are related.

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:

- Give the student a series of boxes and containers (e.g., cubes, rectangular solids, cylinders, spheres and cones) of different sizes and have him or her build a robot, using these shapes.
- Send a note home to parents, asking them to help their child find examples of 2-D shapes and 3-D objects in their home. Have students draw the shapes and objects and parents can help label them.

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.