Mathematics

Planning Guide

Grade 1 *3-D Objects/2-D Shapes*

Shape and Space
(3-D Objects and 2-D Shapes)
Specific Outcomes 2, 3, 4

This Planning Guide can be accessed online at:
http://www.learnalberta.ca/content/mepg1/html/pg1_3dobjects2dshapes/index.html

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Planning Guide: *Grade 1 3-D Objects/2-D Shapes*

Strand: Shape and Space (3-D Objects and 2-D Shapes)
Specific Outcomes: 2, 3, 4

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 and 2-D shapes, using one attribute, and explain the sorting rule.
3. Replicate composite 2-D shapes and 3-D objects.
4. Compare 2-D shapes to parts of 3-D objects in the environment.

Curriculum Focus

This sample focuses on:

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

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

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

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.
4. Compare 2-D shapes to parts of 3-D objects in the environment.

Grade 2
Specific Outcomes
6. Sort 2-D shapes and 3-D objects, using two attributes, and explain the sorting rule.
7. Describe, compare and construct 3-D objects, including:
   - cubes
   - spheres
   - cones
   - cylinders
   - pyramids.
8. Describe, compare and construct 2-D shapes, including:
   - triangles
   - squares
   - rectangles
   - circles.
9. Identify 2-D shapes as parts of 3-D objects in the environment.

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 these specific outcomes.

- Sort a given set of familiar 3-D objects or 2-D shapes, using a given sorting rule.
- Sort a given set of familiar 3-D objects, using a single attribute determined by the student, and explain the sorting rule.
- Sort a given set of 2-D shapes, using a single attribute determined by the student, and explain the sorting rule.
- Determine the difference between two given pre-sorted sets of familiar 3-D objects or 2-D shapes and explain a possible rule used to sort them.
- Select 2-D shapes from a given set of 2-D shapes to reproduce a given composite 2-D shape.
- Select 3-D objects from a given set of 3-D objects to reproduce a given composite 3-D object.
- Predict and select the 2-D shapes used to produce a composite 2-D shape, and verify by deconstructing the composite shape.
- Predict and select the 3-D objects used to produce a composite 3-D object, and verify by deconstructing the composite object.
- Identify 3-D objects in the environment that have parts similar to a given 2-D shape.

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:

- Give students a cylinder, cone, sphere, pyramid and rectangular prism. Ask them to separate the objects into two groups and explain why they chose to sort the objects as they did.
- Show students a cylinder and ask them to tell you about things in their homes that have a similar shape. Do the same with spheres and rectangular prisms.
- Give students modelling clay and ask them to build a sphere, cylinder and cube.

As you do these kinds of activities, it is important to have students verbalize their thinking whenever possible.

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**
Give students a cylinder, cone, sphere, pyramid and rectangular prism. Ask them to separate the objects into two groups and explain why they chose to sort the objects as they did.	• Objects are not sorted with any clear attribute.	• Can explain why the objects are sorted as they are.
Show students a cylinder and ask them to tell you about things in their homes that have a similar shape. Do the same with spheres and rectangular prisms.	• Identifies objects of each shape incorrectly.	• Identifies, correctly, objects that are of similar shapes to those you display.
Give students modelling clay and ask them to build a sphere, cylinder and cube.	• Builds the wrong shape or a shape not recognizable.	• Builds the correct shape without hesitation.

B. Choosing Instructional Strategies

Consider the following strategies when planning lessons.

- Provide students with many opportunities to represent 2-D shapes and 3-D objects concretely.
- Allow students to identify 2-D shapes and 3-D objects in their daily lives. This should include common everyday objects.

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. 9)

Sample Activity 1: Teaching Shape and Space

1. Pattern Blocks

   Give students a set of pattern blocks and ask them to predict what pieces are needed to cover a 2-D shape. Then have students verify their predictions by covering the shape with pattern block pieces.

Look For …
Do students:
- ☐ predict the appropriate shape and number of pieces?

2. Rectangles

   Give students a sheet with large rectangular shapes, about two per page. Each student needs to have between four and six rectangles, all the same size. Ask students to cut their rectangles out. Challenge them to find out how many different pairs of shapes can be made by folding each rectangle. Ask them to fold their rectangle and then cut along the fold line to produce two new 2-D shapes. They can repeat this for each rectangle, trying to fold each one differently. They might create triangles, squares, long narrow rectangles or trapezoids. Encourage them to find how many different 2-D shapes can be made by folding each rectangle. Students can display the results of their cutting out of the 2-D shapes by pasting them on a large sheet of paper.

3. Sorting Rules

   Present students with a set of geoblocks or other 3-D objects. Ask them to sort the objects into two sets and describe the sorting rule.

Look For …
Do students:
- ☐ sort objects, using one attribute?

4. Identifying Shapes

   Have students examine a collection of objects found in their environment; e.g., cans, cereal boxes, ice cream cones, tissue boxes. Ask them to identify the shape of each face of each 3-D object. Ask, "What shape is the face? Do all the faces have the same shape?" Have students identify vertices and edges on the shapes.

5. Build a 3-D Object

   Display pictures of various 3-D objects, such as a rocket or sculpture. Ask students what 3-D objects were used to build the object. Students can then build their own composite 3-D objects from individual 3-D objects, such as small cardboard boxes or modelling clay. Once they are built, display the creations in class and ask students to identify the 3-D objects used to build the composite object.

Look For …
Do students:
- ☐ clearly distinguish between 2-D shapes and 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, or pair of students, a collection of pattern blocks. Say to them, "I am going to build a design with pattern blocks on the overhead projector. I want you to use your pattern blocks to build a design just like mine." Observe their construction.

2. Give each student, or pair of students, a collection of pattern blocks. Say to them, "I want you to build the following shape with your pattern blocks. Place a red trapezoid on your desk. On top of the trapezoid place a green triangle. On the left place a blue rhombus and on the right place another blue rhombus." Observe their construction.

B. One-on-one Assessment

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

1. Show the student a drawing that has five triangles in one set and five or six shapes, including rectangles, in another set. Pointing to the set of triangles, ask, "What is the same about all the shapes in this set? How are these shapes different from the shapes in this other set (pointing to the set of different shapes)?"

2. Give the student a set of 3-D objects, including a cone, pyramid, rectangular prism, triangular prism and sphere. Ask him or her to separate the objects into two groups. He or she can then explain why he or she decided to sort them that way.

C. Applied Learning

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

1. Create a book, using photographs taken on a mathematics trail. Using either a video camera or a digital camera, take students for a walk around the school neighbourhood, asking them to look for 2-D shapes and 3-D objects. Record the items they identify (they may be able to use the camera themselves). Back in the classroom, make a geometry book, using the pictures taken and adding to it other photographs or illustrations students can collect at home. In the book, have students sort the photographs by 2-D shape or 3-D object and label them.

2. Have students look through magazines and newspapers to find examples of 2-D shapes and 3-D objects. Posters can be made from their collections or photographs can be added to the large class mathematics book.

3. Have students create labels of 3-D objects around the classroom and fix the labels to the objects.

4. Explore Web sites, such as those provided by the National Council of Teachers of Mathematics at http://illuminations.nctm.org/Activities.aspx?grade=1, where you can find interactive software for students to explore composing shapes.

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 students are having difficulty recognizing 3-D objects, go back to an exploration of 2-D shapes with them. Have students work on recognizing how 3-D objects are linked to 2-D shapes as they explore the faces of 3-D shapes. Use as many hands-on manipulatives as possible to allow students to explore the full dimensions of the 3-D shapes. Ensure that you are using mathematical language when you describe 2-D shapes and 3-D objects to prevent misconceptions.

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.

- Challenge students to explore which of the regular polygons (2-D shape with all sides equal and all angles equal) can be used to tessellate a surface. Have them use pattern blocks to try to cover a surface equal to the size of one page of paper with a tiling pattern. When the polygon covers the surface without any gaps, we are able to tile the surface and we call this a tessellation. To further this investigation, have students try to cover the surface with two different pattern blocks.

- Pre-cut quilt pieces, enough for each student to create one square of a quilt, can be cut from construction paper. Using a variety of quilting patterns ensures a beautiful final product. A parent helper may be available to help cut pieces. Make sure each student has a variety of colours in his or her square. Assemble all the squares together in a large quilt taped to the wall or board. This project could also be done with real material and sewed together.

- Construct a sculpture, using 3-D objects. Have students gather cereal boxes, tissue boxes, paper towel rolls, plastic foam cups, cones, etc. and create a large object. Depending on the theme you are working on, have students create robots, castles, aliens, machines, etc. and then paint the objects. The designs are limitless!

Bibliography

Step 2 References

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

Step 4 References

National Council of Teachers of Mathematics. *Activities. Grades: pre-K–2*. http://illuminations.nctm.org/Activities.aspx?grade=1 (Accessed May 25, 2007).

Other References

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