

Planning Guide

Kindergarten *Repeating Patterns*

Patterns and Relations (Patterns)
Specific Outcome 1

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Planning Guide: Kindergarten Repeating Patterns

Strand: Patterns and Relations (Patterns)

Specific Outcome: 1

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

Strand: Patterns and Relations (Patterns)

Specific Outcome: 1. Demonstrate an understanding of repeating patterns (two or three elements) by:

- identifying
- reproducing
- extending
- creating

patterns using manipulatives, sounds and actions.

Curriculum Focus

This sample focuses on:

- using patterns to describe the world and solve problems.

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. 9)
- **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

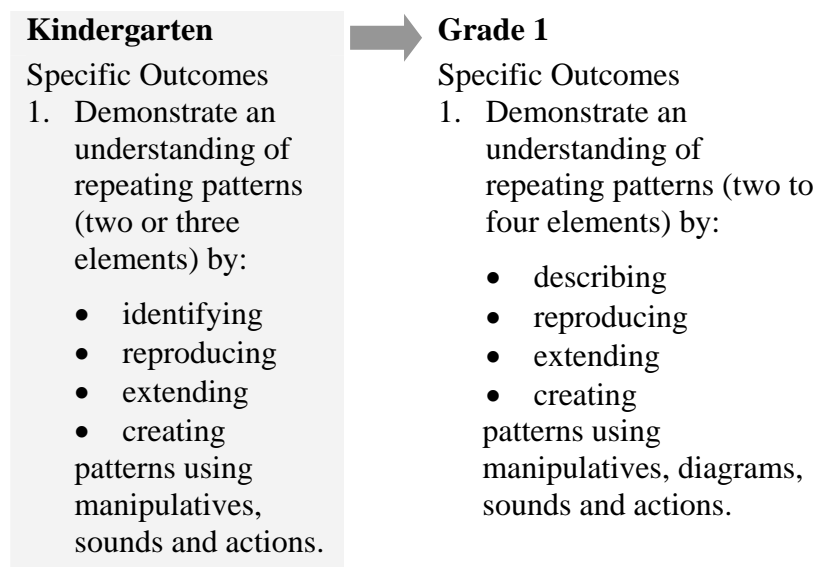
Mathematics is about recognizing, describing and working with numerical and nonnumerical patterns. Patterns exist in all strands and it is important that connections are made among strands. Working with patterns enables students to make connections within and beyond mathematics. These skills contribute to students' interactions with and understanding of their environment.

Patterns may be represented in concrete, visual or symbolic form. Students should develop fluency in moving from one representation to another.

Students must learn to recognize, extend, create and use mathematical patterns. Patterns allow students to make predictions and justify their reasoning when solving routine and nonroutine problems. Learning to work with patterns in the early grades helps develop students' algebraic thinking that is foundational for working with more abstract mathematics in higher grades.

Sequence of Outcomes from the Program of Studies

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



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.

- Distinguish between repeating patterns and nonrepeating sequences in a given set by identifying the part that repeats.
- Copy a given repeating pattern, e.g., action, sound, colour, size, shape, orientation, and describe the pattern.
- Extend a variety of given repeating patterns to two more repetitions.
- Create a repeating pattern using manipulatives, musical instruments or actions and describe the pattern.
- Identify and describe a repeating pattern in the classroom, school and outdoors; e.g., in a familiar song, in a nursery rhyme.

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. 6).

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 patterns. For example:

- Using concrete materials, ask students to identify what might come next; e.g., using clear colour counters on the overhead projector in an ABABAB pattern.
- Have students line up at the front of the room and make a pattern by having one student put his or her leg out, the next put his or her arm out and so on until everyone is included in the pattern.
- Create an up–down pattern by having alternating students stand and crouch.
- Create a forward–backward pattern by having one student face forward and the next student face backward until all are included in the pattern around the room.

As you do these patterns, have students say the patterns out loud to communicate the pattern verbally. Ask questions such as, "What could come next?" or "Why is Billy crouching?"

B. Choosing Instructional Strategies

Consider the following strategies when planning lessons.

- Wherever possible, the pattern activities should involve some physical materials.
- Students should communicate the pattern in various ways.
- Provide opportunities for students to draw simple shape patterns.
- Encourage students to display concrete patterns whenever possible, either with manipulatives or by enacting the pattern physically.
- To motivate students, use familiar objects whenever possible.
- Students should also be encouraged to demonstrate oral patterns, including singing or clapping/stomping.
- Expect students to explain, verbally, how they know what comes next.
- Whenever possible, use activities that encourage students to look for similarities and differences in patterns.
- As the year progresses, students should be encouraged to communicate patterns, using symbols such as ABABAB.

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 Patterns and Relations** (p. 7)

Sample Activity 1: Teaching Patterns and Relations

1. Pattern Strips

Give each student a strip of adding machine paper (or paper cut in thin strips). Have students work in groups to draw three complete repetitions of a pattern of their own creation. At their tables, give them concrete materials, including pattern blocks, buttons, traceable shapes, stickers, keys and coloured squares. After creating the patterns, have students display their work and explain the patterns to the class. Once all patterns are displayed, students should be asked to look for similarities in the patterns: "Can you find two patterns that are similar?" Have students explain why they are similar.

Look For ...

Do students:

- identify the core of their pattern when asked?
- identify similar patterns?

2. Physical Patterns

Either take students outside or push desks to one side of the room. Have students take turns in leading the class in creating physical patterns such as HOP, HOP, CLAP, HOP, HOP, CLAP or CLAP, STOMP, CLAP, STOMP. They might also continue with the earlier idea of standing, crouching, standing, crouching. Other patterns might include a singing pattern of different vowel sounds, such as "OH-LA, OH-LA." Students might create a BOY, GIRL, BOY, GIRL pattern.

Cover pointed party hats with three different colours of construction paper. Give each student a hat and ask a student to create a pattern. This activity allows you to move from two elements to three elements. Ask questions such as "Who could go next?" and "Why can they go next?" Always encourage students to explain their patterns. You might also remind them about the BOY, GIRL pattern and ask them how many colours of hats you would need to use to make a similar pattern. Encourage them to describe what is similar and what is different.

3. Beaded Necklaces

Tell the class the following story. "Lee Marten and his sister Debbie are visiting their grandmother in Fort McKay. In the afternoon, their grandmother teaches them to make beaded necklaces using coloured beads in the four traditional colours: yellow, red, white and black. Lee makes a necklace using this pattern: red, yellow, white, black, red, yellow, white, black, red, yellow, white, black." Hold up an example necklace made using a pattern with the traditional colours. "Debbie makes a necklace and she used red, yellow, yellow, red, yellow, yellow, red, yellow, yellow." Students then each make some necklaces for their friends. Using the following pattern, they can design necklaces for their friends.

4. Pattern Beats

Henry Chalifoux is learning how to drum from his grandfather Joseph. He is exploring the difference in playing **LOUD** and *soft*. When he plays a two-beat song, he creates four songs:

LOUD – **LOUD**
soft – *soft*
soft – **LOUD**
LOUD – *soft*

When he plays a song with three beats, he can play:

LOUD – **LOUD** – **LOUD**
soft – *soft* – *soft*
soft – **LOUD** – **LOUD**

How many other ways can he make a three-beat song?

Teacher backgrounder: Drum songs are passed from generation to generation, using oral tradition and practice. Some songs are sacred and are used only in ceremonies. Some are sung for pleasure and at community gatherings, such as round dances and powwows. Some are used for grand entries at powwows. Some are honour songs that celebrate someone's or some group's achievements. The drum beats are representative of the heart beats of those hearing the songs and Mother Earth.

Enrichment: Ask students what would happen if Henry's grandfather asked him to play four-beat songs. What would the four-beat songs look like?

Look For ...

Do students:

- chant out loud?
- create the appropriate number of beats?

As an extension to this activity, give each student a rhythm instrument, such as beans in a small plastic container, and ask students to make **LOUD** and *soft* sounds, and then have them try to play two-beat songs, three-beat songs and so on.

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. Show the class a pattern of interlocking cubes that show YELLOW, GREEN, YELLOW, GREEN, GREEN, YELLOW and ask them what would they change to make this pattern work.
2. Hand out large triangle and square shapes, one to each student. Line students up in the following pattern: TRIANGLE, SQUARE, TRIANGLE, SQUARE, TRIANGLE, SQUARE and ask students (without showing them), "If we had 10 students standing up here, what would the 10th student be holding?" Change the pattern and ask again; e.g., try TRIANGLE, TRIANGLE, SQUARE.
3. On the overhead projector, place an ABAB pattern, using transparent coloured counters. Show it to students for 10 seconds and then cover the pattern. Ask them to draw what would come next. Then, draw on the overhead an ABAB pattern using Xs and Os. After allowing students to look for 10 seconds, cover the pattern and ask them to draw what comes next. This can also be done using ABBABB or ABCABC patterns and so on.
4. Show students five different patterns you have made with interlocking cubes; e.g.,
RGRGRGRGR
BYYBYYBYY
GRGRGRGR
BBWBBWBBW
YRYRYRYR
Where R=Red, B=Blue, Y=Yellow, G= Green and W=White
Have students build these pattern trains in small groups and answer the following question:
"Which patterns are the same as each other and why?"

B. One-on-one Assessment

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

1. Snap together some interlocking cubes, such as GBGBGB. Ask the student to look carefully and add another cube in the pattern. Have the student continue to add at least three cubes to extend the ABAB pattern. Ask why he or she picked these cubes.
Snap together interlocking cubes in an ABBABB pattern. Have the student repeat the pattern at least twice. Ask the student to explain why he or she selected these cubes.
2. Tell the student, "I made a pattern with 12 connecting cubes and then it fell apart. All I have left are three together: RED, BLUE, GREEN." Show the three cubes together to the student. Do not show the other nine but allow the student to see the container holding all the other blocks of multiple colours. "Draw a picture of what my pattern might have looked like." After the student has completed one possible answer, ask, "Might it have looked another way?" Allow the student to show you other possibilities.

There are several solutions to this problem. For example, the student may use RED, BLUE, GREEN or the student may suggest a RED, BLUE, GREEN, BLACK pattern or the student may use RED, BLUE, GREEN, YELLOW, BLACK. There are many other combinations using all of the possible colour combinations. It is most important that you allow the student to explain his or her thinking about how the pattern might have been set up.

3. By showing the student a set of interlocking cubes of a predetermined pattern, you can use the following rubric to assess him or her individually:

The student:	Yes	No	Comments
adds the next correct piece in the pattern			
can continue the pattern with additional pieces			
explains why pieces were added to the pattern			
can identify the core pattern in the longer pattern			

Be open to all possibilities in extending the pattern. For example, you may give the student an ABABAB pattern and ask what comes next. Legitimately, the student could respond with A, assuming that the pattern is a straightforward ABABAB pattern. However, an equally correct answer would be B if the student sees a pattern emerging of ABABABBABB. The important thing to do in assessing the student's answer is to have him or her explain his or her thinking and extend the pattern even further.

C. Applied Learning

Provide opportunities for students to use their pattern strategies in a practical situation and notice whether or not the strategies transfer. For example, have students think about their weekly pattern of living. They have five days of school and two days without school and this pattern repeats. Have them think about their weekly pattern of activities in school. Is there a pattern to when they have music class? Is there a pattern for when they go to the school library? Is there a pattern to when they play an extra-curricular sport; e.g., every Saturday morning? Have students ask at home if there is a pattern in the daily living; e.g., about meal time. There are patterns on television. If appropriate, ask what pattern their favorite TV shows follow; e.g., some shows are on at the same time five days a week; others are only on Saturday mornings.

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 identify or extend patterns, check the student's ability to work with ABABAB patterns first. Use concrete materials whenever possible but with only one different attribute; e.g., use crayons with only one difference in the colour. Do not use objects with a difference in colour, size and shape.

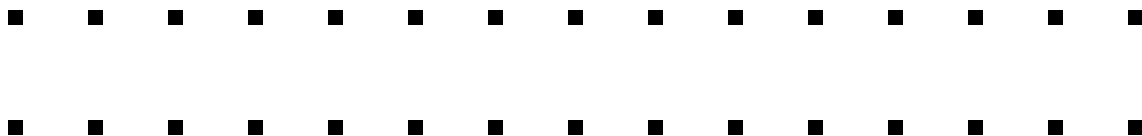
Encourage students to focus on the core of the pattern, not on each individual unit, as they try to extend it. Also, students should work through patterns starting with ABABAB to ABCABCABC to ABBABBABB.

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.

- Provide tips for parents on practicing the identification or extension of patterns at home. Look for patterns in their daily living or patterns on the wallpaper or in a tiling design. Parents might be able to identify musical patterns, especially in different cultures.
- In class, have two parallel series of dots and have students create patterns, using UP, DOWN. For example, place dots as shown below. UP, DOWN will result in a zigzag pattern being created (if you skip every second dot on a line). Using an UP, UP, DOWN pattern will result in a straight line between each pointed zigzag.



- Take advantage of opportunities that arise in the classroom to identify patterns. Look for patterns in who chooses white milk, chocolate milk or no milk at lunch time. Line students up to go out for recess according to different patterns; e.g., BOY, GIRL, BOY, GIRL or by hair colour patterns.

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.