

Kindergarten Mathematics

Support Document for Teachers



KINDERGARTEN MATHEMATICS

Support Document for Teachers

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math/supports.html](http://www.edu.gov.mb.ca/k12/cur/math/supports.html)>.

Available in alternate formats upon request.

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List of Blackline Masters (BLMs)

Kindergarten Mathematics Blackline Masters

Number (N)

BLM K-4.1: Assessment Checklist

BLM K.N.1&3&5.1: Activity Cards

BLM K.N.1&3&5.2: Concentration Cards

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BLM K.SS.1.1: Spinner

BLM K.SS.1.2: Comparison Assessment: How Can Objects Be Compared?

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INTRODUCTION

Purpose of the Document

Kindergarten Mathematics: Support Document for Teachers provides various instructional activities, assessment strategies, and learning resources that promote the meaningful engagement of mathematics learners in Kindergarten. The document is intended to be used as an aid to teachers as they work with students in achieving the prescribed outcomes and achievement indicators identified in *Kindergarten to Grade 8 Mathematics: Manitoba Curriculum Framework of Outcomes (2013)* (Manitoba Education).

Background

Kindergarten to Grade 8 Mathematics: Manitoba Curriculum Framework of Outcomes is based on *The Common Curriculum Framework for K–9 Mathematics*, which resulted from ongoing collaboration with the Western and Northern Canadian Protocol (WNCP). In its work, WNCP emphasizes

- common educational goals
- the ability to collaborate and achieve common goals
- high standards in education
- planning an array of educational activities
- removing obstacles to accessibility for individual learners
- optimum use of limited educational resources

The growing effects of technology and the need for technology-related skills have become more apparent in the last half century. Mathematics and problem-solving skills are becoming more valued as we move from an industrial to an informational society. As a result of this trend, mathematics literacy has become increasingly important. Making connections between mathematical study and daily life, business, industry, government, and environmental thinking is imperative. The Kindergarten to Grade 12 Mathematics curriculum is designed to support and promote the understanding that mathematics is

- a way of learning about our world
- part of our daily lives
- both quantitative and geometric in nature

Beliefs about Students and Mathematics Learning

The Kindergarten to Grade 8 Mathematics curriculum is designed with the understanding that students have unique interests, abilities, and needs. As a result, it is imperative to make connections to all students' prior knowledge, experiences, and backgrounds.

Students are curious, active learners with individual interests, abilities, and needs. They come to classrooms with unique knowledge, life experiences, and backgrounds. A key component in successfully developing numeracy is making connections to these backgrounds and experiences.

Students learn by attaching meaning to what they do, and need to construct their own meaning of mathematics. This meaning is best developed when learners encounter mathematical experiences that proceed from the simple to the complex and from the concrete to the abstract. The use of manipulatives and a variety of pedagogical approaches can address the diversity of learning styles and developmental stages of students. At all levels, students benefit from working with a variety of materials, tools, and contexts when constructing meaning about new mathematical ideas. Meaningful student discussions can provide essential links among concrete, pictorial, and symbolic representations of mathematics.

Students need frequent opportunities to develop and reinforce their conceptual understanding, procedural thinking, and problem-solving abilities. By addressing these three interrelated components, students will strengthen their ability to apply mathematical learning to their daily lives.

The learning environment should value and respect all students' experiences and ways of thinking, so that learners are comfortable taking intellectual risks, asking questions, and posing conjectures. Students need to explore problem-solving situations in order to develop personal strategies and become mathematically literate. Learners must realize that it is acceptable to solve problems in different ways and that solutions may vary.

Conceptual understanding: comprehending mathematical concepts, relations, and operations to build new knowledge. (Kilpatrick, Swafford, and Findell 5)

Procedural thinking: carrying out procedures flexibly, accurately, efficiently, and appropriately.

Problem solving: engaging in understanding and resolving problem situations where a method or solution is not immediately obvious. (OECD 12)

First Nations, Métis, and Inuit Perspectives

First Nations, Métis, and Inuit students in Manitoba come from diverse geographic areas with varied cultural and linguistic backgrounds. Students attend schools in a variety of settings including urban, rural, and isolated communities. Teachers need to recognize and understand the diversity of cultures within schools and the diverse experiences of students.

First Nations, Métis, and Inuit students often have a whole-world view of the environment; as a result, many of these students live and learn best in a holistic way. This means that students look for connections in learning, and learn mathematics best when it is contextualized and not taught as discrete content.

Many First Nations, Métis, and Inuit students come from cultural environments where learning takes place through active participation. Traditionally, little emphasis was placed upon the written word. Oral communication along with practical applications and experiences are important to student learning and understanding.

A variety of teaching and assessment strategies are required to build upon the diverse knowledge, cultures, communication styles, skills, attitudes, experiences, and learning styles of students. The strategies used must go beyond the incidental inclusion of topics and objects unique to a culture or region, and strive to achieve higher levels of multicultural education (Banks and Banks, 1993).

Affective Domain

A positive attitude is an important aspect of the affective domain that has a profound effect on learning. Environments that create a sense of belonging, encourage risk taking, and provide opportunities for success help students develop and maintain positive attitudes and self-confidence. Students with positive attitudes toward learning mathematics are likely to be motivated and prepared to learn, participate willingly in classroom activities, persist in challenging situations, and engage in reflective practices.

Teachers, students, and parents* need to recognize the relationship between the affective and cognitive domains, and attempt to nurture those aspects of the affective domain that contribute to positive attitudes. To experience success, students must be taught to set achievable goals and assess themselves as they work toward these goals.

Striving toward success and becoming autonomous and responsible learners are ongoing, reflective processes that involve revisiting the setting and assessment of personal goals.

* In this document, the term *parents* refers to both parents and guardians and is used with the recognition that in some cases only one parent may be involved in a child's education.

Early Childhood

Young children are naturally curious and develop a variety of mathematical ideas before they enter Kindergarten. Children make sense of their environment through observations and interactions at home, in daycares, preschools, and in the community. Mathematics learning is embedded in everyday activities, such as playing, reading, storytelling, and helping around the home.

Activities can contribute to the development of number and spatial sense in children. Curiosity about mathematics is fostered when children are engaged in activities such as comparing quantities, searching for patterns, sorting objects, ordering objects, creating designs, building with blocks, and talking about these activities.

Positive early experiences in mathematics are as critical to child development as are early literacy experiences.

Mathematics Education Goals for Students

The main goals of mathematics education are to prepare students to

- communicate and reason mathematically
- use mathematics confidently, accurately, and efficiently to solve problems
- appreciate and value mathematics
- make connections between mathematical knowledge and skills, and their application
- commit themselves to lifelong learning
- become mathematically literate citizens, using mathematics to contribute to society and to think critically about the world

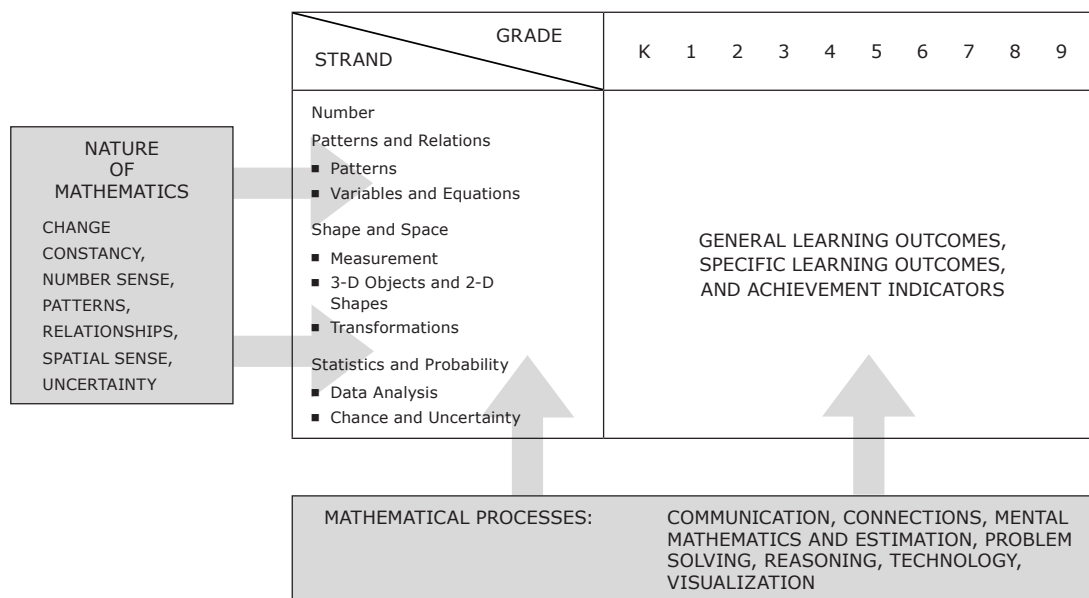
Mathematics education must prepare students to use mathematics to think critically about the world.

Students who have met these goals will

- gain understanding and appreciation of the contributions of mathematics as a science, philosophy, and art
- exhibit a positive attitude toward mathematics
- engage and persevere in mathematical tasks and projects
- contribute to mathematical discussions
- take risks in performing mathematical tasks
- exhibit curiosity

CONCEPTUAL FRAMEWORK FOR KINDERGARTEN TO GRADE 9 MATHEMATICS

The chart below provides an overview of how mathematical processes and the nature of mathematics influence learning outcomes.



Mathematical Processes

There are critical components that students must encounter in mathematics in order to achieve the goals of mathematics education and encourage lifelong learning in mathematics.

Students are expected to

- communicate in order to learn and express their understanding
- connect mathematical ideas to other concepts in mathematics, to everyday experiences, and to other disciplines
- demonstrate fluency with mental mathematics and estimation
- develop and apply new mathematical knowledge through problem solving
- develop mathematical reasoning
- select and use technologies as tools for learning and solving problems
- develop visualization skills to assist in processing information, making connections, and solving problems

The common curriculum framework incorporates these seven interrelated mathematical processes that are intended to permeate teaching and learning.

- **Communication [C]:** Students communicate daily (orally, through diagrams and pictures, and by writing) about their mathematics learning. They need opportunities to read about, represent, view, write about, listen to, and discuss mathematical ideas. This enables them to reflect, to validate, and to clarify their thinking. Journals and learning logs can be used as a record of student interpretations of mathematical meanings and ideas.
- **Connections [CN]:** Mathematics should be viewed as an integrated whole, rather than as the study of separate strands or units. Connections must also be made between and among the different representational modes – concrete, pictorial, and symbolic (the symbolic mode consists of oral and written word symbols as well as mathematical symbols). The process of making connections, in turn, facilitates learning. Concepts and skills should also be connected to everyday situations and other curricular areas.
- **Mental Mathematics and Estimation [ME]:** Mental mathematics and estimation are a combination of cognitive strategies that enhance flexible thinking and number sense. Strategies within mental mathematics and estimation enable students to calculate mentally without the use of external aids. In the process, they improve their computational fluency – developing efficiency, accuracy, and flexibility.
- **Problem Solving [PS]:** Students are exposed to a wide variety of problems in all areas of mathematics. They explore a variety of methods for solving and verifying problems. In addition, they are challenged to find multiple solutions for problems and to create their own problems.
- **Reasoning [R]:** Mathematics reasoning involves informal thinking, conjecturing, and validating – these help children understand that mathematics makes sense. Students are encouraged to justify, in a variety of ways, their solutions, thinking processes, and hypotheses. In fact, good reasoning is as important as finding correct answers.
- **Technology [T]:** Technology contributes to the learning of a wide range of mathematical outcomes, and enables students to explore and create patterns, examine relationships, test conjectures, and solve problems.
- **Visualization [V]:** Mental images help students to develop concepts and to understand procedures. Students clarify their understanding of mathematical ideas through images and explanations.

These processes are outlined in detail in *Kindergarten to Grade 8 Mathematics: Manitoba Curriculum Framework of Outcomes* (2013).

Strands

The learning outcomes in the Manitoba curriculum framework are organized into four strands across Kindergarten to Grade 8. Some strands are further subdivided into substrands.

The strands and substrands, including the general learning outcome for each, follow.

Number

- Develop number sense.

Patterns and Relations

- Patterns
 - Use patterns to describe the world and solve problems.
- Variables and Equations
 - Represent algebraic expressions in multiple ways.

Shape and Space

- Measurement
 - Use direct and indirect measure to solve problems.
- 3-D Objects and 2-D Shapes
 - Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.
- Transformations
 - Describe and analyze position and motion of objects and shapes.

Statistics and Probability

- Data Analysis
 - Collect, display, and analyze data to solve problems.
- Chance and Uncertainty
 - Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.

Outcomes and Achievement Indicators

The Manitoba curriculum framework is stated in terms of general learning outcomes, specific learning outcomes, and achievement indicators.

- **General learning outcomes** are overarching statements about what students are expected to learn in each strand/substrand. The general learning outcome for each strand/substrand is the same throughout the grades from Kindergarten to Grade 8.
- **Specific learning outcomes** are statements that identify the specific skills, understanding, and knowledge students are required to attain by the end of a given grade.
- **Achievement indicators** are samples of how students may demonstrate their achievement of the goals of a specific learning outcome. The range of samples provided is meant to reflect the depth, breadth, and expectations of the specific learning outcome. While they provide some examples of student achievement, they are not meant to reflect the sole indicators of success.

In this document, the word *including* indicates that any ensuing items **must be addressed** to meet the learning outcome fully. The phrase *such as* indicates that the ensuing items are provided for illustrative purposes or clarification, and are **not requirements that must be addressed** to meet the learning outcome fully.

Summary

The conceptual framework for Kindergarten to Grade 9 mathematics describes the nature of mathematics, mathematical processes, and the mathematical concepts to be addressed in Kindergarten to Grade 9 mathematics. The components are not meant to stand alone. Learning activities that take place in the mathematics classroom should stem from a problem-solving approach, be based on mathematical processes, and lead students to an understanding of the nature of mathematics through specific knowledge, skills, and attitudes among and between strands. The *Kindergarten Mathematics: Support Document for Teachers* is meant to support teachers to create meaningful learning activities that focus on formative assessment and student engagement.

Authentic assessment and feedback are a driving force for the suggestions for assessment in this document. The purposes of the suggested assessment activities and strategies are to parallel those found in *Rethinking Classroom Assessment with Purpose in Mind: Assessment for Learning, Assessment as Learning, Assessment of Learning* (Manitoba Education, Citizenship and Youth). These include the following:

- assessing *for, as, and of* learning
- enhancing student learning
- assessing students effectively, efficiently, and fairly
- providing educators with a starting point for reflection, deliberation, discussion, and learning

Assessment *for* learning is designed to give teachers information to modify and differentiate teaching and learning activities. It acknowledges that individual students learn in idiosyncratic ways, but it also recognizes that there are predictable patterns and pathways that many students follow. It requires careful design on the part of teachers so that they use the resulting information to determine not only what students know, but also to gain insights into how, when, and whether students apply what they know. Teachers can also use this information to streamline and target instruction and resources, and to provide feedback to students to help them advance their learning.

Assessment *as* learning is a process of developing and supporting metacognition for students. Assessment *as* learning focuses on the role of the student as the critical connector between assessment and learning. When students are active, engaged, and critical assessors, they make sense of information, relate it to prior knowledge, and use it for new learning. This is the regulatory process in metacognition. It occurs when students monitor their own learning and use the feedback from this monitoring to make adjustments, adaptations, and even major changes in what they understand. It requires that teachers help students develop, practise, and become comfortable with reflection, and with a critical analysis of their own learning.

Assessment *of* learning is summative in nature and is used to confirm what students know and can do, to demonstrate whether they have achieved the curriculum outcomes, and, occasionally, to show how they are placed in relation to others. Teachers concentrate on ensuring that they have used assessment to provide accurate and sound statements of students' proficiency, so that the recipients of the information can use the information to make reasonable and defensible decisions.

Overview of Planning Assessment			
	Assessment for Learning	Assessment as Learning	Assessment of Learning
Why Assess?	<ul style="list-style-type: none"> to enable teachers to determine next steps in advancing student learning 	<ul style="list-style-type: none"> to guide and provide opportunities for each student to monitor and critically reflect on his or her learning and identify next steps 	<ul style="list-style-type: none"> to certify or inform parents or others of student's proficiency in relation to curriculum learning outcomes
Assess What?	<ul style="list-style-type: none"> each student's progress and learning needs in relation to the curriculum outcomes 	<ul style="list-style-type: none"> each student's thinking about his or her learning, what strategies he or she uses to support or challenge that learning, and the mechanisms he or she uses to adjust and advance his or her learning 	<ul style="list-style-type: none"> the extent to which each student can apply the key concepts, knowledge, skills, and attitudes related to the curriculum outcomes
What Methods?	<ul style="list-style-type: none"> a range of methods in different modes that make a student's skills and understanding visible 	<ul style="list-style-type: none"> a range of methods in different modes that elicit the student's learning and metacognitive processes 	<ul style="list-style-type: none"> a range of methods in different modes that assess both product and process
Ensuring Quality	<ul style="list-style-type: none"> accuracy and consistency of observations and interpretations of student learning clear, detailed learning expectations accurate, detailed notes for descriptive feedback to each student 	<ul style="list-style-type: none"> accuracy and consistency of a student's self-reflection, self-monitoring, and self-adjustment engagement of the student in considering and challenging his or her thinking the student records his or her own learning 	<ul style="list-style-type: none"> accuracy, consistency, and fairness of judgments based on high-quality information clear, detailed learning expectations fair and accurate summative reporting
Using the Information	<ul style="list-style-type: none"> provide each student with accurate descriptive feedback to further his or her learning differentiate instruction by continually checking where each student is in relation to the curriculum outcomes provide parents or guardians with descriptive feedback about student learning and ideas for support 	<ul style="list-style-type: none"> provide each student with accurate, descriptive feedback that will help him or her develop independent learning habits have each student focus on the task and his or her learning (not on getting the right answer) provide each student with ideas for adjusting, rethinking, and articulating his or her learning provide the conditions for the teacher and student to discuss alternatives the student reports his or her learning 	<ul style="list-style-type: none"> indicate each student's level of learning provide the foundation for discussions on placement or promotion report fair, accurate, and detailed information that can be used to decide the next steps in a student's learning

Source: Manitoba Education, Citizenship and Youth. *Rethinking Classroom Assessment with Purpose in Mind: Assessment for Learning, Assessment as Learning, Assessment of Learning*. Winnipeg, MB: Manitoba Education, Citizenship and Youth, 2006, 85.

INSTRUCTIONAL FOCUS

The Manitoba mathematics curriculum framework is arranged into four strands. These strands are not intended to be discrete units of instruction. The integration of learning outcomes across strands makes mathematical experiences meaningful. Students should make the connection between concepts both within and across strands.

Consider the following when planning for instruction:

- Routinely incorporating conceptual understanding, procedural thinking, and problem solving within instructional design will enable students to master the mathematical skills and concepts of the curriculum.
- Integration of the mathematical processes within each strand is expected.
- Problem solving, conceptual understanding, reasoning, making connections, and procedural thinking are vital to increasing mathematical fluency, and must be integrated throughout the program.
- Concepts should be introduced using manipulatives and gradually developed from the concrete to the pictorial to the symbolic.
- Students in Manitoba bring a diversity of learning styles and cultural backgrounds to the classroom and they may be at varying developmental stages. Methods of instruction should be based on the learning styles and abilities of the students.
- Use educational resources by adapting to the context, experiences, and interests of students.
- Collaborate with teachers at other grade levels to ensure the continuity of learning of all students.
- Familiarize yourself with exemplary practices supported by pedagogical research in continuous professional learning.
- Provide students with several opportunities to communicate mathematical concepts and to discuss them in their own words.

“Students in a mathematics class typically demonstrate diversity in the ways they learn best. It is important, therefore, that students have opportunities to learn in a variety of ways – individually, cooperatively, independently, with teacher direction, through hands-on experience, through examples followed by practice. In addition, mathematics requires students to learn concepts and procedures, acquire skills, and learn and apply mathematical processes. These different areas of learning may involve different teaching and learning strategies. It is assumed, therefore, that the strategies teachers employ will vary according to both the object of the learning and the needs of the students” (Ontario 24).

DOCUMENT ORGANIZATION AND FORMAT

This document consists of the following sections:

- **Introduction:** The Introduction provides information on the purpose and development of this document, discusses characteristics of and goals for Early Years learners, and addresses First Nations, Métis, and Inuit perspectives. It also gives an overview of the following:
 - **Conceptual Framework for Kindergarten to Grade 9 Mathematics:** This framework provides an overview of how mathematical processes and the nature of mathematics influence learning outcomes.
 - **Assessment:** This section provides an overview of planning for assessment in mathematics, including assessment *for, as, and of* learning.
 - **Instructional Focus:** This discussion focuses on the need to integrate mathematics learning outcomes and processes across the four strands to make learning experiences meaningful for students.
 - **Document Organization and Format:** This overview outlines the main sections of the document and explains the various components that comprise the various sections.
- **Number:** This section corresponds to and supports the Number strand for Kindergarten from *Kindergarten to Grade 8 Mathematics: Manitoba Curriculum Framework of Outcomes (2013)*.
- **Patterns and Relations:** This section corresponds to and supports the Patterns and Relations strand for Kindergarten from *Kindergarten to Grade 8 Mathematics: Manitoba Curriculum Framework of Outcomes (2013)*.
- **Shape and Space:** This section corresponds to and supports the Measurement and 3-D Objects and 2-D Shapes substrands of the Shape and Space strand for Kindergarten from *Kindergarten to Grade 8 Mathematics: Manitoba Curriculum Framework of Outcomes (2013)*.
- **Blackline Masters (BLMs):** Blackline Masters are provided to support student learning. They are available in *Microsoft Word* format so that teachers can alter them to meet students' needs, as well as in *Adobe PDF* format.
- **Bibliography:** The bibliography lists the sources consulted and cited in the development of this document.

Guide to Components and Icons

Each of the sections supporting the strands of the Kindergarten Mathematics curriculum includes the components and icons described below.

Enduring Understanding(s):

These summarize the core idea of the particular learning outcome(s). Each statement provides a conceptual foundation for the learning outcome. It can be used as a pivotal starting point in integrating other mathematical learning outcomes or other subject concepts. The integration of concepts, skills, and strands remains of utmost importance.

Essential Question(s):

These are used to guide students' learning experiences and may be useful when planning assessments. Inquiring into essential questions gives teaching and learning purposeful and meaningful focus for achieving the specific learning outcome(s).

SPECIFIC LEARNING OUTCOME(S):	ACHIEVEMENT INDICATORS:
<p>Specific learning outcome (SLO) statements define what students are expected to achieve by the end of the grade.</p> <p>A code is used to identify each SLO by grade and strand, as shown in the following example:</p> <p>K.N.1 The first number refers to the grade (Kindergarten). ▲▲▲ The letter(s) refer to the strand (Number). └─ The last number indicates the SLO number. [C, CN, ME, PS, R, T, V]</p> <p>Each SLO is followed by a list indicating the applicable mathematical processes.</p>	<p>Achievement indicators are examples of a representative list of the depth, breadth, and expectations for the learning outcome. The indicators may be used to determine whether students understand the particular learning outcome. These achievement indicators will be addressed through the learning activities that follow.</p>

PRIOR KNOWLEDGE

Prior knowledge is identified to give teachers a reference to what students may have experienced previously. Teachers should assess students' prior knowledge before planning instruction.

BACKGROUND INFORMATION

Background information is identified to give teachers knowledge about specific concepts and skills related to the particular learning outcome.

MATHEMATICAL LANGUAGE

Lists of terms students will encounter while achieving particular learning outcomes are provided. These terms can be placed on math word walls or used in a classroom math dictionary. *Kindergarten to Grade 8 Mathematics Glossary: Support Document for Teachers* (Manitoba Education, Citizenship and Youth) provides teachers with an understanding of key terms found in Kindergarten to Grade 8 mathematics. The glossary is available on the Manitoba Education and Advanced Learning website at www.edu.gov.mb.ca/k12/cur/math/supports.html.

LEARNING EXPERIENCES

Suggested teaching strategies and assessment ideas for the specific learning outcomes and achievement indicators are provided. In general, learning activities and teaching strategies related to specific learning outcomes are developed individually, except in cases where it seems more logical to develop two or more learning outcomes together. Suggestions for assessment include information that can be used to assess students' progress in their understanding of a particular learning outcome or learning experience.



Assessing Prior Knowledge:

Observation Checklist:

Assessing Understanding:

Suggestions are provided for assessing prior to and after lessons, and checklists are provided for observing during lessons to direct instruction.

Suggestions for Instruction

- **Achievement indicators appropriate to particular learning experiences are listed.**

The instructional suggestions include the following:

- **Materials/Resources:** Outlines the resources required for a learning activity.
- **Organization:** Suggests groupings (individual, pairs, small group, and/or whole class).
- **Procedure:** Outlines detailed steps for implementing suggestions for instruction.

Some learning activities make use of BLMs, which are found in the Blackline Masters section in *Microsoft Word* and *Adobe PDF* formats.

PUTTING THE PIECES TOGETHER



Putting the Pieces Together tasks are found at the end of some learning outcomes and consist of a variety of assessment strategies. They may assess one or more learning outcomes across one or more strands and may make cross-curricular connections.

NOTES



KINDERGARTEN MATHEMATICS

Number

Kindergarten: Number (K.N.1, K.N.3, K.N.5)

Enduring Understanding: Quantities can be counted and compared using numbers, words, and numerals.

Essential Question(s): What math words can be used to count?
How can objects be counted?

SPECIFIC LEARNING OUTCOME(S):	ACHIEVEMENT INDICATORS:
<p>K.N.1 Say the number sequence by 1s, starting anywhere from 1 to 30 and from 10 to 1. [C, CN, V]</p>	<ul style="list-style-type: none">→ Recite the number sequence from 1 to 30 and from 10 to 1.→ Name the number that comes after a given number, 1 to 9.→ Name the number that comes before a given number, 2 to 10.→ Recite number names from a given number to a stated number (forward – 1 to 10, backward – 10 to 1) using visual aids.
<p>K.N.3 Relate a numeral, 1 to 10, to its respective quantity. [CN, R, V]</p>	<ul style="list-style-type: none">→ Construct a set of objects corresponding to a given numeral.→ Name the number for a set of objects.→ Hold up the appropriate number of fingers for a given numeral.→ Match numerals with their pictorial representations.
<p>K.N.5 Demonstrate an understanding of counting to 10 by</p> <ul style="list-style-type: none">■ indicating that the last number said identifies “how many”■ showing that any set has only one count <p>[C, CN, ME, R, V]</p>	<ul style="list-style-type: none">→ Answer the question, “How many are in the set?” using the last number counted in a set.→ Show that the count of the number of objects in a set does not change regardless of the order in which the objects are counted.→ Count the number of objects in a given set, rearrange the objects, predict the new count, and recount to verify the prediction.

PRIOR KNOWLEDGE

Students' knowledge of counting will depend on experiences in the home and in other settings such as daycare or nursery.

BACKGROUND INFORMATION

Stages of Counting

Rote Counting (Ages 2 to 6): Most preschool children learn some counting words, even though they may not say these words in the correct order.

With experience they learn the proper sequence (stable order) but may be unable to make one-to-one correspondence between the object being counted and the number names that are applied to them.

Rational Counting (Ages 5 to 7): The students attach the correct number name to each object as it is counted (one-to-one correspondence).

The students understand that the final count number indicates the number of objects in a set (cardinality).

Strategic Counting (Ages 5 to 8): Counting on and counting back are two strategies that extend students' understanding of numbers and provide a basis for later development of addition and subtraction concepts.

In counting on, the students count forwards beginning at any number. Counting back is challenging for many young students, and students need many opportunities to gain skill and confidence in counting backwards from different numbers.

Counting Principles

The research related to how children learn to count identifies principles which children need to acquire to become proficient at counting. They include

Stable Order: Words used in counting must be the same sequence of words used from one count to the next.

Order Irrelevance: The order in which objects are counted does not matter. Counting things in a different order still gives the same count.

Conservation: The count for a set of objects stays the same whether the objects are spread out or close together. The only way the count can change is when objects are added to the set or removed from the set.

Abstraction: Different things can be counted and still give the same count. Things that are the same, different, or imaginary (ideas) can be counted.

One-to-one Correspondence: Each object being counted is given one count in the counting sequence.

Cardinality: After a set of objects has been counted, the last number counted represents the number of objects in that set. If students need to recount they don't understand the principle.

Note: The numbers 11 to 19 in English often cause difficulties for students because of the way they are said and read. The oral language pattern of 14 as "four and ten," for example, is the reverse of the usual pattern of "tens first and then ones." Other languages use the pattern of "tens first and then ones" for these numbers. Invite students to share their language with the class.

MATHEMATICAL LANGUAGE

Counting numbers: one to thirty, backward, forward

Position words: after, before, count on, count back

LEARNING EXPERIENCES



Assessing Prior Knowledge: Interview

1. Have students start at 1 and rote count forward as far as they can. Stop after the first error.
2. Have students count backward from 10 to 1.
3. Place a set of objects in a line. The number selected (4 to 10) will depend on the students' rote counting. Have the students count the objects. Observe the students as they count.

Do the students

- touch or move the objects as they say the number word?
- count each object once only?
- say the number sequence correctly?

Ask: "How many objects are there?" Do the students reply without having to recount?

4. Have the students spread the objects out on the table. Ask: "How many objects are there?" Do the students reply without having to recount?

- **Name the number that comes after a given number, 1 to 9.**
- **Name the number that comes before a given number, 2 to 10.**

Note: Students can be expected to name the number after a given number if they can count forward beyond that number. Inversely, students can be expected to name the number before a given number if they can count backward beyond that number.

The counting sequence for these experiences should be adjusted to meet varied student needs.

- **Echo counting:** The teacher counts and the students echo the teacher. Begin with single numbers and work towards a small grouping of numbers (e.g., 6, 7, 8 or 6, 5, 4). Support students by holding up two or three fingers so students can keep track of the next two or three numbers.
- **I say ... You say ...:** The teacher (or leader) says a number in the counting sequence and the class or individual student responds with the number that comes after or before.
- **Orchestra counting:** Put students into groups. The first group begins counting forward from 1. When the leader points to another group they continue the count from where the previous group left off.
- Use poems, songs, and stories that have forward and backward counting sequences. Have students predict which number comes next as you read through the poem or story. Use sticky notes to cover up the numbers on each page or each section of a poem and have students identify the hidden number.
- **Rote counting and one-to-one:** Divide students into groups of two or three, and provide each group with laces and beads. Have the students count in unison by ones as they string the beads. Ask questions such as: “When we put on another bead how many will be on our string?” This task can be repeated counting backward as beads are removed.
- **Bead number line:** Have students count (forward and backward) as the beads are moved one-by-one from one side to another.

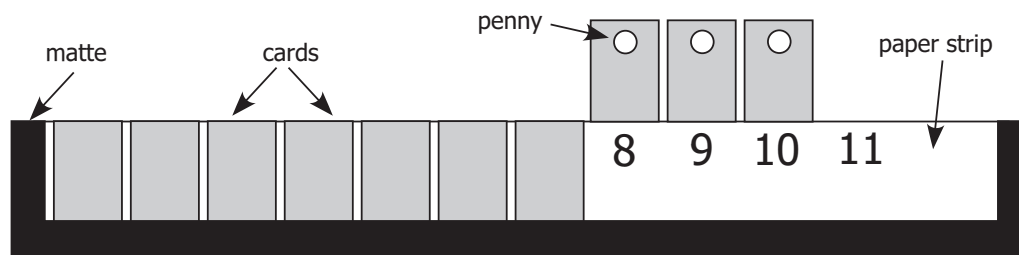


- **Hidden Numeral Boards:**

Materials:

- picture matting or heavy cover stock about 10 cm wide and 60 cm long
- cards 6 cm x 9 cm
- pennies or washers

Tape the cards onto the mat with transparent tape so that the top is taped down and the card can be raised easily. On the underside of each card near the bottom, tape a penny or a washer. This helps to keep the card from flipping up.



Strips can be customized to meet students' needs. Hint: When making a new number strip insert it into the numeral board and write the numbers in as you lift the flaps. This way the numbers will match up with the flaps.

The hidden numeral track can now be used to

- count forward and backward by lifting the flaps
 - identify the number before and after by lifting one flap and pointing to the flaps to the left and right of the visible number
 - identify the number between by using a group of three flaps and leaving the middle flap closed
 - count on from a stated number to a given number by raising the flap of one of the numbers near the beginning of the numeral board and one near the end of the board
- **Use a row of 10 squares:** Place a number somewhere in the row. Have students place another number on the grid using the language of before and after to explain the number placement. *When students are confident with numbers to 10 you can add another row. **Note:** You do not need to assess beyond 10.

For example,



“The 5 goes right after the 4.”



BLM
K-4.1

Assessing Understanding: Checklist

Use an assessment checklist to track student progress over time.

Number After		
Student's Name	0-5	6-9

Number Before		
Student's Name	5-0	10-5

- **Recite number names from a given number to a stated number (forward—1 to 10, backward—10 to 1) using visual aids.**
- **Beaded Number Line:** Have students count while beads are being moved from one side to the other side. Stop after a particular number. Put a clip or a bread tag on the line to mark the stopping point. Have students count on from the marked number to the end of the line.
- **Make a vertical number line 1 to 10** with spaces large enough for students to stand or jump in. Have students take turns starting at a given number and then jumping from space to space until they reach a stated end number. As the students jump, they can count aloud or the class can count in unison.
- **Horizontal Number Line:** Use a number line along with a frog or kangaroo attached to a craft stick. Students take turns jumping the frog/kangaroo from a given number to an end number counting aloud as they move forward or backward.
- **Use two 1 to 10 (1 to 6, 1 to 20, or 1 to 30) dice:** Select a student to roll the first die and identify the number. This will be the start number. Have a second student roll the second die and say the number. This will be the end number. The class then begins with the start number and counts either forward or backward to arrive at the end number.

These learning experiences work on the count on and count back strategies. Students should be introduced to the vocabulary through teacher-modelling.



Observation Checklist

The students are able to

- confidently count forward by 1s from random starting points in the range
- confidently count backward by 1s from random starting points in the range

- **Construct a set of objects corresponding to a given numeral.**
- **Name the number for a set of objects.**
- **Match numerals with their pictorial representations.**
- **Answer the question, "How many are in the set?" using the last number counted in a set**

- Daily Counting Routines

- **Attendance:** Select a student to count the number of students present.

- **Counting Jar:** Fill a small jar with a different item each day. Select one or two students to count the objects each day. Have the class confirm the number by counting aloud as the student(s) points to each item.

- **Counting Tree or Counting Wall:** Fill zippered bags with different numbers of items. Hang the bags on a tree (branch placed in a pail of sand) or on a bulletin board. Select one or two students to 'pick' a bag and count the number of objects. Items in the bags could support classroom themes or special events.

Vary the objects students count (not always using cubes, etc.). Include mixed sets of different objects (size, shape, etc.).

- Use a set of dot cards or dominoes with representations to 10. Place them face down on the table. Have students take turns drawing a card/domino and identifying the number shown.
- Prepare a set of activity cards. Seat students in a circle. Place cards face down in the middle of the circle. Students take turns drawing a card and then leading the class in performing the activity on the card. Have students count aloud as the actions are performed.

Example:



BLM
K.N.1&3&5.1

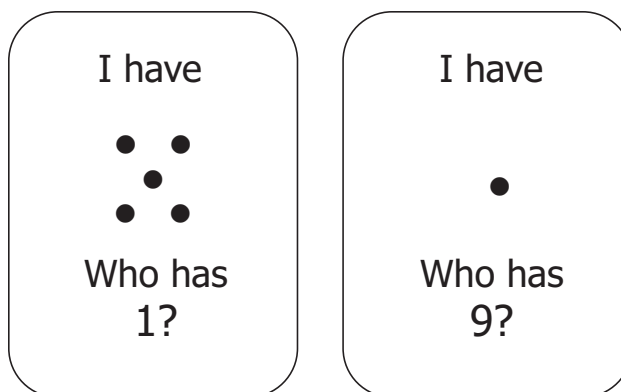
- **Paper Plate Match:** Put a different number of unifix cubes on paper plates. Have students match the numeral to the quantity shown. Reverse the procedure by placing a numeral in front of each plate and having students put the correct number of cubes on the plates.
- **Spin or Roll and Build:** Use a 1 to 10 spinner or a ten-sided dice. Students take turns spinning or rolling and then building a unifix tower to match the number shown.
- **Concentration:** Prepare a set of numeral cards, dot representations, five frames, and finger representations. Shuffle the cards. Place them face down in a grid. Students draw two cards. If they match they keep the pair; if not, they return them to the grid. The game continues until all cards have been matched.

BLM
K.N.1&3&5.2

Differentiate the game by

- limiting the number of cards used (e.g., 1 to 5 or using only numerals 2 and 3) and corresponding representations
 - using only one representation along with the numeral cards (e.g., numeral cards and finger representations)
 - placing the cards face up in the grid
- **I Have. . . Who has. . . ?:** Prepare a set cards from BLM 4.

Example:



BLM
K.N.1&3&5.3

Note: The cards have been placed in order. Change the order to make the game more challenging.

Play with a small group (not more than 10). Pass out a card to each student. Model reading the card for students. Have one student begin by reading his or her card. The person with the answer to the “Who has...?” question follows by reading his or her card. Play continues until it gets back to the student who started the game.

- **Number Necklaces:** Give each student a numeral card, a dot pattern or a finger pattern card. Attach string and have students wear it as a necklace. On your signal have students find their partners.



Observation Checklist

The students are able to

- count a set of objects
 - 2 to 5
 - 6 to 10
- name the number for a given set 1 2 3 4 5 6 7 8 9 10
- match a numeral to a set of objects 1 2 3 4 5 6 7 8 9 10
- make a set of objects to match a numeral 1 2 3 4 5 6 7 8 9 10
- match a numeral to different representations 1 2 3 4 5 6 7 8 9 10
- respond to the question, “How many are there?” without having to recount

Integrating Counting into Kindergarten Routines and Centres

CENTRE	SUGGESTED ACTIVITIES
Arts and Crafts	Paint a picture that includes a specified number of objects. Make a picture with a specified number of different types of paper or colours. Connect to the Paper cluster in science. Use playdough to make objects. Have them counted.
Math	Play board games that require counting. Use manipulative materials such as unifix cubes to make towers to match the number rolled on a dice.
Sand and Water	Have students count the number of sand shapes they have made. Count the number of small containers it takes to fill a larger one.
Block/Construction	Make towers/buildings and count the number of blocks used. Make a structure that uses a specified number of blocks.
Role Play	One-to-one matching setting the table. Matching cars with garages, etc.
Music and Reading	Read or listen to counting stories and act them out. Use finger plays and number rhymes. Sing counting songs



Performance Task: Mystery Bags

Materials: a collection of paper bags with different numbers of objects in each bag (e.g., math materials, keys, buttons, small toys, erasers, pencils, etc.)

Context: Someone left a box in our classroom. The box is full of bags. The bags have different objects in them. I would like your help putting the name and number of objects on the outside of each bag.

Have students work in pairs. Provide each pair with two or three bags. The number of objects in each bag should be within (or just outside of) their counting range. Direct them to count the number of objects and then write the number and the object name on the bag.

Observe students as they work.

- Are they able to count the collections?
- Do they have a strategy for keeping track of the counting for a larger collection, for example, snapping cubes together in groups of five or ten?
- Are they able to record the number of objects?

Have students share their findings with the class.

Kindergarten: Number (K.N.2)

Enduring Understanding: The quantity of a small collection can often be determined through instant recognition or by thinking of it in its parts.

Essential Question(s): How many dots/objects do you see?
How do you see them?

SPECIFIC LEARNING OUTCOME(S):	ACHIEVEMENT INDICATORS:
<p>K.N.2 Subitize and name familiar arrangements of 1 to 6 dots (or objects). [C, CN, ME, V]</p>	<ul style="list-style-type: none">→ Look briefly at a given familiar arrangement of 1 to 6 dots (or objects), and identify the number represented without counting.→ Identify the number represented by a given dot arrangement on a five frame, and describe the number's relationship to 5.→ Identify the number represented by a given dot arrangement on a five frame, and identify the numbers that are one more and one less.

PRIOR KNOWLEDGE

Students may have had no formal experience with this skill.

BACKGROUND INFORMATION

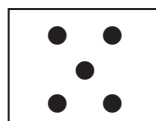
Subitizing is the ability to rapidly determine the quantity of a small group of objects without counting. Subitizing is a fundamental skill in a student's development of number understanding.

There are two types of subitizing; perceptual and conceptual. Perceptual subitizing is the ability to recognize the quantity of a set without counting. It is the basis for counting and cardinality and the focus of the Kindergarten outcomes. Conceptual subitizing is seeing number patterns within a set (part – whole) and then determining the quantity by putting the number patterns together.

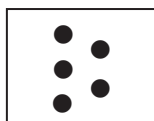
Dot representations can be regular and irregular. Regular representation show the dots as you would find them on a dice or domino (see example on the following page).

Irregular representations group the dots in a variety of ways.

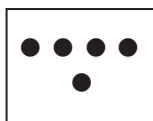
Example:



Regular



Irregular



MATHEMATICAL LANGUAGE

Sets, subitizing, “How many”, dots, pips, five frames

LEARNING EXPERIENCES



Assessing Prior Knowledge: Interview or Small Group

Use dot cards for 1, 2, and 3.

Flash the cards in a random order.

Have students show with their fingers the number of dots they saw.

The students are able to subitize: 1 2 3

- **Look briefly at a given familiar arrangement of 1 to 6 dots (or objects), and identify the number represented without counting.**
- **Identify the number represented by a given dot arrangement on a five frame, and describe the number’s relationship to 5.**
- **Identify the number represented by a given dot arrangement on a five frame, and identify the numbers that are one more and one less.**

- **Dot Card Flash:** Use a set of dot cards with regular dot formations for the numbers 1 to 6. Give each student a work mat and counters. Explain to the students that you are going to flash a card and then ask them to make the arrangement they saw using the counters. Hold up the card for about three seconds.

After they have built the dot arrangement, ask:

How many dots did you see?

How did you see them?

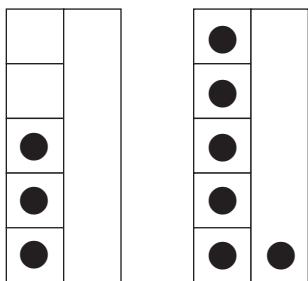
How many counters did you use on your mat?

BLM
K.N.2.2

- **Flash Math:** Use an overhead projector and a set of dot transparencies or cards with the dot patterns made with a hole-punch. Briefly flash the dot formation. Have students hold up fingers to show the number.
- **Five Frame Flash:** Use a set of five frame cards. Briefly flash a five frame. Have students identify the number shown.

BLM
K.N.2.1

Example:



Using five frames, as shown, encourages the development of additive thinking and supports using 5 as a benchmark. Students can easily see 6 as 5 and 1 extra.

BLM
K.N.2.3

- **Dot Card/Five Frame Flash:**

Materials: a double set of dot cards or five frame cards (or a mixture)

Directions: Have students play with a partner. Place the cards face down in a pile on the table. Students take turns turning over the top card. The first person to identify the number shown gets the card. In the event of a tie a second card is turned over. Play continues until all cards have been played.

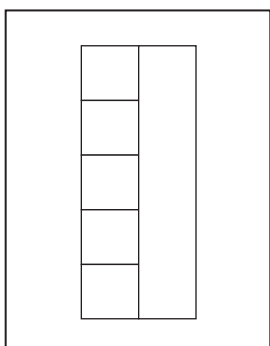
BLM
K.N.2.1

BLM
K.N.2.2

BLM
K.N.2.1

- **More or Less Than Five:** Show students a five frame card. Ask, “Is the number shown more or less than 5? How many more? How many less?”
- **One More, One Less:** Give each student a five frame mat and counters. Show a five frame dot card. Ask students to identify and then make the number shown. Have them identify and make the number that is one more and one less.

BLM
K.N.2.1



BLM
K.N.2.3



Assessing Understanding

1. Observe students as they play a board game that uses a 1-to-6 numbered die.
2. Flash dot and five frame cards and have the students identify the number shown.
3. Show a five frame card. Ask the students to give the number that is one more and one less.

Observation Checklist

The students are able to

- count the pips
- subitize the numbers 1 2 3 4 5 6
- identify a dot formation on a five frame
- show the number that is one more and one less

Kindergarten: Number (K.N.4)

Enduring Understanding: Quantities can be represented in a variety of ways with objects, pictures, and numerals.

Essential Question(s): How can quantities be shown?

How many different ways can you represent a number?

SPECIFIC LEARNING OUTCOME(S):	ACHIEVEMENT INDICATORS:
K.N.4 Represent and describe numbers 2 to 10 in two parts, concretely and pictorially. [C, CN, ME, R, V]	→ Show a number as two parts, using fingers, counters, or other objects, and name the number of objects in each part. → Show a number as two parts using pictures, and name the number of objects in each part.

PRIOR KNOWLEDGE

Students may have had experience

- counting beyond 10
- understanding that for any given set there is only one count

BACKGROUND INFORMATION

Part-whole understanding is the ability to conceptualize a number as being composed of other numbers. It is one of the most important number relationships. For example, the number 8 is a whole amount but it is also made up of smaller groups 7 and 1, 2 and 6, 3 and 5, and 4 and 4.

Research shows that a strong part-whole understanding positively impacts students' performance in number concepts, place value, and problem solving.

The development of part-whole understanding with numbers to 10 is the basis of success with larger numbers.

Kindergarten students need to progress at their own rate. Not all students, therefore, will necessarily be working on the same number at the same time. Having students work with larger numbers before they are fluent with smaller numbers can encourage them to become dependent on rote procedures.

It is recommended that you begin working with the number 4. It is easy to show with fingers on one hand and to show the part-part-whole relationships. From there students can learn about the numbers 2 and 3 before progressing to 5 through 10.

MATHEMATICAL LANGUAGE

Sets, part, whole, numbers, groups

LEARNING EXPERIENCES



Assessing Prior Knowledge

1. Have the students count orally. Stop at 15.
2. Use a set of objects (5 to 10). Have the students count them. Ask, "How many are there?"
3. Have the students rearrange the counters. Ask, "Now, how many are there?"

Observation Checklist

The students are able to

- Count beyond 10
- Count a collection (5 to 10) accurately.
- Recount when asked, "How many are there?"
- Answer the question, "How many are there?" without counting.
- Recount the new arrangement.
- Identify the quantity of the new arrangement without counting.

- **Show a number as two parts, using fingers, counters, or other objects, and name the number of objects in each part.**
- **Show a number as two parts using pictures, and name the number of objects in each part.**

Students should be provided with multiple opportunities to explore part-part-whole relationships for each number 2 to 10. They should focus on a single number until they can confidently identify/show the different combinations for that number.

Note: Although part-whole activities resemble those for addition and subtraction there is no formal operation work in Kindergarten. Avoid the use of addition, subtraction, and equal symbols.

Possible materials/objects to use for representing number and showing part-part-whole relationships

- fingers
- toothpicks
- craft sticks
- unifix cubes
- blocks
- colour tiles
- commercial counters (e.g., bear counters)
- pattern blocks
- spray painted lima beans or two-coloured counters—shake and spill
- “junk” box material— keys, shells, buttons, etc.

Examples of representing a number as a whole:

Note: This should be done with the support of the teacher perhaps as part of the group meeting time.

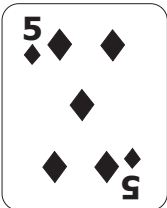

BLM
K-4.1

All about 5


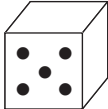
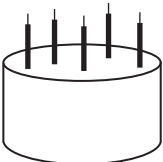

○ ○ ○ ○ ○

5

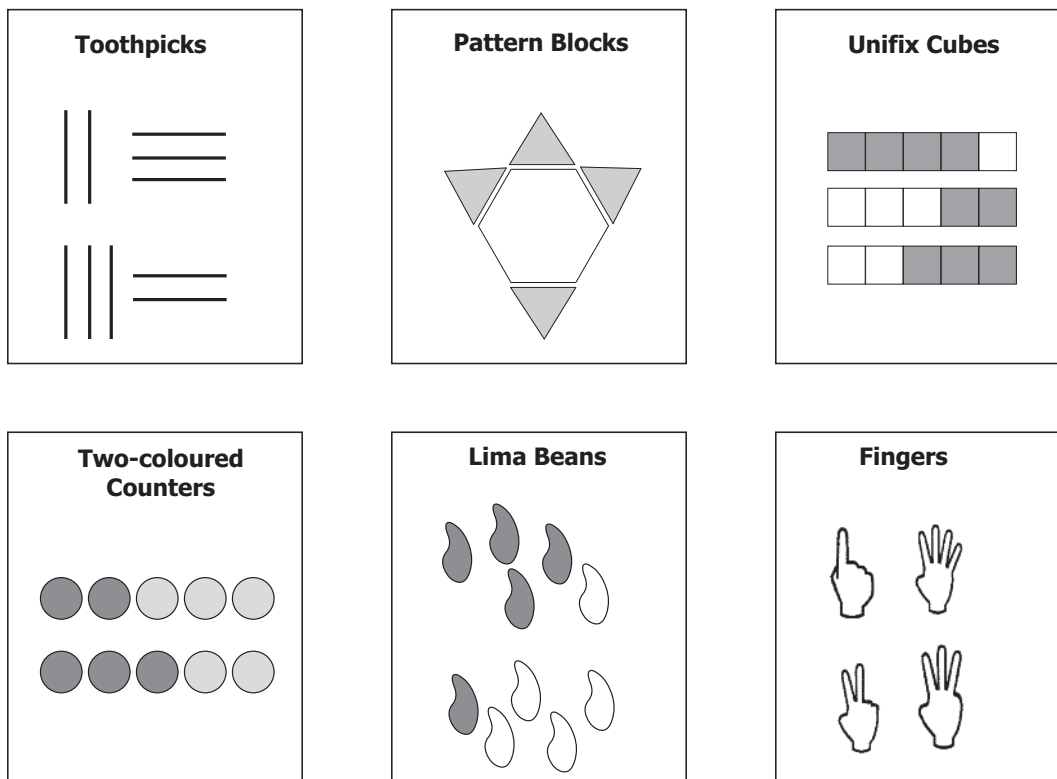
There are 5 toes on my foot.



My telephone number has a 5.



Examples of part-part-whole representations for the number 5:



Students should be able to use the same material to show all of the combinations for a number.

- **Dominoes:** Have students find the dominoes that total a particular number (e.g., 5).

BLM
K.N.4.1



- **Story Mats:** Use story mats to provide meaningful contexts for problem solving (e.g., use a 'fishbowl' story mat and fish counters or crackers with the following problem).

The twins, Mary and Paul, got 9 fish on their birthday. They both want fish in their bedrooms. How many different ways can they share the fish?

BLM
K.N.4.2



Have students draw pictures to record their findings.

Examples of story mats:

- trees (leaves or apples)
- treasure chests (counters or pennies)
- piggy banks (pennies or counters)
- ponds (counters or paper ducks)
- playground (counters, paper dogs)

- **Rabbit Ears:** Have students put their hands behind their heads like rabbit ears. Ask them to use their fingers to show a number. Discuss the representations shown. Encourage students to show it in a different way. Note: Some students will have to work with their fingers where they can see them.
- **How many are hiding?:** Use a plastic container or box. Place a selected number of counters on top of the container. Be sure that the number is agreed upon by the students. Ask them to close their eyes. Put some of the counters underneath the container. Have them look at the counters remaining and ask, "How many are hiding? How do you know?"
- **Visualizing Numbers:** Have students close their eyes and imagine a particular number of objects. Ask, "How do you see 5?" Students should reply giving the part-part-whole representation (e.g., "I see 3 and 2." or "I see 1 and 4.").



Observation Checklist

Use a checklist to record students' progress related to part-part-whole understanding.

Students demonstrate part-part-whole understanding for a number when they are able to

- represent the number in two parts using a variety of materials
- apply part-part-whole understanding related to the number in problem-solving situations
- represent the number in two parts with objects and with pictures and name the number of objects in each part
- begin to use a strategy in order to identify the missing part when the other part is shown

BLM
K.N.4.3

Student	Part-Part-Whole Understanding								
	2	3	4	5	6	7	8	9	10

PUTTING THE PIECES TOGETHER



Performance Task: Frogs—Part–Part–Whole Story

Read a book such as *Quack and Count* by Keith Baker. This book shows many ways to make seven in two parts.

or

BLM
K.N.4.4

Use a flannel/magnetic story board. Select a number. Tell a part-part-whole story. For example: There are 8 frogs living in Mr. Smith’s yard. They like to play in the grass and swim in the pond.



On Monday, 6 frogs played in the grass and 2 frogs swam in the pond.

On Tuesday, 4 frogs played in the grass and 4 frogs swam in the pond, etc.

Record the number combinations as the story is read/told.

Example:

Grass	Pond
6	2
4	4

Tell students that they are now going to make their own part-part-whole stories.

Note: Students can make up their own story context or use a math story board. Numbers can be selected by the students or assigned by the teacher depending on student needs.

Have students work in partners to make up and record their stories. Encourage them to use all possible combinations of their number.

Share stories with the class.



Assessing Understanding

Observe students as they work.

Observation Checklist

Students are able to

- tell a part-part-whole story
- record the story using pictures
- identify the number for each part
- find all the combinations for their number

NOTES

Kindergarten: Number (K.N.6)

Enduring Understanding: Quantities can be counted and compared using numbers, words, and numerals.

Essential Question(s): Which has more?
Which has less?

SPECIFIC LEARNING OUTCOME(S):	ACHIEVEMENT INDICATORS:
<p>K.N.6 Compare quantities, 1 to 10,</p> <ul style="list-style-type: none">■ using one-to-one correspondence■ by ordering numbers representing different quantities <p>[C, CN, V]</p>	<ul style="list-style-type: none">→ Construct a set to show more than, fewer than, or as many as a given set.→ Compare two sets through direct comparison, and describe the sets using words such as “more,” “fewer,” “as many as,” or “the same number.”→ Order quantities using objects, five frames, ten frames, or dot cards.→ Order, using at least 2 benchmarks, numerals 1 to 10 on a vertical or horizontal number line.

PRIOR KNOWLEDGE

Students may have had no formal experience with this skill.

BACKGROUND INFORMATION

One-to-one Correspondence: Each object being counted is given one count in the counting sequence. There are many opportunities in the classroom to practise one-to-one correspondence, for example, passing out materials (scissors, pencils, paper, books), voting (one vote per person).

Students often have difficulty with comparative vocabulary. They need direct instruction in order to develop facility with the terms.

MATHEMATICAL LANGUAGE

More than, fewer than, as many as, the same number, less than, greater than



Assessing Prior Knowledge: Individual or Small Group

Give each student three paper plates and counters. Make a set of three counters on one of your paper plates. Ask students to use their paper plates to

- make a set that is the same as yours
- make a set that is smaller than yours
- make a set that is larger than yours
- identify the number of objects on each plate
- order the plates from the smallest to the largest

Observation Checklist

Students are able to

- make a set that is the same as yours
- make a set that is smaller than yours
- make a set that is larger than yours
- identify the number of objects on each plate
- count using one-to-one correspondence
- subitize
- order the plates from the smallest to the largest

- **Construct a set to show more than, fewer than, or as many as a given set.**
- **Compare two sets through direct comparison, and describe the sets using words such as "more," "fewer," "as many as," or "the same number."**

- **One-to-One Correspondence:** Have students sit in a circle. Students take turns rolling a 1 to 6 numbered die and making a unifix train to match the number rolled. When all students have had a turn, compare the trains. Ask, "Who has more? Who has less? Does anyone have the same number?"

Extend the activity by

- using two dice or dominoes
- asking, "How many more cubes would we need to make the trains the same?"

- **Matching Trains:** Make a set of unifix trains of different lengths (some the same, some not). Have students find the ones that are the same.

Extend the activity by selecting one tower. Have students sort the rest into groups using the selected tower as a benchmark.

BLM
K.N.6.1

- **Dueling Towers (partner activity):** Students build a tower of 10 interlocking/unifix cubes. Have them put the tower behind their backs and break off a piece. Players put the pieces on the table in front of them and compare using the terms more than, fewer/less than, or the same as.

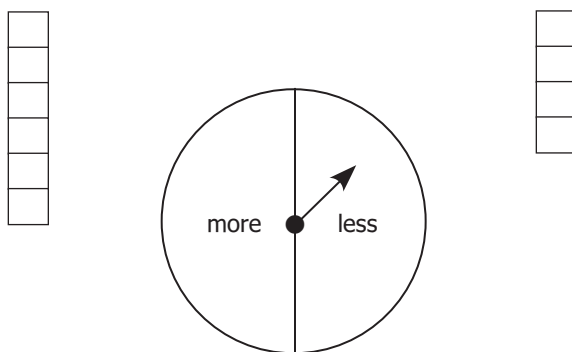
Once students have had practise with this activity they can play it as a game.

Students continue to break off pieces of the tower but now they spin a 'more or less' spinner to determine which team member scores a point (gets a counter). Play continues until someone has collected five counters/points.

Example:

Player A has a tower of 6.

Player B has a tower of 4.

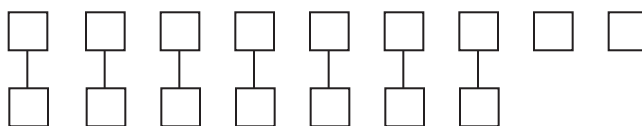


Player A spins the more or less spinner and it lands on less. Player B gets a counter/point because his or her tower has fewer cubes. If the towers are the same both players get a counter/point.

- **Handfuls:** Work in partners. Each student takes a handful of cubes and then uses one-to-one correspondence to compare them. Vary the materials depending on the needs of the students (e.g., smaller objects for students comfortable with larger numbers).

Support students by providing pipe cleaners, yarn, stir sticks, or craft sticks. Students can use them to join the objects between sets.

Example:



BLM
K.N.6.2

- **Board Games:** Playing board games in which students roll dice and move along a path reinforces one-to-one correspondence and subitizing.



Observation Checklist

Students are able to

- construct a set to show fewer than a given set
- construct a set to show more than a given set
- construct a set to show as many as a given set
- use the language of comparison correctly
- compare two sets using direct comparison (one-to-one correspondence)

- **Order quantities using objects, five frames, ten frames, or dot cards.**
- **Order, using at least 2 benchmarks, numerals 1 to 10 on a vertical or horizontal number line.**

- **What's the Order?:** Place a different number of objects on several paper plates. Select three of the plates and ask students to order them from least to greatest. Ask, "How do you know your order is correct?" Add another plate and have them reorder. Continue until all plates have been used.

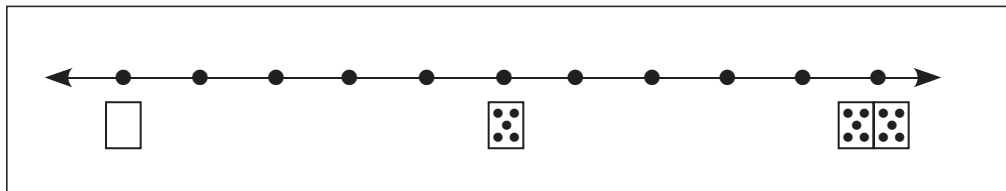
BLM
K.N.6.3&4&5

Repeat the activity using five frames, ten frames, dot cards, and finger representations.

Extend the activity by having students use numerals along with the objects and representations.

- **Ordering on a Number Line:** Make a large number line (see example). Use dot cards, five frames, ten frames, or finger representations. Place cards on the number line to be used as benchmarks. Have students place the remaining cards giving reasons for their placement.

Example:



Repeat the activity using numeral cards.

- **Clothesline Numbers:** Put up a clothesline (string). Make a set of numeral cards. The cards should be folded (tent-like) to make it easier for them to be hung on the line. Place two or three cards on the line to be used as benchmarks. Have students take turns placing the remaining numerals. Ask them to justify their placement. Support students by increasing the number of benchmarks on the line.

BLM
K.N.6.6

Extend the activity by reducing the number of benchmarks on the line. Some students may be able to order the numbers using only an empty number line.

Change the orientation of the number line so that it is vertical.

Repeat the activities.



- **Where Do You Belong?:** Prepare a set of numeral cards to be worn around the neck. Randomly distribute them. Have students order themselves from least to greatest. Extend the activity by ordering from greatest to least.



Observation Checklist

Students are able to

- order quantities using various representations
- order numerals on a number line
- justify the placement of a particular numeral

NOTES



KINDERGARTEN MATHEMATICS

Patterns and Relations

Kindergarten: Patterns and Relations

Mathematics is the study of patterns and relationships. Recognizing and exploring the inherent patterns in mathematics make it easier for children to see relationships and understand concepts.

Children first learn about patterns by discriminating similarities and differences as they sort. As they begin to understand the relationships between objects, they can start to make predictions. They then proceed to the recognition of visual, kinesthetic, and auditory patterns in their environment. From recognition, they progress to extension of patterns, translation of a given pattern to other modes, and finally to the creation of their own.

Teachers should be mindful of the needs of all students in the classroom including EAL (English as an Additional Language) students. Manitoba's schools include young people of varied backgrounds and who have varying degrees of fluency in a number of different languages. When selecting activities and resources to support sorting and patterning, teachers are encouraged to ensure these choices support inclusion of all students that is respectful to the culture of the students.

Cultural background and language can influence the way children identify, translate, and create a pattern. For example, the patterns created by First Nations students may not fit English language criteria for patterns, but may make perfect sense to a First Nations language speaker. One of the reasons for this is that First Nations languages, such as Ojibwe, categorize things differently than they are categorized in English. Some First Nations language speakers categorize nouns, pronouns, and even verbs into animate or inanimate. Yet some things, such as rocks, would be classified as animate by a First Nations language speaker and inanimate or non-living by an English speaker depending on the circumstance of the situation.

First Nations, Métis, and Inuit languages do not follow a universal form and are diverse among the First Nations, Métis, and Inuit communities in Manitoba. Teachers are encouraged to seek support from within the community to ensure that classroom instruction and resources used are accurate and authentic and reflect sensitivity of the First Nations, Métis, and Inuit peoples of the community.

It is important to interview, in a non-judgmental manner, the students who appear not to have the concept of patterns. Children must feel comfortable communicating verbally about why a particular combination of objects, sounds, shapes, actions, or colours form a pattern. An interview will help clarify if the misunderstanding is culturally based or not. Further investigation into cultural background, either through reading or talking to the parents, may be necessary to verify the assessment made. Teachers should provide a wide variety of work and play with patterns of all kinds, including those from different cultures. Language and cultural activities should be carefully organized and incorporated into lesson plans to enrich the teaching content.

NOTES

Kindergarten: Patterns and Relations (Patterns) (K.PR.1)

Enduring Understandings:

Patterns show order in the world.

Patterns can be found in many different forms.

Essential Question(s): Where are patterns found?

What is a pattern?

What is the repeating unit (core) in the pattern?

SPECIFIC LEARNING OUTCOME(S):	ACHIEVEMENT INDICATORS:
<p>K.PR.1 Demonstrate an understanding of repeating patterns (two or three elements) by</p> <ul style="list-style-type: none">■ identifying■ reproducing■ extending■ creating <p>patterns using manipulatives, sounds, and actions. [C, CN, PS, V]</p>	<ul style="list-style-type: none">→ Distinguish between repeating patterns and non-repeating sequences in a set by identifying the part that repeats.→ Copy a repeating pattern (e.g., actions, sound, colour, size, shape, orientation) and describe the pattern.→ Extend a variety of 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, the school and outdoors (e.g., in a familiar song, in a nursery rhyme).

PRIOR KNOWLEDGE

Experiences with sorting and classifying may help with the learning of patterns. The ability to work with patterns is strengthened by the recognition and identification of attributes such as colour, size, and shape.

Students may know some nursery rhymes and songs with repeating verses or choruses.

BACKGROUND INFORMATION

Repeating patterns can be extended in both directions.

It is difficult to identify a pattern from a small part of the pattern. Therefore, the pattern core should be repeated more than twice.

The teacher's role involves posing questions that alert students to patterns which occur naturally in the sequence of the day, such as in the songs sung, the books read, and the games played in gym. This is an ongoing and natural process. Activities should highlight patterns that are visual, kinesthetic, and auditory.

MATHEMATICAL LANGUAGE

Repeating pattern, core, position words (after, between, beside, before, next), attribute vocabulary (colour, size and shape)

LEARNING EXPERIENCES



Assessing Prior Knowledge

1. Use a small collection of pattern blocks.
Have the students tell you about the blocks.
2. Have them group/sort them. Note: Some students may have difficulty with the terms 'sort' or 'group'. Adjust the directions as needed.
(If students are unable to sort on their own, model sorting by colour. Then, have the students complete the sorting.)
3. Make a pattern using cubes by alternating colours such as: blue, yellow, blue, yellow, blue, yellow. (Note: Left to right sequence is not important here.) Ask: Can you make a line of cubes just like mine? Tell me about the line of cubes.
4. Make an ABC pattern with the cubes. (Example: red, blue, green, red, blue, green, red, blue, green) Ask: Which cube comes next? (Put it in the cube line.) How did you know which cube to choose? Can you show me the part that repeats?



Observation Checklist

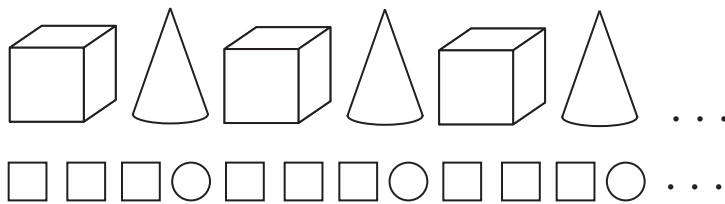
Students are able to

- Identify the following attributes
 colour _____ size _____
 shape _____ other _____
- Sort by
 one attribute _____
- Recognize the pattern _____ Copy the pattern _____
 Describe the pattern _____
- Extend the pattern _____ Identify the core _____

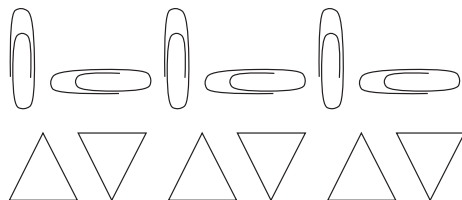
- **Copy a repeating pattern (e.g., actions, sound, colour, size, shape, orientation) and describe the pattern.**
- **Extend a variety of repeating patterns to two more repetitions.**

Teacher works with the children to copy, describe, and extend patterns, such as:

- people patterns (e.g., 1 stands, 1 sits, 1 stands. . . ; hand up, hand down, hand up. . .)
- colour patterns (e.g., red, red, blue, red, red, blue. . .)
- geometric patterns (e.g., see below)

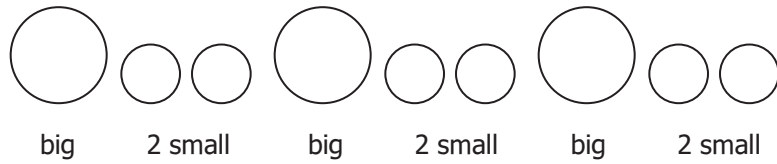


- object patterns (e.g., leaf, stone, stick, leaf, stone. . .)
- action patterns (e.g., clap, snap, clap, snap. . .)
- music patterns (e.g., beat, beat, beat, pause, beat, beat, beat, pause. . .)
- orientation patterns (e.g., see below)



Teacher's questions should focus students' attention on the underlying mathematical skills or concepts elicited by the learning experience(s).

- size patterns (e.g., see below)



During these experiences ask questions such as

- What comes next/before/after? How do you know?
- Can you finish the pattern?
- What part of the pattern repeats?



Observation Checklist

Students are able to

- copy a pattern with a two element (AB) core
 - copy a pattern with a three element (ABC) core
 - extend a pattern with a two element core
 - extend a pattern with a three element core
- using a variety of materials and modalities.

■ Create a repeating pattern using manipulatives, musical instruments, or actions, and describe the pattern.

- Provide a variety of materials such as cubes, keys, small toys, and pattern blocks. Have students use them to create their own repeating patterns. Ask students to describe their pattern(s).
- Use a xylophone that has different coloured keys. Provide a set of construction paper strips that match the colours on the xylophone. Students can compose their own musical pattern, record it with the coloured strips glued on to paper strips, and leave them with the xylophone so that others can play it.
- Involve the students in creating their own action patterns for others to follow. Pictures of the actions can be glued to paper strips to record their patterns.

Example:



During these learning experiences ask questions such as

- Can you make a new pattern using the same materials?
- What other materials could you use to make the same pattern?
- What will come next in your pattern?
- Are these patterns the same?
- Which shapes, colours, sizes have you used in your pattern?
- How is this pattern different from this pattern?



Observation Checklist

Students are able to

- create a pattern with a two element (AB) core
- create a pattern with a three element (ABC) core
- describe a pattern with a two element core
- describe a pattern with a three element core using a variety of materials and modalities.

■ Identify and describe a repeating pattern in the classroom, the school, and outdoors (e.g., in a familiar song, in a nursery rhyme).

- Pose questions which alert students to patterns in natural circumstances (e.g., in songs, in books, in the sequence of the day, in clothing, on floors, in games.)
- Discuss with students patterns found in nature (e.g., leaf patterns, petal arrangements, animal stripes . . .).
- “Let’s find all the patterns in our room.” (Examples: clothing, tiles, wall trim, wrapping paper, windows . . .).
- Go on a “Pattern Patrol” in search of patterns around the school.
- Use a digital camera to take pictures of student-created and environmental patterns. The pictures can be compiled along with student descriptions to make a class Pattern book. (Literacy with ICT connection.)



Observation Checklist

Students are able to

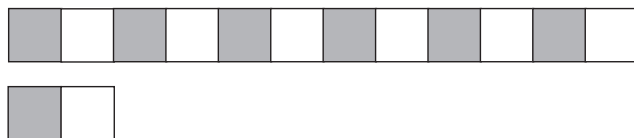
- recognize patterns in music, poetry, and stories
- recognize patterns in their environment
- describe a pattern with a two element (AB) core
- describe a pattern with a three element (ABC) core using a variety of materials and modalities.

■ Distinguish between repeating patterns and non-repeating sequences in a set by identifying the part that repeats.

BLM
K.PR.1.1&2

- Show students a set of repeating patterns and non-repeating sequences on paper strips. Students sort them into two groups – Patterns and Non-Patterns – and give reasons for their placement.
- Make repeating patterns with unifix/interlocking cubes. Have students snap off the part that repeats (core). Match the snapped off core with the rest of the pattern so that students can see the repetition.

Example:



Observation Checklist

Students are able to

- distinguish between patterns and non-patterns
- identify the pattern core for an AB pattern
- identify the pattern core for an ABC pattern

Integrating Patterns into Kindergarten Routines and Centres

CENTRE	SUGGESTED ACTIVITIES
Arts & Crafts	<p>Make patterns by: painting, cutting and pasting, drawing, stamping, using playdough or stickers.</p> <p>Connect to the Paper cluster in Science.</p>
Sand	<p>Make patterns using cookie cutter shapes in wet sand.</p> <p>Use a variety of materials (shells, sticks, etc.) to make patterns.</p>
Blocks/Construction	<p>Make a pattern using two or three different types of blocks.</p> <p>Make structures with patterns as part of their design.</p> <p>Use blocks to copy or extend a given pattern.</p>
Math	<p>Explore patterns with materials such as: pegs and pegboards, beads and laces, pattern blocks, unifix or interlocking cubes, buttons, keys, coloured pasta shapes, colour tiles, etc.</p>
Role Play/Dress-Up	<p>Make pattern necklaces and bracelets with beads and laces.</p> <p>Arrange toy animals in patterns (e.g., farm animals going into the barn).</p> <p>Make patterns with small cars going into the parking garage or driving on the road.</p>
Music	<p>Sing songs with repeating choruses or verses.</p> <p>Play repeating patterns on percussion instruments.</p> <p>Compose their own musical patterns and play them for others.</p>
Pocket Chart	<p>Use different shapes and objects to make patterns in the pocket chart.</p>
Book/Reading	<p>Find patterns in the illustrations.</p> <p>Find patterns in predictable text.</p>



Observation Checklist

Students are able to

- apply their knowledge of pattern in different contexts
- demonstrate an interest in finding and creating patterns

PUTTING THE PIECES TOGETHER



Investigation: Manitoba Wrapping Paper Company Design Challenge

Scenario: Our class has been asked by the Manitoba Wrapping Paper Company to help them design new wrapping paper. The company wants their wrapping paper to have three different repeating patterns on each sheet. Each sheet can use a combination of two or three different rubber stamps/stickers/shapes.

Note: If possible show students some examples of sheets of wrapping paper.

Have students work in partners.

Provide each group with a large piece of paper (11" x 17") divided into three sections and no more than three different rubber stamps or types of stickers/shapes. Allow them the freedom to try to solve the problem. Scaffold the task, if necessary, while students are working on the investigation (not before).

Select a variety of solutions to have students share in a whole-class meeting.

Note: In working with a Kindergarten class on this task we found that students, although very successful, needed support. Extra adults (perhaps older students) would be ideal. If this is not possible, it is suggested that the task be done as a teacher station/centre with groups rotating through tasks over several days



KINDERGARTEN MATHEMATICS

Shape and Space

Kindergarten: Shape and Space (Measurement) (K.SS.1)

Enduring Understanding: Objects can be compared using the same attribute.

Essential Question(s): How can objects be compared?

SPECIFIC LEARNING OUTCOME(S):	ACHIEVEMENT INDICATORS:
<p>K.SS.1 Use direct comparison to compare two objects based on a single attribute, such as length (height), mass (weight), and volume (capacity). [C, CN, PS, R, V]</p>	<ul style="list-style-type: none">→ Compare the length (height) of two objects, and explain the comparison using the words “shorter,” “longer (taller),” or “almost the same.”→ Compare the mass (weight) of two objects, and explain the comparison using the words “lighter,” “heavier,” or “almost the same.”→ Compare the volume (capacity) of two objects, and explain the comparison using the words “less,” “more,” “bigger,” “smaller,” or “almost the same.”

PRIOR KNOWLEDGE

Students may have had no formal experiences with these concepts.

BACKGROUND INFORMATION

During free and directed play, students discover the properties of materials and develop an awareness of the specific attributes of measurement. Students, at this age, use language in keeping with their understanding, such that big can mean long, heavy, holds more, and so on. As they have more experience with comparisons, and as they hear a teacher model language more specific to the attributes of materials, students replace big with appropriate terms.

TEACHER KNOWLEDGE

Mass is a measure of how much matter there is in an object. It can be measured using a pan balance and standard masses. The mass of an object is measured in grams and kilograms.

The word “weight” is a measure comprised of a combination of the mass of an object and the pull of gravity on that mass. It can be measured using a spring balance. Weight is frequently used when mass is intended. Weight is measured in Newtons.

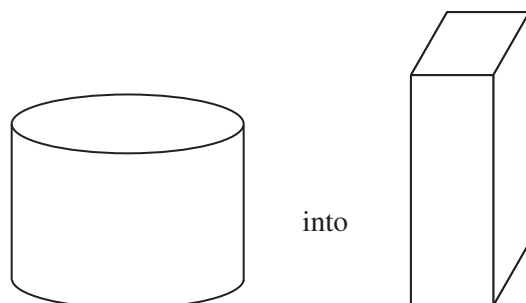
Note: Students may assume that large objects are automatically heavier and small objects lighter. They need to have opportunities to pick and compare containers of different sizes, shapes, and weights.

Volume is the amount of space occupied by an object (solid, liquid, or gas).

“Capacity” is the amount a container is able to hold.

Note: When pouring from one container to another a student may believe that the second container holds more if the level appears higher even if they pour the contents back into the first container.

Example:



This is because the child is not yet conserving the capacity of the container or the volume of the material in it.

Students need to be aware of the common usage of the word “full.” A full glass of milk is one in which the volume of milk measures less than the capacity of the glass. If a student fills a glass to the brim with milk, he or she is likely to be told that the glass is too full. There are many instances of this anomaly in daily life (e.g., a full bottle of pop, a room full of people, a box full of blocks, etc.)

MATHEMATICAL LANGUAGE

Longer, shorter, taller, almost the same, lighter, heavier, less, more, bigger, smaller, length, height, full, empty, compare



Assessing Prior Knowledge

Brainstorm with the class things that are long or short, heavy or light, full or empty. This will help to determine their understanding of the vocabulary.

- **Compare the length (height) of two objects, and explain the comparison using the words “shorter,” “longer (taller),” or “almost the same.”**

- Provide students with objects of different length or height. Model the language of comparison, then have students compare objects using these words:
 - long/short
 - tall/short
 - almost the same

Note: Focus their attention on the need for a common starting point. Show them how to line up the two objects so that they start from a common point.

- **Socks:** Gather a collection of adult socks – one pair of long socks, one pair of medium length, and one pair of short socks. Hold up the long socks. Choose a student to put them on over his or her own socks. Ask students to describe how they fit (e.g., “They are really long. They go all the way past his or her knees.”).

Show the short socks. Have another student put them on. Ask students to describe how they fit (e.g., “They are really short. They only go up to her or his ankle.”).

Now, show the medium length socks. Ask, “Are these socks short or long?” Have a student put them on. Compare this student with the student in the long socks then compare with the short socks.

Encourage students to look at their own socks and compare them with the adult socks.

- **How Do We Compare?:** Put students in pairs. Have the pairs take turns standing back-to-back while the other groups use the terms; taller than, shorter than, or almost the same, to compare their heights.

- **Size Detective:** Play with the whole class or a small group.

Materials: overhead projector, objects

Directions: Place a pencil on the overhead. Ask students to look for something that is longer/shorter than the pencil. Place their objects on the overhead to compare. Continue with other objects.

Ask students to make collections of objects that are similar, shorter, or longer in length.

- Supply craft supplies so students can make objects of specific lengths, such as, as long as your foot, as short as their thumb, and the same length as this paper.
- Ask students to use unifix cubes to make trains that are longer than, shorter than, and the same length as a given object.
- Provide class with strips of ribbon and one stick approximately 30 cm long. Have students sort ribbons into three groups: shorter than, longer than, and the same length as the stick.



Assessing Understanding: Performance Task

Block Towers: Have students work with a partner at the block centre. Ask them to choose five blocks and to build the tallest tower they can. As they work ask the following questions:

- “How many blocks did you use for your tower?”
- “How did you decide what blocks to use?”
- “Is this the tallest tower you can build?”
- “Can you build a different tower using 5 blocks?”
- “Is the new tower taller or shorter than the first one? How do you know?”
- “Is there anything you can do to make one of your towers taller? Shorter?”

Observation Checklist

Students are able to

- construct a tower with five blocks
- justify the choice of blocks
- make a different tower
- identify whether the second tower is taller or shorter than the first
- use the language of comparison correctly
- suggest ways to make the tower taller or shorter

■ **Compare the mass (weight) of two objects, and explain the comparison using the words “lighter,” “heavier,” or “almost the same.”**

- Read a book such as *Mighty Maddie* a MathStart book by Stuart J. Murphy as an introduction to the comparative vocabulary for mass (light, lighter, heavy, heavier).
- Ask students to compare the masses of objects using just their hands. Model the language of comparison. For example:
 - The book is heavier than the unifix cube.
 - The ball is lighter than the book.

- **Balancing Act:** Provide free exploration time for students to experiment with a pan/equal arm balance and a variety of objects. Have them record their observations. Have them share their findings with the class. Note: Some students may not realize that the pan/side that goes down holds the heavier object. Ask focus questions such as

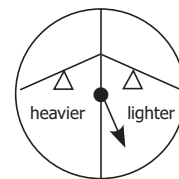


- How do you know which object is heavier?
- How do you know which object is lighter?
- What can you tell me about these two objects? (e.g., A is lighter/heavier than B.)

- **Making Predictions:** Have students stand with their arms outstretched to simulate a pan balance. The teacher holds a heavier object in their right hand and a lighter one in their left. Ask students to show what they think will happen on the pan balance. Confirm their predictions by using the pan balance. Repeat this activity with other objects.

- **Problem Solving:** Students work in partners. Give each group a small box or bag and three or four objects, each of different mass. Let students become familiar with the objects then place them in another container or under a cover. Have the first student secretly place one of the objects in the box/bag. Have the second student guess which object was chosen by handling the box/bag. Have them justify their choice using related vocabulary. Reverse roles and play again.

- **Who’s Bag Is Heavier?:** Have students work in pairs with a screen between them. Provide each student with a collection of classroom objects and a bag. Each pair will also need a heavier/ lighter spinner. Student A rolls the dice and calls out the number rolled. Both students, independently, place a corresponding number of objects in their bags. Student A spins the spinner. They then compare their bags to determine the heaviest/lightest. The student with the heaviest/lightest bag gets a counter or scores a point. Play continues until one player scores five points. As students play ask questions such as



- How did you decide what objects to put in your bag?
- How can you change the weight of your bag?
- How did you test to see who had the heaviest/lightest bag?

BLM
K.SS.1.1



Assessing Understanding: Paper-and-Pencil Task

Set up four stations. Place two objects, each of different mass, at three of the stations. Place two objects of similar mass at one of the stations. Have students rotate through the stations comparing the objects and recording their findings with pictures (words if applicable).

- **Compare the volume (capacity) of two objects, and explain the comparison using the words “less,” “more,” “bigger,” “smaller,” or “almost the same.”**
- **Exploring Volume (capacity):** Students should develop an understanding of volume (capacity) through free and directed play. Possible activities include
 - filling a variety of containers. Provide several kinds of containers (bottles, cans, jugs, cups, cartons). There should be containers with different shapes but equal capacities, and containers that will “nest” so that they have an obvious ordered relationship.
 - filling containers with various materials such as sand, water, rice, beans, small math materials (unifix, counters, centimetre cubes, buttons)
 - filling one container and then pouring it into another container
- **More, Less, or Almost the Same:** Ask students to find something that will hold “more than,” “less than,” or “almost the same as” a given container. Ask questions such as:
 - How can you tell if your container holds more than, less than, or almost the same as the first container?
 - If you filled the containers with something else would your container still hold more than, less than, or almost the same as the first container?
- **Pack and Unpack:** Have students pack and unpack classroom objects such as math materials, toys, books, or games to develop a sense of what will and will not fit.
- **Real-World Connections:** Brainstorm a list of situations where you might be filling or packing. For example:
 - filling the bathtub
 - filling a cup or glass with drink
 - filling a bowl with cereal
 - packing groceries
 - packing a suitcase
- **Science Connection:** Connect to the Paper cluster in science. Have students follow the design process to construct an object to hold a certain volume.



Observation Checklist

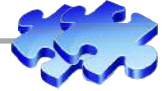
Students are able to

- use the terms less, more, bigger, smaller, or almost the same to compare the volume of two objects
- find a container that holds more than a given container
- find a container that holds less than a given container
- find a container that holds almost the same as a given container

Integrating Measurement into Kindergarten Routines and Centres

CENTRE	SUGGESTED ACTIVITIES
Arts and Crafts	Making playdough objects that are long, short, or the same length. Make a picture with objects of different lengths.
Sand and Water	Filling and pouring sand and water. Making sandcastles with different sized containers. Estimating and then checking to see how many smaller containers it takes to fill a larger container; how many smaller containers can be filled by a larger container.
Block/Construction	Make towers/buildings of different heights. Packing blocks into different sized containers. Sorting blocks into categories such as long or short, heavy or light.
Theme	Ordering stuffed animals, toys, food stuff, etc., by length or mass (weight). Comparing objects using a pan/equal arm balance. Comparing containers (teacups, pots, etc.) by volume (capacity).
Science	Compare leaves and/or pictures of trees. Sort according to length/height. Explore different types of paper to determine the best material to use to hold various objects (volume/capacity and mass/weight).

PUTTING THE PIECES TOGETHER



Investigation: Compare Stations

1. Set up a table with six “compare” stations – two stations each of mass (weight), length, and volume (capacity). Have students compare objects at each station, explaining the comparisons. As students become confident in the measurement process, have children record the results of the comparisons.

Observation Comments

BLM
K.SS.1.2

Student	Mass (weight)	Length	Volume (capacity)

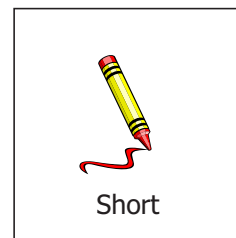
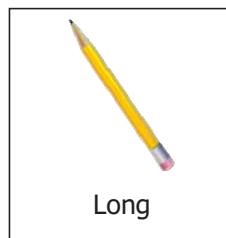
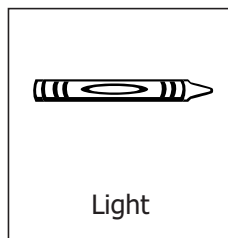
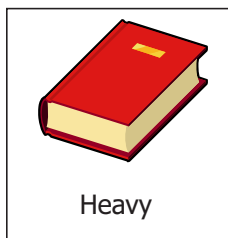
What to look for

- Do students understand the concept of mass, length, or volume?
 - Do they have an effective strategy for doing the comparisons?
(Example: measure from a common starting point; use hands or a balance scale; fill or pack)
 - Do they confidently use the comparative vocabulary related to the particular concept?
2. Class measurement book

Have students work in pairs or small groups. Assign each group to a measurement topic or to specific vocabulary.

Use a digital camera (Literacy with ICT connection) or have students draw pictures to illustrate the book.

Example:



Kindergarten: Shape and Space

(3-D Objects and 2-D Shapes) (K.SS.2, K.SS.3)

Enduring Understanding: Objects can be sorted by similarities.

Shapes can be described and compared using their attributes.

Essential Question(s): How are the objects alike?

In which ways can the objects be sorted?

What is the sorting rule?

How can 3-D objects be described?

SPECIFIC LEARNING OUTCOME(S):	ACHIEVEMENT INDICATORS:
<p>K.SS.2 Sort 3-D objects using a single attribute. [C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> → Sort a 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 pre-sorted sets by explaining a sorting rule used to sort them.
<p>K.SS.3 Build and describe 3-D objects. [CN, PS, V]</p>	<ul style="list-style-type: none"> → Create a representation of a 3-D object using materials such as modelling clay and building blocks, and compare the representation to the original 3-D object. → Describe a 3-D object, using words such as “big,” “little,” “round,” “like a box,” and “like a can.”

PRIOR KNOWLEDGE

Students may have had no formal instruction with these concepts.

BACKGROUND INFORMATION

Sorting and classifying are basic concepts that help students organize and understand their surroundings. Through sorting and classifying experiences students come to understand that objects can be grouped in different ways. This supports part-part-whole understanding (e.g., 8 can be grouped as 7 and 1 or 5 and 3).

In order to sort, students need to identify attributes such as colour, shape, or size. This is the basis of patterning.

Note: Support sorting by providing defined areas for grouping (e.g., paper plates or yarn circles).

MATHEMATICAL LANGUAGE

Sorting: Colour words, informal vocabulary for shape (round, flat, pointy, like a box, like a can, etc.), vocabulary for size (big, small, heavy, light, long, short, etc.), sort, classify, group, the same as, different

3-D Objects: big, little, round, “like a box”, “like a can”, ball, flat, etc.

LEARNING EXPERIENCES



Assessing Prior Knowledge

Give students a small collection of objects that can be sorted by one attribute (e.g., unifix cubes that can only be sorted by colour). Ask them to sort them or to put them into groups. Ask them to explain their sorting rule.

If successful, give them a small number of pattern blocks and have them sort them. Ask them to explain their sorting rule.

Observation Checklist

Students are able to

- sort objects by colour
- sort objects by shape
- explain their sorting rule

3-D objects refers to objects in the environment not to the set of 3-D objects typically purchased as math materials.

- **Sort a 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 pre-sorted sets by explaining a sorting rule used to sort them.**

- Students should have many sorting and classifying experiences using a wide variety of objects.
- **What's My Rule?:** Sort a set of attribute (logic) blocks into two groups. Have students guess your sorting rule. Select a student to resort the objects. Have students guess their sorting rule.
- **Student Sort:** Sort students in different ways and have students guess the rule (e.g., boys/girls; wearing jeans/not wearing jeans; dark hair/not dark hair; wearing red/not wearing red; etc.).
- **Where Does It Belong?:** Sort a set of objects into two groups leaving some objects out of the sort. Hold up one of the objects and ask students to identify where it belongs. Have students justify their choice.

Attribute blocks can be sorted by colour, shape, size, and thickness.

Note: Students at this level may not be ready to sort by thickness.

Note: Connect sorting to the measurement activities.



Assessing Understanding

Give students a small group of attribute blocks.

1. Have them sort them and then state their sorting rule.
2. Ask them to re-sort the set and then state their new sorting rule.
3. Sort a set of objects into two groups. Have students identify the sorting rule. Hold up another one of the sorted objects and ask them to identify where it should go.

Observation Checklist

Students are able to

- sort a collection of objects using one attribute
- state the sorting rule
- re-sort a set of objects in another way
- identify the sorting rule of a pre-sorted set
- identify the placement of an additional object

- **Create a representation of a 3-D object using materials such as modelling clay and building blocks, and compare the representation to the original 3-D object.**
- **Describe a 3-D object using words such as “big,” “little,” “round,” “like a box,” and “like a can.”**

- Gather a collection of small 3-D objects from the classroom. Have students select one of the objects and make a model of it using playdough or plasticine. Have them compare their model with the actual object. Ask, “Is your model the same as the object? How do you know?”

Although students are using informal vocabulary, teachers should model correct terminology.

Mix up the original objects and the student models.

Have students see if they can match the models to the original objects.

- Have students bring in a collection of ‘food stuff’ containers. Use this collection for sorting, building with, and exploring 3-D objects. **Note:** The containers can also be used for some of the measurement activities.
- Show students a group of objects – cans, cones, balls, boxes, etc. Have them sorted into groups. Ask students to describe the objects in each group.
- **I Spy:** Give students a clue to a particular 3-D object in the classroom and have them guess which object you have selected (e.g., “I spy with my little eye something that is like _____.”). Hold up an object. Are students guessing objects that are similar in shape?

Integrating Measurement into Kindergarten Routines and Centres

CENTRE	SUGGESTED ACTIVITIES
Arts and Crafts	The creation of 3-D structures can be expressed by providing students with a rich variety of paper, writing tools, plasticine/playdough, paper rolls, and similar craft items. Draw pictures of various 3-D objects and constructions.
Sand	Build sandcastles and different shape patterns in the sand.
Block/Construction	Have both commercial and non-commercial objects for building and constructing. Sorting blocks by shape.
House/Theme	Use food stuff containers.
Technology	Use drawing software to make shapes and pictures.

POSITIONAL LANGUAGE

Although there are no specific outcomes related to positional language in the curriculum it is important for students to develop these skills.

At this level, students describe the world in relation to themselves. Because of this egocentricity, positional language should be developed, beginning with comparison of self to others and of self to objects. Proceed to make comparisons of objects to self, and then object to object.

LEARNING EXPERIENCES

- Model positional language in everyday activities – lining up, finding things, calendar work, gym activities . . .
- Use objects to explore and foster student understanding of positional language: “The car is in front of that truck. Now Joel is driving it over the bridge . . .”
- **Play *Simon Says*:**
 - “Simon says stand outside our circle but beside the teacher’s desk.”
 - “Simon says step over the triangle.”
 - “Simon says put the pencil between the two crayons.”
- Have a student take a teddy bear and position it so it is visible to the group. Ask other students to describe where the bear is.
Examples: “The bear is between the bookshelf and the chair.” “It is under the ceiling.”
- **Play *Twenty Questions*:** Use cubes to count the number of questions students ask to identify an object.
Example:
Teacher says “I am thinking of an object on our bulletin board.” Students ask, “Is it over the _____?” (Students will likely need modelling of the types of Yes/No questions expected.)

PUTTING THE PIECES TOGETHER



Investigation: Kindergarten Town/City

Materials: classroom objects
food stuff containers, paper rolls
playdough, plasticine
scissors, glue, paper, tape, etc.

Tell students that they are going to design/make a model of a Kindergarten Town/City. Brainstorm buildings and structures they would like to have in their town or city.

Have students work in small groups. Designate a specific area in the classroom for each group. A large piece of cardboard or tag can be used to define the dimensions of the construction.

As students are working, talk to them about their constructions and particular 3-D objects.

Have each group present their constructions. Ask them to take turns describing the 3-D objects used. Encourage the use of measurement vocabulary as well, especially vocabulary related to length/height.



Observation Checklist

Students are able to

- identify objects used in the construction
- describe an object using informal (formal) vocabulary



KINDERGARTEN MATHEMATICS

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