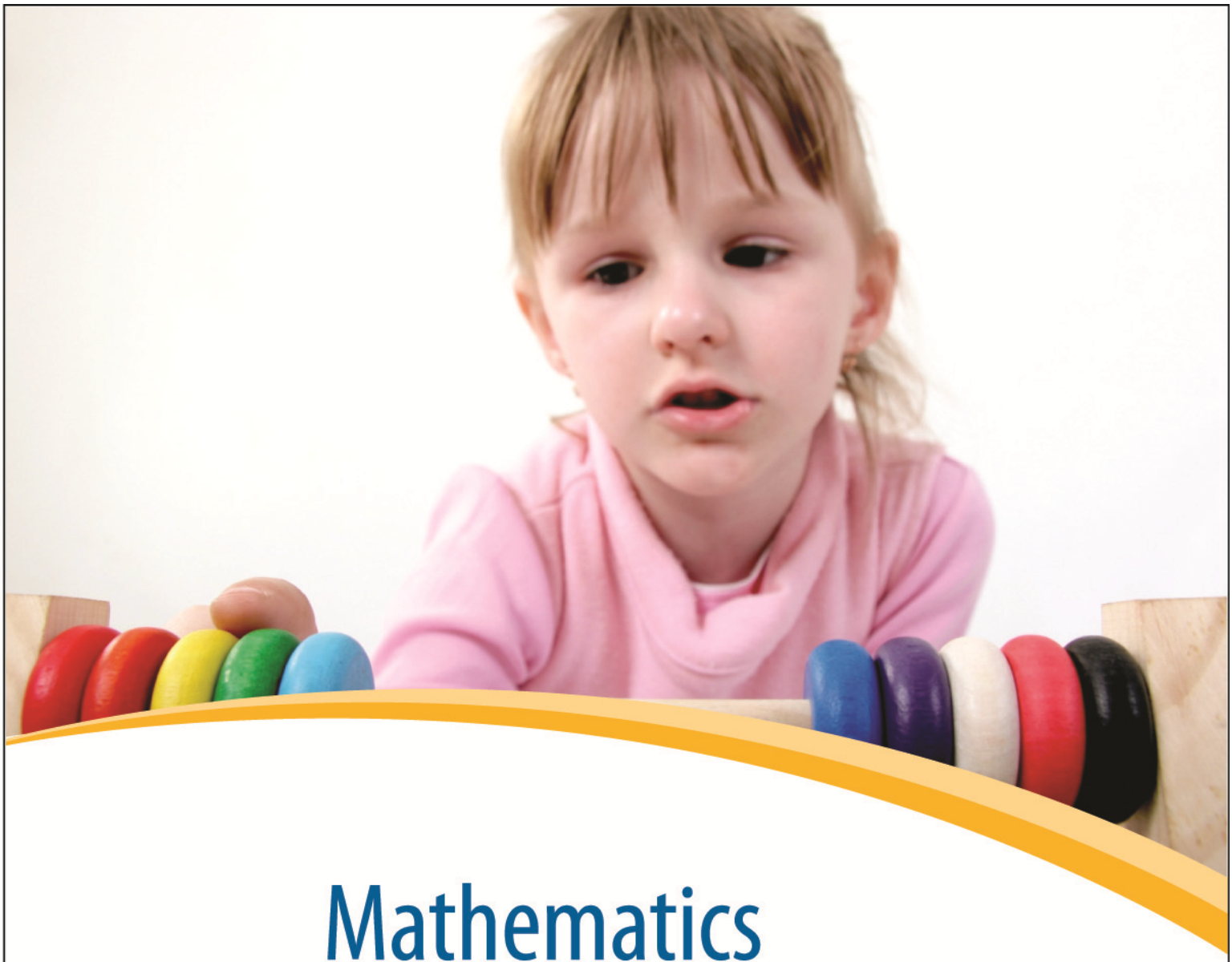

Mathematics Kindergarten Curriculum

Implemented September 2008

New Nouveau Brunswick

Be...in this place • Être...ici on le peut

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2008
Department of Education
Educational Programs and Services

Additional copies of this document may be obtained using the **Title Code: 844380**

Table of Contents

BACKGROUND AND RATIONALE

Mathematics curriculum is shaped by a vision which fosters the development of mathematically literate students who can extend and apply their learning and who are effective participants in society.

It is essential the mathematics curriculum reflects current research in mathematics instruction. To achieve this goal, the Western and Northern Canadian Protocol (WNCP) *Common Curriculum Framework for K-9 Mathematics* (2006) has been adopted as the basis for a revised mathematics curriculum in New Brunswick. The Common Curriculum Framework was developed by the seven ministries of education (Alberta, British Columbia, Manitoba, Northwest Territories, Nunavut, Saskatchewan and Yukon Territory) in collaboration with teachers, administrators, parents, business representatives, post-secondary educators and others. The framework identifies beliefs about mathematics, general and specific student outcomes, and achievement indicators agreed upon by the seven jurisdictions. This document is based on both national and international research by the WNCP and the NCTM.

There is an emphasis in the New Brunswick curriculum on particular key concepts at each grade which will result in greater depth of understanding and ultimately stronger student achievement. There is also a greater emphasis on number sense and operations concepts in the early grades to ensure students develop a solid foundation in numeracy.

The intent of this document is to clearly communicate high expectations for students in mathematics education to all education partners. Because of the emphasis placed on key concepts at each grade level, time needs to be taken to ensure mastery of these concepts. Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge (NCTM Principles and Standards, 2000).

BELIEFS ABOUT STUDENTS AND MATHEMATICS LEARNING

The New Brunswick Mathematics Curriculum is based upon several key assumptions or beliefs about mathematics learning which have grown out of research and practice. These beliefs include:

- mathematics learning is an active and constructive process;
- learners are individuals who bring a wide range of prior knowledge and experiences, and who learn via various styles and at different rates;
- learning is most likely to occur when placed in meaningful contexts and in an environment that supports exploration, risk taking, and critical thinking and that nurtures positive attitudes and sustained effort; and
- learning is most effective when standards of expectation are made clear with on-going assessment and feedback.

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

Students develop a variety of mathematical ideas before they enter school. Children make sense of their environment through observations and interactions at home and in the community. Mathematics learning is embedded in everyday activities, such as playing, reading, storytelling and helping around the home. Such 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.

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 models and a variety of pedagogical approaches can address the diversity of learning styles and developmental stages of students, and enhance the formation of sound, transferable, mathematical concepts. At all levels, students benefit from working with and translating through a variety of materials, tools and contexts when constructing meaning about new mathematical ideas. Meaningful discussions can provide essential links among concrete, pictorial and symbolic representations of mathematics.

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.

GOALS FOR MATHEMATICALLY LITERATE STUDENTS

The main goals of mathematics education are to prepare students to:

- use mathematics confidently to solve problems
- communicate and reason mathematically
- appreciate and value mathematics
- make connections between mathematics and its applications
- commit themselves to lifelong learning
- become mathematically literate adults, using mathematics to contribute to society.

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

OPPORTUNITIES FOR SUCCESS

A positive attitude has a profound effect on learning. Environments that create a sense of belonging, encourage risk taking, and provide opportunities for success help 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 assessing of personal goals.

DIVERSE CULTURAL PERSPECTIVES

Students attend schools in a variety of settings including urban, rural and isolated communities. Teachers need to understand the diversity of cultures and experiences of all students.

Aboriginal students often have a whole-world view of the environment in which they live and learn best in a holistic way. This means that students look for connections in learning and learn best when mathematics is contextualized and not taught as discrete components. Aboriginal students come from cultures 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. It is also vital that teachers understand and respond to non-verbal cues so that student learning and mathematical understanding are optimized. It is important to note that these general instructional strategies may not apply to all students.

A variety of teaching and assessment strategies is 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).

ADAPTING TO THE NEEDS OF ALL LEARNERS

Teachers must adapt instruction to accommodate differences in student development as they enter school and as they progress, but they must also avoid gender and cultural biases. Ideally, every student should find his/her learning opportunities maximized in the mathematics classroom. The reality of individual student differences must not be ignored when making instructional decisions.

As well, teachers must understand and design instruction to accommodate differences in student learning styles. Different instructional modes are clearly appropriate, for example, for those students who are primarily visual learners versus those who learn best by doing. Designing classroom activities to support a variety of learning styles must also be reflected in assessment strategies.

CONNECTIONS ACROSS THE CURRICULUM

The teacher should take advantage of the various opportunities available to integrate mathematics and other subjects. This integration not only serves to show students how mathematics is used in daily life, but it helps strengthen the students' understanding of mathematical concepts and provides them with opportunities to practise mathematical skills. There are many possibilities for integrating mathematics in literacy, science, social studies, music, art, and physical education.

ASSESSMENT

Ongoing, interactive assessment (*formative assessment*) is essential to effective teaching and learning. Research has shown that formative assessment practices produce significant and often substantial learning gains, close achievement gaps and build students' ability to learn new skills (Black & William, 1998, OECD, 2006). Student involvement in assessment promotes learning. Interactive assessment, and encouraging self-assessment, allows students to reflect on and articulate their understanding of mathematical concepts and ideas.

Assessment in the classroom includes:

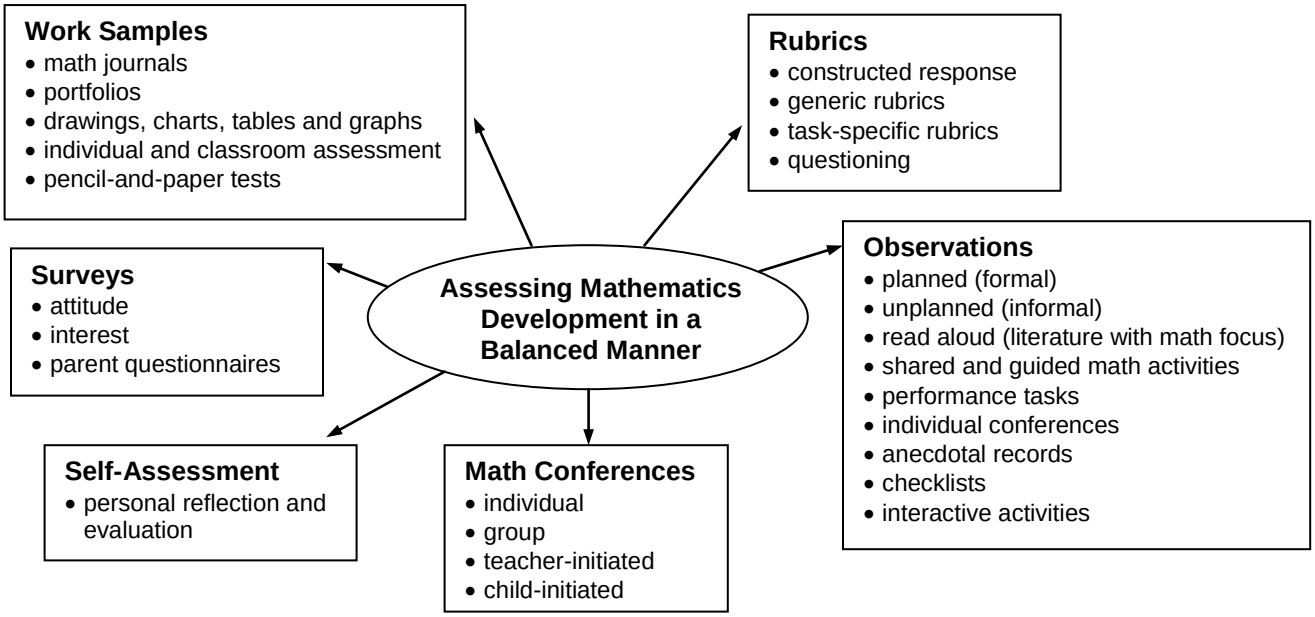
- providing clear goals, targets and learning outcomes
- using exemplars, rubrics and models to help clarify outcomes and identify important features of the work
- monitoring progress towards outcomes and providing feedback as necessary
- encouraging self-assessment
- fostering a classroom environment where conversations about learning take place, where students can check their thinking and performance and develop a deeper understanding of their learning (Davies, 2000)

Formative assessment practices act as the scaffolding for learning which, only then, can be measured through summative assessment. *Summative assessment,* or assessment *of* learning, tracks student progress, informs instructional programming and aids in decision making. Both forms of assessment are necessary to guide teaching, stimulate learning and produce achievement gains.

Student assessment should:

- align with curriculum outcomes
- use clear and helpful criteria
- promote student involvement in learning mathematics during and after the assessment experience
- use a wide variety of assessment strategies and tools
- yield useful information to inform instruction

(adapted from: NCTM, Mathematics Assessment: A practical handbook, 2001, p.22)



CONCEPTUAL FRAMEWORK FOR K – 9 MATHEMATICS

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

GRADE / STRAND	K 1 2 3 4 5 6 7 8 9
Number **Patterns and Relations** • Patterns • Variables and Equations **Shape and Space** • Measurement • 3-D Objects and 2-D shapes • Transformations **Statistics and Probability** • Data Analysis • Chance and Uncertainty	**GENERAL OUTCOMES** **SPECIFIC OUTCOMES** **ACHIEVEMENT INDICATORS**

NATURE OF MATHEMATICS

Change
Constancy
Number Sense
Patterns
Relationships
Spatial Sense
Uncertainty

MATHEMATICAL PROCESSES – COMMUNICATION, CONNECTIONS, REASONING, MENTAL MATHEMATICS AND ESTIMATION, PROBLEM SOLVING, TECHNOLOGY, VISUALIZATION

INSTRUCTIONAL FOCUS

The New Brunswick Curriculum is arranged into four strands. These strands are not intended to be discrete units of instruction. The integration of 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:

- Integration of the mathematical processes within each strand is expected.
- By decreasing emphasis on rote calculation, drill and practice, and the size of numbers used in paper and pencil calculations, more time is available for concept development.
- Problem solving, reasoning and connections are vital to increasing mathematical fluency, and must be integrated throughout the program.
- There is to be a balance among mental mathematics and estimation, paper and pencil exercises, and the use of technology, including calculators and computers. Concepts should be introduced using models and gradually developed from the concrete to the pictorial to the symbolic.
- There is a greater emphasis on mastery of specific curriculum outcomes.

The mathematics curriculum describes the nature of mathematics, mathematical processes and the mathematical concepts to be addressed. The components are not meant to stand alone. 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.

MATHEMATICAL PROCESSES

There are critical components that students must encounter in a mathematics program 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 of mathematics (Communications: C)
- connect mathematical ideas to other concepts in mathematics, to everyday experiences and to other disciplines (Connections: CN)
- demonstrate fluency with mental mathematics and estimation (Mental Mathematics and Estimation: ME)
- develop and apply new mathematical knowledge through problem solving (Problem Solving: PS)
- develop mathematical reasoning (Reasoning: R)
- select and use technologies as tools for learning and solving problems (Technology: T)
- develop visualization skills to assist in processing information, making connections and solving problems (Visualization: V).

The New Brunswick Curriculum incorporates these seven interrelated mathematical processes that are intended to permeate teaching and learning.

Communication [C]

Students need opportunities to read about, represent, view, write about, listen to and discuss mathematical ideas. These opportunities allow students to create links between their own language and ideas, and the formal language and symbols of mathematics. Communication is important in clarifying, reinforcing and modifying ideas, knowledge, attitudes and beliefs about mathematics. Students should be encouraged to use a variety of forms of communication while learning mathematics. Students also need to communicate their learning using mathematical terminology. Communication can help students make connections among concrete, pictorial, symbolic, verbal, written and mental representations of mathematical ideas.

Connections [CN]

Contextualization and making connections to the experiences of learners are powerful processes in developing mathematical understanding. When mathematical ideas are connected to each other or to real-world phenomena, students can begin to view mathematics as useful, relevant and integrated. Learning mathematics within contexts and making connections relevant to learners can validate past experiences, and increase student willingness to participate and be actively engaged. The brain is constantly looking for and making connections.

"*Because the learner is constantly searching for connections on many levels, educators need to orchestrate the experiences from which learners extract understanding… Brain research establishes and confirms that multiple complex and concrete experiences are essential for meaningful learning and teaching*" (Caine and Caine, 1991, p. 5).

Reasoning [R]

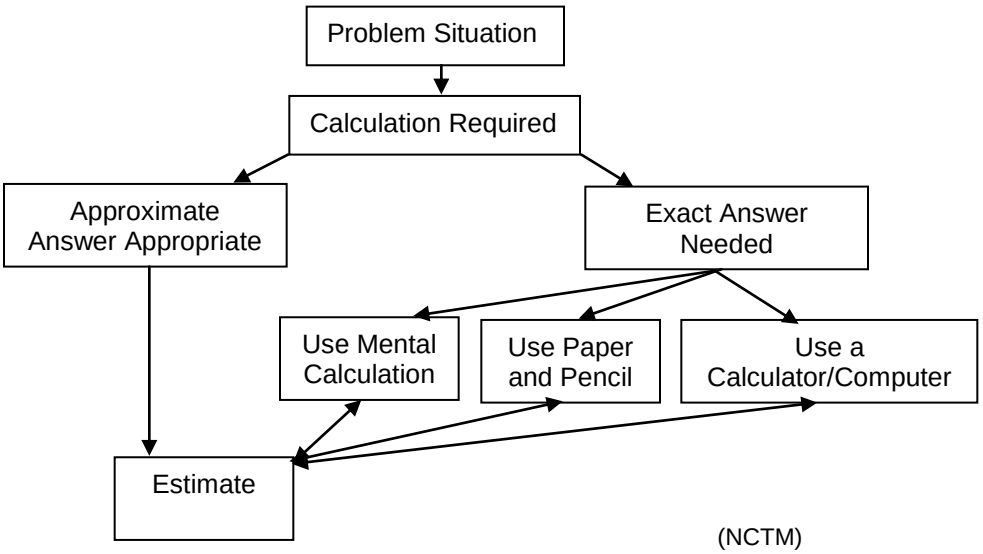
Mathematical reasoning helps students think logically and make sense of mathematics. Students need to develop confidence in their abilities to reason and justify their mathematical thinking. High-order questions challenge students to think and develop a sense of wonder about mathematics. Mathematical experiences in and out of the classroom provide opportunities for inductive and deductive reasoning. Inductive reasoning occurs when students explore and record results, analyze observations, make generalizations from patterns and test these

generalizations. Deductive reasoning occurs when students reach new conclusions based upon what is already known or assumed to be true.

Mental Mathematics and Estimation [ME]
Mental mathematics is a combination of cognitive strategies that enhance flexible thinking and number sense. It is calculating mentally without the use of external memory aids. Mental mathematics enables students to determine answers without paper and pencil. It improves computational fluency by developing efficiency, accuracy and flexibility. Even more important than performing computational procedures or using calculators is the greater facility that students need—more than ever before—with estimation and mental mathematics (National Council of Teachers of Mathematics, May 2005).
Students proficient with mental mathematics "*become liberated from calculator dependence, build confidence in doing mathematics, become more flexible thinkers and are more able to use multiple approaches to problem solving*" (Rubenstein, 2001). Mental mathematics "*provides a cornerstone for all estimation processes offering a variety of alternate algorithms and non-standard techniques for finding answers*" (Hope, 1988).

Estimation is a strategy for determining approximate values or quantities, usually by referring to benchmarks or using referents, or for determining the reasonableness of calculated values. Students need to know how, when and what strategy to use when estimating. Estimation is used to make mathematical judgments and develop useful, efficient strategies for dealing with situations in daily life.

Students need to develop both mental mathematics and estimation skills through context and not in isolation so they are able to apply them to solve problems. Whenever a problem requires a calculation, students should follow the decision making process as described below.



(NCTM)

Problem Solving [PS]
Learning through problem solving should be the focus of mathematics at all grade levels. When students encounter new situations and respond to questions of the type, "*How would you...?"* or "*How could you...?"* the problem-solving approach is being modeled. Students develop their own problem-solving strategies by being open to listening, discussing and trying different strategies.

In order for an activity to be problem-solving based, it must ask students to determine a way to get from what is known to what is sought. If students have already been given ways to solve the problem, it is not a problem, but practice. A true problem requires students to use prior learning in new ways and contexts. Problem solving requires and builds depth of conceptual understanding and student engagement.

Problem solving is also a powerful teaching tool that fosters multiple, creative and innovative solutions. Creating an environment where students openly look for and engage in finding a variety of strategies for solving problems empowers students to explore alternatives and develops confident, cognitive, mathematical risk takers.

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.
Calculators and computers can be used to:

- explore and demonstrate mathematical relationships and patterns
- organize and display data
- extrapolate and interpolate
- assist with calculation procedures as part of solving problems
- decrease the time spent on computations when other mathematical learning is the focus
- reinforce the learning of basic facts and test properties
- develop personal procedures for mathematical operations
- create geometric displays
- simulate situations
- develop number sense.

Technology contributes to a learning environment in which the growing curiosity of students can lead to rich mathematical discoveries at all grade levels. While technology can be used in K–3 to enrich learning, it is expected that students will meet all outcomes without the use of technology.

Visualization [V]
Visualization "*involves thinking in pictures and images, and the ability to perceive, transform and recreate different aspects of the visual-spatial world*" (Armstrong, 1993, p. 10). The use of visualization in the study of mathematics provides students with opportunities to understand mathematical concepts and make connections among them. Visual images and visual reasoning are important components of number, spatial and measurement sense. Number visualization occurs when students create mental representations of numbers.

Being able to create, interpret and describe a visual representation is part of spatial sense and spatial reasoning. Spatial visualization and reasoning enable students to describe the relationships among and between 3-D objects and 2-D shapes.

Measurement visualization goes beyond the acquisition of specific measurement skills. Measurement sense includes the ability to determine when to measure, when to estimate and to know several estimation strategies (Shaw & Cliatt, 1989).

Visualization is fostered through the use of concrete materials, technology and a variety of visual representations.

NATURE OF MATHEMATICS

Mathematics is one way of trying to understand, interpret and describe our world. There are a number of components that define the nature of mathematics and these are woven throughout this document. These components include: **change**, **constancy**, **number sense**, **relationships**, **patterns**, **spatial sense** and **uncertainty**.

Change

It is important for students to understand that mathematics is dynamic and not static. As a result, recognizing change is a key component in understanding and developing mathematics. Within mathematics, students encounter conditions of change and are required to search for explanations of that change. To make predictions, students need to describe and quantify their observations, look for patterns, and describe those quantities that remain fixed and those that change. For example, the sequence 4, 6, 8, 10, 12 … can be described as:

- skip counting by 2s, starting from 4
- an arithmetic sequence, with first term 4 and a common difference of 2
- a linear function with a discrete domain

(Steen, 1990, p. 184).

Constancy

Different aspects of constancy are described by the terms stability, conservation, equilibrium, steady state and symmetry (AAAS–Benchmarks, 1993, p. 270). Many important properties in mathematics and science relate to properties that do not change when outside conditions change. Examples of constancy include:

- the area of a rectangular region is the same regardless of the methods used to determine the solution
- the sum of the interior angles of any triangle is 180°
- the theoretical probability of flipping a coin and getting heads is 0.5.

Some problems in mathematics require students to focus on properties that remain constant. The recognition of constancy enables students to solve problems involving constant rates of change, lines with constant slope, direct variation situations or the angle sums of polygons.

Number Sense

Number sense, which can be thought of as intuition about numbers, is the most important foundation of numeracy (The Primary Program, B.C., 2000, p. 146). A true sense of number goes well beyond the skills of simply counting, memorizing facts and the situational rote use of algorithms. Number sense develops when students connect numbers to real-life experiences, and use benchmarks and referents. This results in students who are computationally fluent, flexible with numbers and have intuition about numbers. The evolving number sense typically comes as a by-product of learning rather than through direct instruction. However, number sense can be developed by providing rich mathematical tasks that allow students to make connections.

Relationships

Mathematics is used to describe and explain relationships. As part of the study of mathematics, students look for relationships among numbers, sets, shapes, objects and concepts. The search for possible relationships involves the collection and analysis of data, and describing relationships visually, symbolically, orally or in written form.

Patterns
Mathematics is about recognizing, describing and working with numerical and non-numerical patterns. Patterns exist in all strands and it is important that connections are made among strands. Working with patterns enables students to make connections within and beyond mathematics. These skills contribute to students' interaction with and understanding of their environment. Patterns may be represented in concrete, visual or symbolic form. Students should develop fluency in moving from one representation to another. Students must learn to recognize, extend, create and use mathematical patterns. Patterns allow students to make predictions, and justify their reasoning when solving problems. Learning to work with patterns in the early grades helps develop students' algebraic thinking that is foundational for working with more abstract mathematics in higher grades.

Spatial Sense
Spatial sense involves visualization, mental imagery and spatial reasoning. These skills are central to the understanding of mathematics. Spatial sense enables students to reason and interpret among and between 3-D and 2-D representations and identify relationships to mathematical strands. Spatial sense is developed through a variety of experiences and interactions within the environment. The development of spatial sense enables students to solve problems involving 3-D objects and 2-D shapes. Spatial sense offers a way to interpret and reflect on the physical environment and its 3-D or 2-D representations. Some problems involve attaching numerals and appropriate units (measurement) to dimensions of objects. Spatial sense allows students to make predictions about the results of changing these dimensions. For example:

- knowing the dimensions of an object enables students to communicate about the object and create representations
- the volume of a rectangular solid can be calculated from given dimensions
- doubling the length of the side of a square increases the area by a factor of four.

Uncertainty
In mathematics, interpretations of data and the predictions made from data may lack certainty. Events and experiments generate statistical data that can be used to make predictions. It is important to recognize that these predictions (interpolations and extrapolations) are based upon patterns that have a degree of uncertainty. The quality of the interpretation is directly related to the quality of the data. An awareness of uncertainty allows students to assess the reliability of data and data interpretation. Chance addresses the predictability of the occurrence of an outcome. As students develop their understanding of probability, the language of mathematics becomes more specific and describes the degree of uncertainty more accurately.

STRUCTURE OF THE MATHEMATICS CURRICULUM

STRANDS

The learning outcomes in the New Brunswick Curriculum are organized into four strands across the grades, K–9. Strands are further subdivided into sub-strands which are the general curriculum outcomes.

OUTCOMES AND ACHIEVEMENT INDICATORS

The New Brunswick Curriculum is stated in terms of general curriculum outcomes, specific curriculum outcomes and achievement indicators.

General Curriculum Outcomes (GCO) are overarching statements about what students are expected to learn in each strand/sub-strand. The general curriculum outcome for each strand/sub-strand is the same throughout the grades.

Specific Curriculum Outcomes (SCO) are statements that identify specific concepts and related skills underpinned by the understanding and knowledge attained by students as required for a given grade.

Achievement Indicators are one example of a representative list of the depth, breadth and expectations for the outcome. Achievement indicators are pedagogy and context free.

Strand	General Curriculum Outcome (GCO)
Number (N)	**Number:** Develop number sense
Patterns and Relations (PR)	**Patterns**: Use patterns to describe the world and solve problems
	Variables and Equations: Represent algebraic expressions in multiple ways
Shape and Space (SS)	**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 (SP)	**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

CURRICULUM DOCUMENT FORMAT

This guide presents the mathematics curriculum by grade level so that a teacher may readily view the scope of the outcomes which students are expected to meet during that year. Teachers are encouraged, however, to examine what comes before and what follows after, to better understand how the students' learnings at a particular grade level are part of a bigger picture of concept and skill development.

As indicated earlier, the order of presentation in no way assumes or prescribes a preferred order of presentation in the classroom, but simply lays out the specific curriculum outcomes in relation to the overarching general curriculum outcomes (GCOs).

The specific curriculum outcomes (SCOs) are presented on individual four-page spreads as illustrated below.

GCO:
SCO: (specific curriculum outcome and mathematical processes)
Key for mathematical processes

Scope and Sequence

Current Grade

Elaboration
Guiding Questions

(Describes the "big ideas" and what the students should learn this year in regards to this concept.)

Page 1

GCO:
SCO:

Achievement Indicators

Guiding Questions

(Describes what could be observed to determine whether students have met the specific outcome.)

Page 2

GCO:
SCO:

Planning for Instruction
Guiding Questions

Choosing Instructional Strategies
(Lists general strategies to assist in teaching this outcome.)

Suggested Activities
(Lists possible specific activities to assist students in learning this concept.)

Possible Models

Page 3

GCO:
SCO:

Assessment Strategies
Guiding Questions

(Overview of assessment)

Whole Class/Group/Individual Assessment
(Lists sample assessment tasks.)

Follow-up on Assessment
Guiding Questions

Page 4

SCO: **N1: Say the number sequence by 1s starting anywhere from 1 to 10 and from 10 to 1.** [C, CN, V]			
[C] Communication **[T]** Technology	**[PS]** Problem Solving **[V]** Visualization	**[CN]** Connections **[R]** Reasoning	**[ME]** Mental Math and Estimation

Scope and Sequence of Outcomes

	Kindergarten	Grade One
	N1 Say the number sequence by 1s starting anywhere from 1 to 10 and from 10 to 1.	**N1** Say the number sequence from 0 to 100 by: 2s, 5s and 10s, forward and backward, using starting points that are multiples of 2, 5 and 10 respectively; 10s using starting points from 1 to 9; 2s starting from 1.

ELABORATION

Guiding Questions:

- *What do I want my students to learn?*
- *What do I want my students to understand and be able to do?*

Most children arrive at school with prior knowledge of the number sequence one to ten. This is an important prerequisite for counting items in a set. As early as two years of age, children can repeat words such as one, two, and three; however, children do not always understand the quantity represented by the number. For this reason, it is necessary to assess each child individually in order to determine their understanding of number, not only in the oral expression of numbers but also in counting abilities and sense of number described in more detail in other outcomes.

During the course of daily tasks, students need frequent practice saying the **number sequence** from any given number up to 10. Students should experience situations in which they recite:

- from 1 onward: 1, 2, 3 . . .
- from 10 backward: 10, 9, 8 . . .
- from any number to 10: for example, 4, 5, 6, …
- from any number to 1: for example, 6, 5, 4…

The challenge is to integrate this outcome with other outcomes. Children learn the names of numbers by actually counting objects and working with numbers. Learning activities must be integrated to address more than one outcome at a time.

SCO: **N1: Say the number sequence by 1s starting anywhere from 1 to 10 and from 10 to 1.**
[C, CN, V]

ASSESSING PRIOR KNOWLEDGE AND SKILLS

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

- Ask students to begin at 1 and say the numbers to 10.
- Ask students to begin at 3 and say the numbers to 10.
- Ask students to begin at 10 and say the numbers back to 1.
- Ask students what number comes after 7; before 7.

ACHIEVEMENT INDICATORS

Guiding Questions:

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

Use the following set of indicators as a guide to determine whether students have met the corresponding specific outcome.

- Name the number that comes after a given number, one to nine.
- Name the number that comes before a given number, two to ten.
- Recite number names from a given number to a stated number (forward – one to ten, backward – ten to one) using visual aids.

SCO: **N1: Say the number sequence by 1s starting anywhere from 1 to 10 and from 10 to 1.**
[C, CN, V]

PLANNING FOR INSTRUCTION

Guiding Questions

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

Choosing Instructional Strategies

Consider the following strategies when planning lessons:

- Have children:
  - count backwards while taking items out of the water table
  - count down to special days
  - count while exercising
  - count on while determining the total on a pair of dice
- Use counting songs, finger plays, and rhymes, such as “One, Two, Buckle My Shoe”, “Ten Little Monkeys”, or “Six Little Ducks” to practice counting forward and backwards.
- Use children’s literature to assist students in learning the number sequence.
- Provide opportunities for children to hear and speak mathematical vocabulary in a natural setting through daily calendar routines. The calendar is an effective visual aid for counting. It is not expected that children count beyond 10 at this level; however, a calendar exposes students to counting to and from larger numbers each day as the month progresses. Good questioning techniques during calendar activities provide occasions for children to learn: the number that comes ‘before’; the number that comes ‘after’; and the number(s) that come in between.
- Ensure students have frequent opportunities to say the number sequence, forwards and backwards. For example:
  - count backwards while taking items off a table or putting items away
  - count down to special days
  - count on while determining the total on a pair of dice
  - count while skipping, hopping, bouncing a ball, or taking part in other physical activities

Suggested Activities

- Begin counting, and have students continue up to the number 10. For example, “3, 4, 5 …” This activity can be repeated by reversing the number sequence. For example, “5, 4, 3, …”
- Seat 5-10 students in chairs in front of the class. As the whole class counts, the seated students stand up one at a time. Reverse this activity and have the students at the front, sit down, one at a time as the class counts backwards.
- Have the students count onward and backward while simultaneously creating the count on a calculator.
- Make up riddles for numbers that come before and after a given number less than 10. For example, “I am three. What comes before me?” “I am four. What is one more?”
- Count some items with the students. Cover the starting quantity of items. Have the students count on as you add more items (up to 10).

Possible Models: counters, calendar, calculators

SCO: **N1: Say the number sequence by 1s starting anywhere from 1 to 10 and from 10 to 1.**
[C, CN, V]

ASSESSMENT STRATEGIES

Look back at what you determined as acceptable evidence.

Guiding Questions
• What are the most appropriate methods and activities for assessing student learning?
• How will I align my assessment strategies with my teaching strategies?

Assessment can and should happen every day as a part of instruction. A variety of approaches and contexts should be used for assessing all students: as a class, in groups, and individual students. Consider the following **sample activities** (that can be adapted) for either formative (for learning; as learning) or summative (of learning) assessment.

Whole Class/Group/Individual Assessment

- Play the game: "Find my mistake". Say a number sequence (1 – 10) incorrectly and have children identify your error and correct it. For example, "1, 2, 3, 5, 4, 6" or "7, 6, 5, 3, 4, 2".
- Observe whether or not students:
  - recognize situations where they recite the number sequence;
  - need to start from the beginning when saying the number sequence;
  - correct one another as they say the number sequence together.
- Begin reciting the numbers to 10, but omit some numbers. Have the student tell you the numbers you omit.
- Ask the student to begin saying the number sequence at a given number and continue up to 10 (e.g., have the student begin at 4, and continue by saying, 5, 6, 7, 8, 9, and 10).
- Ask the student to recite backwards starting at a given number (10 and less).
- Ask the student to tell you what number comes after a given number and before a given number.

FOLLOW-UP ON ASSESSMENT

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

SCO: **N2: Recognize, at a glance, and name familiar arrangements of 1 to 5 objects or dots** [C, CN, ME, V]			
[C] Communication **[T]** Technology	**[PS]** Problem Solving **[V]** Visualization	**[CN]** Connections **[R]** Reasoning	**[ME]** Mental Math and Estimation

Scope and Sequence of Outcomes

	Kindergarten	Grade One
	N2 Recognize, at a glance, and name familiar arrangements of 1 to 5 objects or dots.	**N2** Recognize, at a glance, and name familiar arrangements of 1 to 10 objects or dots.

ELABORATION

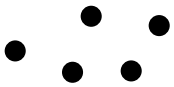
Guiding Questions:

- *What do I want my students to learn?*
- *What do I want my students to understand and be able to do?*

"*A complete and rich understanding of number involves many different ideas, relationships, and skills. Children come to school with many ideas about number. It takes time and lots of experiences for children to develop a full understanding of number that will grow and enhance all of the further number-related concepts of the school years*" (Van de Walle & Lovin, vol. 1, 2006, p. 37).

Number sense can be developed by providing rich mathematical tasks that allow students to make connections to their own experiences and their previous learning. Students should recognize that there are many ways to arrange a set of objects, and that some arrangements are easier to recognize quickly than others. This is called **subitizing** (clustering). For example:

versus



Students will extend this skill with numbers up to and including 10 in grade one to help them with more challenging arrangements, such as the one below.

versus

Recognition of small arrangements of objects helps children understand the process of counting on, composing and decomposing numbers, and that a number can be represented in many ways. At first, children will count the dots or the objects. Eventually, children must be able to recognize the arrangements without counting.

To avoid the misconception that an arrangement can only represent a specific quantity if it is made in a certain way, it is important to vary the orientation of the objects, dots, or pictures. For example, there are many possible arrangements for three, including those shown below.

SCO: **N2: Recognize, at a glance, and name familiar arrangements of 1 to 5 objects or dots**
[C, CN, ME, V]

ASSESSING PRIOR KNOWLEDGE AND SKILLS

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

- Ask students, "How many fingers am I holding up?" and check to see if they are counting or recognizing the number at a glance.
- Show students two sets of objects in familiar arrangements, and observe if students can tell you which set has the largest number of objects and/or which set has the smallest number of objects without counting them.

ACHIEVEMENT INDICATORS

Guiding Questions:

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

Use the following set of indicators as a guide to determine whether students have met the corresponding specific outcome.

- Look briefly at a given familiar arrangement of 1 to 5 objects or dots and identify the number represented without counting.
- Identify the number represented by a given dot arrangement on a five-frame.

SCO: **N2: Recognize, at a glance, and name familiar arrangements of 1 to 5 objects or dots**
[C, CN, ME, V]

PLANNING FOR INSTRUCTION

Guiding Questions

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

Choosing Instructional Strategies

Consider the following strategies when planning lessons:

- Provide opportunities for students to represent quantities in various arrangements.
- Encourage students to display numbers whenever possible, either with materials or by enacting the number physically; e.g., showing fingers, clapping.
- Use familiar and interesting objects for number activities whenever possible.
- Expect students to explain, verbally, how they know how many are in a set.
- Use children's literature, such as the "Cheerios Counting Book", which shows a variety of arrangements for numbers.

Suggested Activities

- Use dot cards or similar cards that show familiar arrangements of dots for numbers. Show students two cards at a time and have students tell you which card has more/less without counting.
- Show a dot card for about three seconds and have students make the pattern they saw using counters at their seats.
- Place between one and five counters on the glass of the overhead projector and cover them. Have students look at the screen. Uncover the counters for a few seconds only. Then ask students to tell you how many counters they saw. Repeat with different numbers and different arrangements for each number.
- Use a five frame and have students identify the number of dots at a glance. Extend this activity to other models and arrangements, such as linking cubes
- Show students a set of cards with dots that all show the same number except for one card. Have students tell you which card does not belong in the set.
- Play a game of "concentration". Place pairs of dot cards face down in an array. Have students take turns turning over two cards at a time and if they match they keep the pair. If the cards do not match, then the student returns the cards.
- Display a five-frame and after three seconds cover it. Ask students to place counters on an empty five-frame to copy what they saw. Repeat with different quantities.
- Have students explore other arrangements of numbers with activities. For example:
  - create their own number cubes;
  - arrange raisins or other items to make patterns;
  - create personal counting books in which each 2-page spread shows a particular number of items, but in a variety of physical arrangements;
  - display the students' arrangements or photographs of them on a class bulletin board.

Possible Models: counters, dot cards, number cubes, dominoes, linking cubes, five-frames and ten-frames

SCO: **N2: Recognize, at a glance, and name familiar arrangements of 1 to 5 objects or dots**
[C, CN, ME, V]

ASSESSMENT STRATEGIES

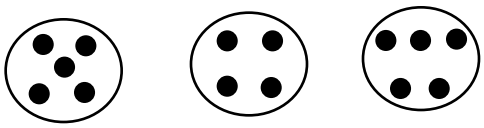
Look back at what you determined as acceptable evidence.

Guiding Questions
• What are the most appropriate methods and activities for assessing student learning?
• How will I align my assessment strategies with my teaching strategies?

Assessment can and should happen every day as a part of instruction. A variety of approaches and contexts should be used for assessing all students: as a class, in groups, and individual students. Consider the following **sample activities** (that can be adapted) for either formative (for learning; as learning) or summative (of learning) assessment.

Whole Class/Group/Individual Assessment

- Hold up a card with an arrangement of dots between one and five and ask, "How many?" Have students write the corresponding numeral on a piece of paper and hold it up for you to see.
- Using individual five-frames, ask students to show you a number that you announce to the class. Walk around and see if they have the correct number of corresponding dots (counters).
- Give each student five cards with the numbers one to five on them. Uncover a series of dots on the overhead projector and have students hold up the number card with the correct corresponding numeral on it. This gives you a quick way of identifying who is able to subitize.
- Show 3 pie plate examples that display familiar arrangements of dots (2 of the plates should display the same amount, but have different arrangements and the third should display a different amount). Have students identify which plate shows the different amount (without counting). For example:



- Have a student roll a number cube with numerals and then, with coloured discs, create a pattern with the corresponding number.
- Using coloured counters, have a student show you three different arrangements that represent a particular number between one and five.
- Have a student roll a number cube with dots and have students tell you the number rolled without counting the dots.
- Ask the student to arrange 5 counters in a way that will make it easy to tell that there are 5.
- Give each student 6 cards with the numbers 1-6 on them. Uncover a series of dots on the overhead projector or interactive whiteboard and have the students hold up the number card with the correct corresponding numeral on it.

FOLLOW-UP ON ASSESSMENT

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

SCO: **N3: Relate a numeral, 1 to 10, to its respective quantity.** [CN, R, V]			
[C] Communication **[T]** Technology	**[PS]** Problem Solving **[V]** Visualization	**[CN]** Connections **[R]** Reasoning	**[ME]** Mental Math and Estimation

Scope and Sequence of Outcomes

	Kindergarten	Grade One
	N3 Relate a numeral, 1 to 10, to its respective quantity.	**N3** Demonstrate an understanding of counting by: indicating that the last number said identifies "how many"; showing that any set has only one count; using the counting on strategy; using parts or equal groups to count sets.

ELABORATION

Guiding Questions:

- *What do I want my students to learn?*
- *What do I want my students to understand and be able to do?*

When students begin Kindergarten, most of them have some initial development of basic **counting**. They need to develop understanding of the size of numbers, number relationships and patterns. Students need repeated experience with counting objects found in their environment. As they count, they link the number word to objects being counted to establish a one-to-one correspondence. Students should develop understanding that the order in which we count does not alter the result and that the last number in the count represents the total number of objects being counted. Students need to be given many opportunities to practise counting as they quantify the amount in a collection. They should answer questions such as, "How many boys are in the front of the room?" or "How many crayons does Bobby have?" You may also ask them to count the number of steps it takes to go to the office and they should be able to make the count.

As contrasted with rote counting, meaningful counting involves an understanding of the following **principles**:

- One number is said for each item in the group and is counted once and only once. (**one-to-one correspondence**)
- Counting begins with the number 1 and there is a set number sequence. (**stable order**)
- The starting point and order of counting the objects does not affect the quantity. (**order irrelevance**)
- The arrangement or types of objects does not affect the count. (**conservation**)
- The number in the set is the last number said. (**cardinality**)
- It does not matter what is being counted, the resulting count will always be the same. (**abstraction**)

Once students are able to determine the number in a group by counting, the next step is to be able to create a group of that number. It is important that students be able to match the numeral with its concrete or pictorial representation up to the number 10. Because it is important that children develop an efficient means of recording numerals, **numeral writing** should be taught as students are ready to record the appropriate numeral(s). Specific instruction and practice will be necessary. Integrating digits in an emergent writing opportunity supports children in the development of writing skills.

SCO: **N3: Relate a numeral, 1 to 10, to its respective quantity.**
[CN, R, V]

ASSESSING PRIOR KNOWLEDGE AND SKILLS

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

- Show the student a numeral (e.g. 4). Ask them to create a set of that many objects.
- Give students a set of five buttons. Ask students how many buttons are in the collection. If the student correctly counts and says "five," rearrange the buttons and ask, "How many buttons are there?" If the student hesitates and counts again, their conservation of number may not be developed as of yet.

ACHIEVEMENT INDICATORS

Guiding Questions:

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

Use the following set of indicators as a guide to determine whether students have met the corresponding specific outcome.

- Construct a set of objects corresponding to a given numeral.
- Name the number for a given set of objects.
- Hold up the appropriate number of fingers for a given numeral.
- Match numerals with their given pictorial representations.

SCO: **N3: Relate a numeral, 1 to 10, to its respective quantity.**
[CN, R, V]

PLANNING FOR INSTRUCTION

Guiding Questions

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

Choosing Instructional Strategies

Consider the following strategies when planning lessons:

- Use a variety of physical materials that students can manipulate and group as they count. Number activities should use concrete objects prior to printed images.
- Encourage students to display numbers whenever possible, either with models or by enacting the number physically; e.g., showing fingers, clapping.
- Use familiar and interesting objects to represent and model numbers whenever possible.
- Expect students to explain, verbally, how they know how many are in a set.
- Allow students to experiment freely writing numerals on unlined paper using markers, crayons, and pencils. At this level, writing digits should not include the use of lined paper.
- Invite children to create sets. Encourage conversation by asking them to count the objects placed in sets.

Suggested Activities

- Play a variety of games which require counting, for example:
  - board games (counting the number of spaces to be moved based on a spin)
  - throwing bean bags (counting how many land in the target box)
- Give each student a ten-frame and 10 counters. On the ten-frame, have students show you different numbers from one to ten. You might say the number or write the numeral on the board and then have students display the number in the ten-frame. Repeat with different examples.
- Sort the numerals in terms of characteristics; for example, those with rounded parts (like 8, 0), those with only straight parts (like 1, 7), and those with both (like 5, 2).
- Ask students to show a given number on their calculator. To confirm their responses, write the symbol on the board, display it on an overhead calculator, or show a large number card. Repeat the process by having students clear their displays and then call out (or have a student call out) another number. Ask students to press the key to show the number of windows in the room, the number of lights in the ceiling, or the number of students wearing glasses.
- Provide students with cards on which the numerals 1 to 10 are written. Make the number arrangements on an overhead, using ten-frames and counters. Ask the students to select and show the number card that represents the arrangement. This activity can also be done with pairs of students.
- Play a concentration game with pairs of cards that show numerals and matching pictorial representations.

Possible Models: counters, collections of objects, five-frames and ten-frames, number cubes, dot cards, number lines and open number lines, coins, calendar, calculators

SCO: **N3: Relate a numeral, 1 to 10, to its respective quantity.**
[CN, R, V]

ASSESSMENT STRATEGIES

Look back at what you determined as acceptable evidence.

Guiding Questions
• What are the most appropriate methods and activities for assessing student learning?
• How will I align my assessment strategies with my teaching strategies?

Assessment can and should happen every day as a part of instruction. A variety of approaches and contexts should be used for assessing all students: as a class, in groups, and individual students. Consider the following **sample activities** (that can be adapted) for either formative (for learning; as learning) or summative (of learning) assessment.

Whole Class/Group/Individual Assessment

- Give each student numeral cards from 1 to 10. Ask them to match the 10 numerals with corresponding sets of numbers. Show sets of up to 10 items and ask them to hold up the corresponding numeral card. You can also hold up dot cards with the numbers from 1 to 10. Also, ask students individually to set out their numeral cards from 1 to 10 and from 10 to 1.
- Give each student a ten-frame. Announce a number to the class and ask students to show you that number on their ten-frames. Observe whether they have the correct number of corresponding dots.
- Ask a student to choose a numeral between 1 and 10 and draw a set of objects that corresponds to that numeral. Repeat for several different numbers. (Students may be able to print the numeral.)
- Show the student a numeral and ask him or her to clap that many times. For variation, clap and ask the student to point to the numeral in front of him or her that indicates the number of claps.
- Ask the student, “How many fingers am I holding up?” or ask the student to hold up a given number of finger(s).
- Observe and note the way in which students count:
  - Do they touch each object as they count?
  - Do they set items aside as they count them?
  - Do they show confidence in their count or feel the need to check?
  - Do they check their counting in the same order as the first count or in a different order?
- Provide a variety of interesting photographs involving multiple people, animals, or objects. Ask the students to tell how many are in the photographs.
- Fill paper bags with 10 different sized counters or objects (e.g., cubes, bear counters, erasers, crayons, large paper clips, etc). In turn, students grab one handful of counters from each bag, count, and record the number of items on a blank sheet of paper or index card. The numbers generated from this task provide a set of numbers which can then be compared, sorted, and placed on a number line.

FOLLOW-UP ON ASSESSMENT

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

SCO: **N4: Represent and describe numbers 2 to 10, concretely and pictorially.** [C, CN, ME, R, V]			
[C] Communication **[T]** Technology	**[PS]** Problem Solving **[V]** Visualization	**[CN]** Connections **[R]** Reasoning	**[ME]** Mental Math and Estimation

Scope and Sequence of Outcomes

	Kindergarten	Grade One
	N4 Represent and describe numbers 2 to 10, concretely and pictorially.	**N4** Represent and describe numbers to 20, concretely, pictorially and symbolically.

ELABORATION

Guiding Questions:

- *What do I want my students to learn?*
- *What do I want my students to understand and be able to do?*

Students need to develop flexibility in thinking about numbers to develop number sense. Teachers need to provide students with opportunities to demonstrate many ways of representing a number, both **concretely** and **pictorially**. Students need to talk about where and when they might use specific numbers and their parts.

The ability to recognize that a given number can be represented by two smaller numbers is essential. Students should be able to see small groups as part of a larger group. They should also be able to recognize how many objects are in each of the small groups. This helps students become familiar with **part-part-whole relationships** for numbers up to 10.

Counting a set of objects will not cause a child to focus on the fact that it could be made of two parts. Focusing on a quantity in terms of its parts has important implications for developing number sense. The ability to think about a number in terms of parts is a major milestone in the development of number (Van de Walle and Lovin, vol. 1, 2006, p. 48).

Understanding the relationship among the parts and the relation between the parts and the whole is essential to developing a sense of numbers and an understanding of mathematical operations. It is important to understand that the action of **partitioning** a set of objects does not affect the count. A student who demonstrates an understanding of these connections can also determine a larger quantity without counting each object.

To conceptualize a number as being made up of two or more parts is the most important relationship that can be developed about numbers. The number 4 can be represented by raising three fingers on one hand and one finger on the other hand, or by raising four fingers on one hand and none on the other, and again by two fingers on each hand. By participating in such an activity, a student begins to understand that 4 can be represented in many ways, for example by 3 and 1, 0 and 4, and 2 and 2 as well as several other representations. It is important to use a variety of representations and materials to avoid the misconception that partitioning can only be represented using fingers.

The principal tool that children will use as they construct part- part-whole relationships is counting.

SCO: **N4: Represent and describe numbers 2 to 10, concretely and pictorially.**
[C, CN, ME, R, V]

ASSESSING PRIOR KNOWLEDGE AND SKILLS

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

- Give students a set of objects (10 or less) and have them separate the set into two groups. Ask them to tell you how many are in each group.
- Show the students a picture of a number of items (10 or less) that are in two groups. Ask them to tell you how many there are altogether and then ask them to tell you how many are in each group.

ACHIEVEMENT INDICATORS

Guiding Questions:

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

Use the following set of indicators as a guide to determine whether students have met the corresponding specific outcome.

- Partition a given quantity into two parts (use fingers, counters or other objects), and identify the number of objects in each part.
- Show a given number as two parts, using pictures, and name the number of objects in each part.

SCO: **N4: Represent and describe numbers 2 to 10, concretely and pictorially.**
[C, CN, ME, R, V]

PLANNING FOR INSTRUCTION

Guiding Questions

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

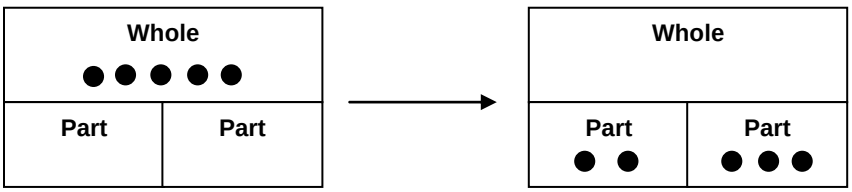
Choosing Instructional Strategies

Consider the following strategies when planning lessons:

- Use a variety of physical materials that students can manipulate and group as they count.
- Represent numbers in a variety of part-part-whole relationships using various models.
- Encourage students to display numbers in parts, whenever possible, either with manipulatives or by enacting the number physically; e.g., showing fingers, clapping.
- Encourage students to explain how they know how many are in each part of a whole.

Suggested Activities

- Have students shake and spill a handful of two colour counters (10 or less) and record (with pictures or numerals) how many counters there are altogether and how many of each colour there are in the two sets. Students should explore making different combinations for the given number by flipping the counters over or by repeating the shake and spill process.
- Provide students with a number of linking cubes (10 or less) and have them make a “train”. Ask the student how many different ways they can break the “trains” of cubes into two groups.
- Ask the student to separate a given number of toys (10 or less) into two groups. Have the student describe how many are in each part and how many there are in total.
- Students might play a variety of games, for example:
  - bowling (counting both the pins knocked down and the pins left standing)
  - throwing bean bags (counting how many land in the target box and how many did not)
- Have students select a number between 5 and 10. Then have them select two dot cards that combine to make that number. Challenge them to see how many different combinations they can make for their chosen number.
- Use part-part-whole mats and counters and show students a set of 5 counters. Ask the student to count how many are in the set. Then partition the counters into two parts, for example 2 and 3, and ask: ‘‘How many objects are there? How do you know?’’ Observe whether the child must recount all of the objects or if he/she knows that partitioning the objects has not changed the quantity. Repeat with a different number of objects.



Possible Models: two colour counters, linking cubes, dot cards, five-frames and ten-frames, dominoes

SCO: **N4: Represent and describe numbers 2 to 10, concretely and pictorially.**
[C, CN, ME, R, V]

ASSESSMENT STRATEGIES

Look back at what you determined as acceptable evidence.

Guiding Questions
• What are the most appropriate methods and activities for assessing student learning?
• How will I align my assessment strategies with my teaching strategies?

Assessment can and should happen every day as a part of instruction. A variety of approaches and contexts should be used for assessing all students: as a class, in groups, and individual students. Consider the following **sample activities** (that can be adapted) for either formative (for learning; as learning) or summative (of learning) assessment.

Whole Class/Group/Individual Assessment

- Shake and spill a handful of two different colours of counters (10 or less) on the overhead. Have the students record (with pictures or numerals) how many counters there are altogether and how many of each colour there are.
- Give students sticker dots of two different colours and ask them to make different dot plates of numbers, using the two colours; e.g., they might show eight dots, with 5 red and 3 yellow or 2 red and 6 yellow. Ask them to share with the class the different ways they made the number.
- Ask each student to get 10 linking cubes: five red, three green and two yellow. Students can work in pairs to solve the following riddles.
    - I have three red cubes and three green cubes. How many cubes do I have?
    - I have two yellow cubes and the same number of red cubes. How many cubes do I have?
    - I have eight cubes altogether. There are five red cubes and the rest are green. How many cubes are green?
- Have students select a number between 5 and 10. Next have them select two dot cards that combine to make that number. Challenge students to see how many different combinations they can make for their chosen number.
- Provide the student with a given number (10 or less) and ask students to make 2-colour bars, using linking cubes (e.g., 5 blue and 3 red) to represent this number. Have the student tell you about the number of cubes.
- Ask the student to count out six blocks/counters into your hand. Shake them up in both hands and then open hands to display a "6" combination, (e.g., 4 in one hand, 2 in the other). Ask the student how many you have altogether. Repeat using different combinations. Observe whether or not students need to count.

FOLLOW-UP ON ASSESSMENT

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

SCO: **N5: Compare quantities, 1 to 10, using one-to-one correspondence.** [C, CN, V]			
[C] Communication **[T]** Technology	**[PS]** Problem Solving **[V]** Visualization	**[CN]** Connections **[R]** Reasoning	**[ME]** Mental Math and Estimation

Scope and Sequence of Outcomes

	Kindergarten	Grade One
	N5 Compare quantities, 1 to 10, using one-to-one correspondence.	**N5** Compare sets containing up to 20 elements, using: referents; one-to-one correspondence to solve problems.

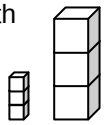
ELABORATION

Guiding Questions:

- *What do I want my students to learn?*
- *What do I want my students to understand and be able to do?*

Given the concrete focus of children at this stage, **comparing** activities should frequently involve the use of concrete materials, as well as pictorial representations of sets. Students should have experiences sorting and matching sets in which:

- the items go together (e.g., forks and spoons);
- the items are unrelated (e.g., glue containers and pieces of paper for the children at the art table);
- arrangements that have the same number, but take up a different amount of space (e.g., both sets have 3 blocks even though the sets take up a different amount of space) .



Most students have an intuitive idea that, in deciding whether one set is more than another, it is possible to match items up in **one-to-one correspondence** to see if one set has any leftovers.
In kindergarten, most students make direct comparisons (one-to-one correspondence) when comparing sets of concrete objects. Students who can successfully distinguish **more**, **fewer**, and **the same number**, by counting do not need engage in **one-to-one matching** activities. However, one-to-one matching is an important principle that should be applied to counting.

Kindergarten students are expected to explore the concept of quantity when it relates to countable and non-countable items. When referring to countable quantities the word **fewer** is used and when referring to measures the word **less** is used. For example: There are **fewer** counters in this group than in that one. There is **less** water in this glass. Students will become more familiar with the term **less than** to compare numbers in later years. In kindergarten, the term fewer than is used when describing sets of objects. When talking about sets that have the same number of objects, use the terms, the same number and as many as.

Though the concept of fewer is logically equivalent to the concept of more, the word fewer proves to be more difficult for children than more. A possible explanation is that students have many opportunities to use the word more (Van de Walle and Lovin, vol. 1, 2006, p. 38).

SCO: **N5: Compare quantities, 1 to 10, using one-to-one correspondence.**
[C, CN, V]

ASSESSING PRIOR KNOWLEDGE AND SKILLS

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

- Show students one spatial relationship of a number and ask students to show another spatial arrangement that shows the same (e.g., given one arrangement of five dots on a pie plate, will they recognize a different arrangement of the five dots?) This shows an understanding of equivalent sets.
- Show students two sets of objects. Can they tell you which set has more objects and/or which set has fewer objects?
- Show students one set of object. Can they find another set with the same number of objects?

ACHIEVEMENT INDICATORS

Guiding Questions:

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

Use the following set of indicators as a guide to determine whether students have met the corresponding specific outcome.

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

SCO: **N5: Compare quantities, 1 to 10, using one-to-one correspondence.**
[C, CN, V]

PLANNING FOR INSTRUCTION

Guiding Questions

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

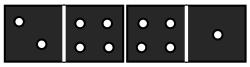
Choosing Instructional Strategies

Consider the following strategies when planning lessons:

- Use materials that students can manipulate when exploring one-to-one correspondence. Avoid using drawings as students cannot move these and experiment with different strategies.
- Encourage students to work in pairs or small groups to facilitate discussion and shared thinking.
- Provide many opportunities for students to pose or answer questions such as:
  - Who has fewer? Who has more?
  - Are there more boys or girls here today?
  - Is there a child here for every name tag?
  - Are there the same number of chairs and students?
- Use a calendar and provide opportunities for students to decide if a set that is shown has more than, fewer than, or the same number of objects as the number of the date (up to 10).

Suggested Activities

- Have 10 students sit in chairs in front of the class. Ask seven students to stand. Check that there are seven standing and then have the students sit down. Next ask for five to stand and then two more to stand. Ask, "What number is that?" Discuss with the class if this group is more, fewer, or the same as the first group who stood. Repeat for different numbers, sometimes asking for the number directly, sometimes asking in combinations, such as one fewer than five. Always ask, "What number is that?"
- Read the story *The Very Hungry Caterpillar* by Eric Carle. Prepare a large blank graph with the names and pictures of the foods the caterpillar ate. Give each student a small sticky note. Have them write their names on the sticky notes, then place the sticky notes on the area of the graph that shows their favourite food. Ask, "Which food did more/fewer students choose? The class can also graph the exact number of items the caterpillar ate and do a direct correspondence.
- Give each student a ten-frame and 10 counters. Have all students show you the number nine with five counters in the top row and four in the bottom, filling from left to right. Now ask students what they will do to display the number six. Ask them, "Will you remove or add counters to the ten-frame?" “Is six more than nine? How do you know?”
- Have students to play "Dot Challenge." Provide a deck of dot cards (1 to 10 dots each). Each student turns up a card; the student who has the card with more dots gets both cards.
- Play the traditional game of dominoes where the students play their domino by matching it with one that has the same number of dots.



Possible Models: counters, linking cubes, dominoes, dot cards, ten-frames, links

SCO: **N5: Compare quantities, 1 to 10, using one-to-one correspondence.**
[C, CN, V]

ASSESSMENT STRATEGIES

Look back at what you determined as acceptable evidence.

Guiding Questions
• What are the most appropriate methods and activities for assessing student learning?
• How will I align my assessment strategies with my teaching strategies?

Assessment can and should happen every day as a part of instruction. A variety of approaches and contexts should be used for assessing all students: as a class, in groups, and individual students. Consider the following **sample activities** (that can be adapted) for either formative (for learning; as learning) or summative (of learning) assessment.

Whole Class/Group/Individual Assessment

- Show pairs of cards with sets of objects: 10 or fewer (e.g., two that show sets of eight, two that show sets of nine, two that show sets of six). As you show each pair, ask students if the pairs match. Make sure that a few pairs are not equivalent. Use large stickers or illustrations when showing these to the whole group.
- Provide representations of two different sets: each 10 or fewer. Ask students which set has more and which has fewer (e.g., one set has 9 and the other has 7).
- Give students a blank plate. Hold up a dot plate and ask the students to:
  - make a set the ‘‘same as’’
  - make a set with ‘‘more’’
  - make a set with ‘‘fewer’’

  Students may then compare their sets at their tables.
- Hold up a dot card that has between 2 and 8 dots. Give the student 3 cards labelled “more”, “fewer”, and “same”. Beside each card, have the student make a collection of counters; one set that has more, one set that has fewer, and one set that has the same as the original card.
- Give the student a domino and have them tell you which side of the domino shows more dots and which side shows fewer dots. For example, “Five dots is more than three dots *and* three dots is fewer than five”.
- Give the student a tower of four cubes and another tower of seven cubes. Ask, "Which is closer to 10?" and then ask, "How do you know?" You could also have the student tell you which is closer to five and explain their thinking. Allow him or her to use more linking cubes if needed to assist in solving this problem.
- Use two sets of objects of differing sizes (e.g., 4 large objects in one set and 5 small objects in the other set).Ask, “Which has more? How do you know?”

FOLLOW-UP ON ASSESSMENT

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

SCO: **PR1: Demonstrate an understanding of repeating patterns (two or three elements) by:**

- **identifying**
- **reproducing**
- **extending**
- **creating**

patterns using manipulatives, sounds and actions.
[C, CN, PS, V]

[C] Communication	**[PS]** Problem Solving	**[CN]** Connections	**[ME]** Mental Math and Estimation
[T] Technology	**[V]** Visualization	**[R]** Reasoning	

Scope and Sequence of Outcomes

	Kindergarten	Grade One
	PR1 Demonstrate an understanding of repeating patterns (two or three elements) by: • identifying • reproducing • extending • creating patterns using manipulatives, sounds and actions.	**PR1** Demonstrate an understanding of repeating patterns (two to four elements) by: describing; reproducing; extending; creating patterns using manipulatives, diagrams, sounds and actions.

ELABORATION

Guiding Questions:

• What do I want my students to learn?
• What do I want my students to understand and be able to do?

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

Students notice and hear patterns in many contexts. It is important to help them recognize the mathematical aspects of these patterns. Kindergarten students need to be exposed to many forms of patterning and should copy and reproduce given patterns before being expected to create their own. When children work with manipulatives it allows them to explore and be flexible with their patterning creations and it allows students to revisit and extend patterning ideas. The concept of patterning is closely linked to those of sorting and classifying. As children classify objects they realize how objects are the same and different. Children's early understandings of sorting are based on single attributes such as colour, shape or size.

Patterns may be represented in **concrete**, **pictorial** or **symbolic** form. Students will require many patterning experiences with concrete materials prior to recording patterns on paper and/or working from patterns of pictures. Kindergarten students enjoy being part of action and word patterns. Students should develop fluency in moving from one representation to another. Students must learn to **recognize**, **extend**, **create** and use mathematical patterns. Patterns allow students to make predictions and justify their reasoning when solving routine and non-routine problems. Learning to work with patterns in the early grades helps students develop algebraic thinking that is the foundation for working with more abstract mathematics in higher grades.

SCO: **PR1: Demonstrate an understanding of repeating patterns (two or three elements) by:**

- **identifying**
- **reproducing**
- **extending**
- **creating**

patterns using manipulatives, sounds and actions.
[C, CN, PS, V]

ASSESSING PRIOR KNOWLEDGE AND SKILLS

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

- Use concrete materials. Ask students to identify what might come next (e.g., using colour counters on the overhead projector in an ABABAB, or other similar pattern).
- Have students line up at the front of the room and make a pattern by having one student put his or her leg out, the next put his or her arm out and so on. As students join the pattern, observe whether they can follow the pattern rule. Continue until everyone is included in the pattern.
- Observe which students are able to follow a repeating auditory pattern (e.g., stomp, clap).

ACHIEVEMENT INDICATORS

Guiding Questions:

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

Use the following set of indicators as a guide to determine whether students have met the corresponding specific outcome.

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

SCO: **PR1: Demonstrate an understanding of repeating patterns (two or three elements) by:**

- **identifying**
- **reproducing**
- **extending**
- **creating**

patterns using manipulatives, sounds and actions.
[C, CN, PS, V]

PLANNING FOR INSTRUCTION

Guiding Questions

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

Choosing Instructional Strategies

Consider the following strategies when planning lessons:

- Provide students with many experiences to sort objects such as paper clips, blocks, toys of various sizes, math manipulatives, beads, buttons, crayons, markers, snap cubes, counters, etc. so they can increase their awareness of attributes.
- Have students communicate patterns in various ways (words, letters, etc.).
- Provide opportunities for students to draw simple shape patterns.
- Encourage students to display concrete patterns whenever possible, either with manipulatives or by enacting the pattern physically.
- Encourage students to demonstrate oral patterns, including singing or clapping/stomping.
- Expect students to explain, verbally, how they know what comes next in a pattern.
- Extend experiences with patterns further by exploring familiar skipping-rope chants and performing the actions for such songs as the Hokey-Pokey. Students also benefit from hearing stories with repeated or predictable language and repeating the patterns.

Suggested Activities

- Create an up and down pattern by having alternating students stand and crouch.
- Create a forward and backward pattern by having one student face forward and the next student face backward until all are included in the pattern around the room.
- Read a story that has a pattern and have the students repeat the pattern once they recognize it.
- Have students reproduce and extend patterns that focus on
  - auditory: clap, clap, clap, snap, clap, clap, clap, snap
  - number of like objects: e.g., ☾ ☆ ☾ ☆
  - orientation: e.g., ◇ □ □ ◇ □ □
  - number of sides: e.g. △ △ △ ⬡ △ △ △ ⬡
  - shape: e.g., ☺ ♡ ☼ ☺ ♡ ☼
  - colour: e.g., red block, blue block, red block, blue block
- Provide a pattern and ask the student to represent it with an action pattern. For example, “green, green, blue, green, green, blue, . . . ” might be represented by “clap, clap, snap, clap, clap, snap,…”

Possible Models: counters, colour tiles, linking cubes, pattern blocks, links, beads

SCO: **PR1: Demonstrate an understanding of repeating patterns (two or three elements) by:**
- **identifying**
- **reproducing**
- **extending**
- **creating**

patterns using manipulatives, sounds and actions.
[C, CN, PS, V]

ASSESSMENT STRATEGIES

Look back at what you determined as acceptable evidence.

Guiding Questions
- *What are the most appropriate methods and activities for assessing student learning?*
- *How will I align my assessment strategies with my teaching strategies?*

Assessment can and should happen every day as a part of instruction. A variety of approaches and contexts should be used for assessing all students: as a class, in groups, and individual students. Consider the following **sample activities** (that can be adapted) for either formative (for learning; as learning) or summative (of learning) assessment.

Whole Class/Group/Individual Assessment

- Have small groups of students build these pattern trains with linking cubes; e.g.,
  RGRGRGRG BYYBYYBYY GRGRGRGR BBWBBWBBW YRYRYRYR
  Ask "Which patterns are the same and why?"
- Show the class a pattern sequence with an error and ask them what they would change to fix this pattern.
  ☺ ★ ☺ ★ ★ ☺ ★ ☺ ★ ☺ ★
- Hand out six large triangle and square shapes; one to each student. Line students up in the following pattern: TRIANGLE, SQUARE, TRIANGLE, SQUARE, TRIANGLE, SQUARE and ask students, "If we had 10 students in this pattern, what shape would the 10th student be holding?"
- Create an ABAB pattern on the overhead projector with different shapes. Show it to students and then cover the pattern. Ask students to describe or draw what would come next. Have them explain how they know. This can also be done using other patterns such as, ABBABB or ABCABC.
- Show the student a set of linking cubes arranged in a repeating pattern. Ask the student to:
  - add the next correct piece in the pattern;
  - continue the pattern with additional pieces at least twice and explain his or her extension;
  - copy the existing pattern using sounds, actions, shapes, etc.;
  - identify the core pattern in the longer pattern.
- Tell the student, "I made a pattern with 12 linking cubes and then it fell apart. All I have left are three together: RBG." Show the three cubes to the student. “Use cubes to build what you think my pattern might have looked like". After the student has completed one pattern, ask, "Might it have looked another way?" Encourage the student to show you other possibilities. It is most important that you have the student to explain his or her thinking.
- Have the student describe a pattern that he/she sees in the classroom.

FOLLOW-UP ON ASSESSMENT

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

SCO: **SS1: 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]

[C] Communication **[T]** Technology	**[PS]** Problem Solving **[V]** Visualization	**[CN]** Connections **[R]** Reasoning	**[ME]** Mental Math and Estimation

Scope and Sequence of Outcomes

	Kindergarten	Grade One
	SS1 Use direct comparison to compare two objects based on a single attribute, such as length (height), mass (weight) and volume (capacity).	**SS1** Demonstrate an understanding of measurement as a process of comparing by: identifying attributes that can be compared; ordering objects; making statements of comparison; filling, covering or matching.

ELABORATION

Guiding Questions:

- *What do I want my students to learn?*
- *What do I want my students to understand and be able to do?*

Measurement activities provide opportunities for students to link their understandings of number and geometry. Through meaningful investigations, children will develop an understanding of 2-D shapes and 3-D objects and their relationships to new situations and problems. They should be provided with many opportunities to explore touch, manipulate, sort and build. Students have intuitive understandings that should be built upon as they continue to recognize **attributes** common to objects and use these attributes to make **direct comparisons**. Students should make direct comparisons by looking at or handling the objects. For example:

- Length: students can compare heights by standing back to back;
- Mass: given two objects, students can predict which is heavier and then check by picking them up or by using a balance;
- Capacity: given two containers, students can predict which one holds more and then check by filling them with a material, such as rice or water. Students should explore the effect of pouring the same amount of water or sand into containers of different shapes and sizes. The focus should be on comparison, rather than describing the capacities of individual containers.

It is important that students have a significant amount of comparison experience prior to using non-standard and standard units. Students should have conversations as they identify which attributes (**length**, **mass**, **volume**) they can use to describe objects and make comparisons. These attributes are best recognized in students' everyday conversations (e.g., "That person is very tall," “My book bag is not very heavy,” "We need a large container for this").

In kindergarten, students will use a variety of nonstandard units for direct comparison. **Estimation** is also important as it is an application of number sense. It contributes to students' development of spatial sense. Children interpret the physical world with geometric ideas (e.g., shape, orientation, spatial relations) and describe it with corresponding vocabulary. They use basic shapes and spatial reasoning to model objects in their environment. Children use predictions and compare measurable attributes such as length, mass, and capacity to solve problems by comparing objects to help them understand their world.

SCO: **SS1: 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]

ASSESSING PRIOR KNOWLEDGE AND SKILLS

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

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

ACHIEVEMENT INDICATORS

Guiding Questions:

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

Use the following set of indicators as a guide to determine whether students have met the corresponding specific outcome.

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

SCO: **SS1: 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]

PLANNING FOR INSTRUCTION

Guiding Questions

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

Choosing Instructional Strategies

Consider the following strategies when planning lessons:

- Encourage students to develop intuitive notions for length, mass and volume, using direct comparison.
- Ensure students first make estimates and then check their predictions.
- Expect students to explain how they determined their measurements.
- Have students make meaningful measurements students including:
  - comparing structures they have built in terms of height and width;
  - comparing their heights and arm lengths;
  - comparing the capacities of different types of cups, spoons, pails, boxes, bowls;
  - comparing the masses of different rocks or different fruits and vegetables;
  - finding objects in the class that are shorter than their foot, about the same length as their foot and longer than their foot;
  - filling containers of the same size and shape with different amounts of water in order to produce different pitches of sound.
- Emphasize the importance of a base line, as students compare the lengths of objects; that is, comparing by starting both objects at the same place.
- Explore the transitive understanding of measurement with students; that is if A is larger than B, and B is larger than C, then A must be larger than C.
- Discuss with students situations in which direct measurement is difficult (e.g. comparing two large objects that cannot be directly compared).

Suggested Activities

- Ask students to describe the steps, in order, that one would take to decide which of two objects is longer, heavier, or holds more.
- Create a sorting station at which students sort objects as longer, shorter, or about the same as a specified object at the station. This activity can be extended to explore mass and volume.
- Have students go on a scavenger hunt where they find several objects that are longer, shorter, or about the same as a specified object. This activity can be extended to explore mass and volume.
- Ask students to estimate and then determine which of two toys is “heavier” by using a pan balance.
- Show students a piece of string that is about one metre long. Ask them if they think they are taller than the string without allowing them to stand beside it. After making a prediction, they measure themselves against the string. Find items that are longer and shorter than the string (e.g., the height of a chair, the height of the door, the length of a book, the length of a pencil, the length of the classroom).

Possible Models: string, various containers, linking cubes, pan balance

SCO: **SS1: 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]

ASSESSMENT STRATEGIES

Look back at what you determined as acceptable evidence.

Guiding Questions
• What are the most appropriate methods and activities for assessing student learning?
• How will I align my assessment strategies with my teaching strategies?

Assessment can and should happen every day as a part of instruction. A variety of approaches and contexts should be used for assessing all students: as a class, in groups, and individual students. Consider the following **sample activities** (that can be adapted) for either formative (for learning; as learning) or summative (of learning) assessment.

Whole Class/Group/Individual Assessment

- Give students a piece of string. Ask them to find two objects that are longer than the string, two objects that are shorter than the string and two objects that are almost the same length as the string. Each student has three pieces of paper that are labelled shorter, same and longer. On the paper, they draw pictures of the objects they found for each category.
- Ask students to take off one of their shoes and then find two objects in the classroom that are heavier than the shoe, lighter than the shoe and almost the same weight as the shoe. Give each student three pieces of paper labelled heavier, same and lighter. On the paper, they draw pictures of the objects they found for each category.
- Provide a box and have students find two containers that would hold more than the box, two containers that would hold almost the same and two containers that would hold less. Give each student three pieces of paper labelled more, same and less. On the paper, they draw pictures of the objects they found for each category.
- Give the student two objects (e.g., crayon, paper clip, pencil, ruler, or eraser). Ask the student to predict and then determine which item is longer or shorter. Have the student explain his/her thinking.
- Give the student two objects (e.g., crayon, paper clip, large book, ruler, or stapler). Ask the student to predict and then determine which item is lighter or heavier. Have the student explain his/her thinking.
- Give the student two containers (e.g., one-litre milk container, empty tuna can, individual milk container, two-litre milk container, or thimble). Ask the student to predict and then determine which item holds more or less. Have the student explain his/her thinking.
- Have the student tell you, for each of the following statements, if it is possible or impossible and explain his/her thinking:
  - A cat is heavier than my mom.
  - A bathtub holds less than a jug of milk.
  - My arm is longer than my foot.

FOLLOW-UP ON ASSESSMENT

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

SCO: **SS2: Sort 3-D objects using a single attribute.** [C, CN, PS, R, V] **SS3: Build and describe 3-D objects.** [CN, PS, V]			
[C] Communication **[T]** Technology	**[PS]** Problem Solving **[V]** Visualization	**[CN]** Connections **[R]** Reasoning	**[ME]** Mental Math and Estimation

Scope and Sequence of Outcomes

	Kindergarten	Grade One
	SS2 Sort 3-D objects using a single attribute. **SS3** Build and describe 3-D objects.	**SS2** Sort 3-D objects and 2-D shapes using one attribute, and explain the sorting rule. **SS3** Replicate composite 2-D shapes and 3-D objects. **SS4** Compare 2-D shapes to parts of 3-D objects in the environment.

ELABORATION

Guiding Questions:

- *What do I want my students to learn?*
- *What do I want my students to understand and be able to do?*

Students come to school having had experience with many **3-D objects**. Their most common experiences are those involving three-dimensional, rather than two-dimensional, shapes. Early school experiences should include sorting 3-D objects and describing how they are alike and how they differ (e.g., smooth sides, sharp corners, will roll, will fit together to make a bigger one of the same shape, etc.). Structuring meaningful contexts for children where they have opportunities to explore, touch, manipulate, play, sort and build with 3-D objects is important to developing spatial sense. The block centre is an important place for students to regularly explore and experiment with 3-D objects. As students make their constructions, they begin to learn about the attributes of the various objects. It is through these investigations that students are able to learn the characteristics and properties of objects.

Students should be given many opportunities to sort objects in the context of everyday activities (e.g., when putting blocks away in the centre). With experience, students learn that each 3-D object has many **attributes** and may fit in more than one category. For example, the ramp-shaped block has both rectangular and triangular faces. Sorting criteria that students might use include number or shape of the faces, whether it rolls and/or stacks, as well as non-geometric criteria such as colour, use, and texture. In kindergarten, students are expected to sort objects using just one attribute.

As students engage in building activities, they have many opportunities to explore geometric concepts such as how the same blocks can be arranged in different ways. Which blocks make the best bases for structures? Which are most stable? How should different blocks be arranged for strength? What blocks can be substituted for others? Student's exploration and development are enhanced by the teacher's questions, space and time to build and elaborate, opportunities to discuss their constructions, and permission to leave them standing for free play or to make future additions to the structure.

As students are asked to describe objects, it becomes helpful for them to explore **geometric vocabulary**. Teachers are encouraged to use geometric terminology (e.g., circle, triangle, rectangle, etc.), but students should not be expected to acquire this language in Kindergarten. The important concept for kindergarten is that students begin to understand the attributes of the various objects.

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

SCO: **SS2: Sort 3-D objects using a single attribute.**
[C, CN, PS, R, V]
SS3: Build and describe 3-D objects.
[CN, PS, V]

ASSESSING PRIOR KNOWLEDGE AND SKILLS

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

- Have students identify 3-D objects in the classroom by asking, "Can you show/tell me something that is shaped like this?" and holding up a sphere, cube, rectangular prism, cone, or cylinder. (Note: there are other types of prisms including square prisms and triangular prisms).

ACHIEVEMENT INDICATORS

Guiding Questions:

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

Use the following set of indicators as a guide to determine whether students have met the corresponding specific outcome.

SS2

- Sort a given set of familiar 3-D objects using a single attribute, such as size or shape, and explain the sorting rule.
- Determine the difference between two given pre-sorted sets by explaining a sorting rule used to sort them.

SS3

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

SCO: **SS2: Sort 3-D objects using a single attribute.**
[C, CN, PS, R, V]
SS3: Build and describe 3-D objects.
[CN, PS, V]

PLANNING FOR INSTRUCTION

Guiding Questions

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

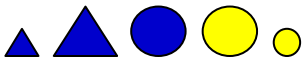
Choosing Instructional Strategies

Consider the following strategies when planning lessons:

- Use a variety of manipulatives and common objects for students to become familiar with the attributes of 3-D objects.
- Ask students to bring 3-D objects from home to share with the class. Have them tell one or two things that they find interesting about what they have brought from home.
- Use the names of the 2-D shapes when talking about them and introduce the names of the 3-D objects through discussions.
- Have students identify the shapes needed to make a 3-D object.

Suggested Activities

- Tape on the floor 2-D shapes, such as, a large triangle, a large circle, a large square and a large rectangle. Have students sort 3-D objects from around the room and block corner into the 2-D shape category (e.g., triangle). Have students explain their sorting rule. For example: a cylinder may be placed in the circle category and a cube may be placed in the square category. Other questions could include:
  - Explain why you put these objects together?
  - According to your (the) sort, where would ___ belong?
  - Which object does not belong to this set?
  - What other way could you sort these objects? Explain your sorting rule.
- Have students build imaginary buildings, monsters, or machines from 3-D objects such as boxes, cans, balls, paper cylinders, and cones.
- Have a student select, and hide from view, a wooden block. Ask him/her to describe the block to the class, one hint at a time, to see if they can guess which one was selected (or have the classmates guess by asking questions without using a 3-D object name).
- Have one student create a structure and ask his/her partner to create one that is quite different and to explain the differences using comparison words (big, small, tall, etc.). Also have students create a structure that is exactly the same as their partner.
- Use a bag or box with a cover for a “Object of the Day” activity. Place different objects inside and get students to feel an object without seeing it and describe it using math vocabulary (e.g., flat, round, points, curvy). Encourage the student to predict the object that is in the bag.
- Ask students to build “one-difference trains”, using attribute blocks. Each neighbouring block differs by one attribute (shape, colour, size, thickness).



Possible Models: blocks, modeling clay, attribute blocks, pattern blocks, geometric solids, collection of objects (boxes, cans, paper rolls, etc.), Polydrons®

SCO: **SS2: Sort 3-D objects using a single attribute.**
[C, CN, PS, R, V]
SS3: Build and describe 3-D objects.
[CN, PS, V]

ASSESSMENT STRATEGIES

Look back at what you determined as acceptable evidence.

Guiding Questions
• What are the most appropriate methods and activities for assessing student learning?
• How will I align my assessment strategies with my teaching strategies?

Assessment can and should happen every day as a part of instruction. A variety of approaches and contexts should be used for assessing all students: as a class, in groups, and individual students. Consider the following **sample activities** (that can be adapted) for either formative (for learning; as learning) or summative (of learning) assessment.

Whole Class/Group/Individual Assessment

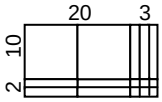
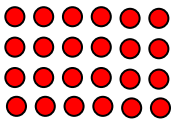
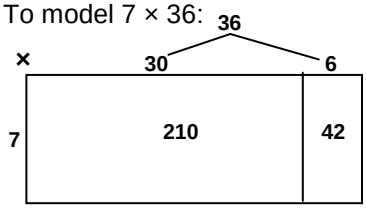
- Ask the student to look at a series of 2-D shapes and 3-D objects. Ask him or her to place the 3-D object on top of the 2-D shape that it is related to and then ask him or her to explain why (e.g., use as examples a circle and sphere, a cone and cylinder, a triangle and pyramid, a square and cube, a rectangle and rectangular prism.
- Give a student a series of 3-D shapes and ask him or her to sort the shapes into two groups, telling you how he or she decided to sort them. Make sure the objects are clearly related in at least two ways so that the student has some obvious choices (e.g., objects with rounded parts and objects with straight edges only, or very large objects and very small objects).
- Show the class two 3-D objects. Have students describe in words or pictures the similarities and differences between the two shapes.
- Give each student enough modeling clay to build one or two objects. Ask them to build 3-D objects with the clay based on models you show (e.g., sphere, cylinder, and cube).
- Place four or five 3-D objects on a table and have students describe each one. For example, students might say ‘‘this object looks like a can’’, ‘‘this one has points’’, ‘‘this one can roll’’. Cover the objects and remove one. Ask students to describe the missing object.
- Have students select shapes from the block corner to construct a model of a dog house (or other simple structure). When it is completed, encourage them to talk about their creations and to provide reasons for their designs (the kind/size of the dog, sleeping space, consideration of cold weather, size of model in relation to an actual dog house, etc.).

FOLLOW-UP ON ASSESSMENT

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

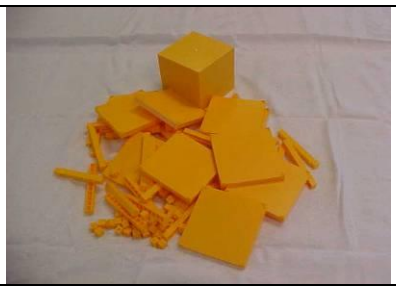
GLOSSARY OF MODELS

This glossary is identical for all grade levels (kindergarten to grade 8). Most of the models have a variety of uses at different grade levels. More information as to which models can be used to develop specific curriculum outcomes is located on the *Instructional Strategies* section of each four-page spread in this curriculum document. The purpose of this glossary is to provide a visual of each model and a brief description of it.

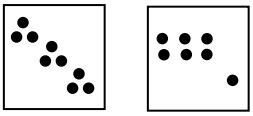
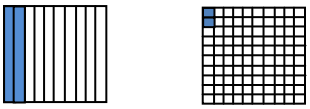
Name	Picture	Description
Algebra tiles		• Sets include “X” tiles (rectangles), “X^2” tiles (large squares), and integer tiles (small squares). • All tiles have a different colour on each side to represent positive and negative. Typically the “X” tiles are green and white and the smaller squares are red and white. • Some sets also include “Y” sets of tiles which are a different colour and size than the “X” tiles.
Area Model	To model 12 × 23: 	• Use base ten blocks to represent the parts of each number that is being multiplied. • To find the answer for the example shown, students can add the various parts of the model: 200 + 30 + 40 + 6 = 276. • This model can also be used for fraction multiplication.
Arrays and Open Arrays	To model 4 × 6:  To model 7 × 36: 	• Use counters arranged in equal rows or columns or a Blackline Master with rows and columns of dots. • Helpful in developing understanding of multiplication facts. • Grids can also be used to model arrays. • Open arrays allows students to think in amounts that are comfortable for them and does not lock them into thinking using a specific amount. These arrays help visualize repeated addition and partitioning and ultimately using the distributive property.

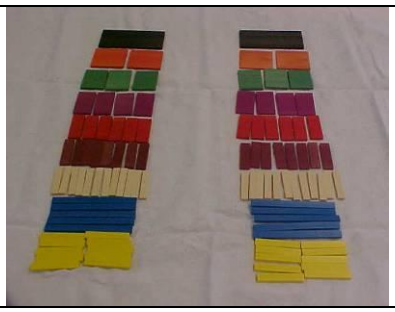
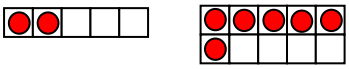
Attribute Blocks		• Sets of blocks that vary in their attributes:
		  ○ 5 shapes
		  circle, triangle, square, hexagon, rectangle
		  ○ 2 thicknesses
		  ○ 2 sizes
		  ○ 3 colours

Balance (pan or beam) scales		• Available in a variety of styles and precision. • Pan balances have a pan or platform on each side to compare two unknown amounts or represent equality. Weights can be used on one side to measure in standard units. • Beam balances have parallel beams with a piece that is moved on each beam to determine the mass of the object on the scale. Offer greater accuracy than a pan balance.

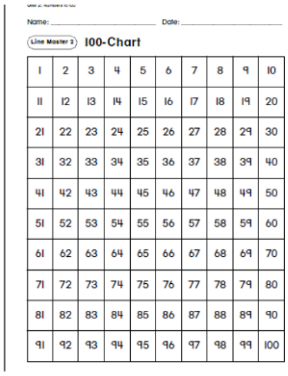
<table>
<tr><td>Base Ten Blocks</td><td>  </td><td>• Include unit cubes, rods, flats, and large cubes.
• Available in a variety of colours and materials (plastic, wood, foam).
• Usually 3-D.</td></tr>
<tr><td>Beam Balance</td><td colspan="2">☞ see Balance (pan or beam)</td></tr>
<tr><td>Carroll Diagram</td><td>Example:
<table>
<tr><td></td><td>1-digit</td><td>2-digit</td></tr>
<tr><td>Even</td><td>2, 4, 6, 8</td><td>26, 34</td></tr>
<tr><td>Odd</td><td>1, 3, 5, 7, 9</td><td>15, 21</td></tr>
</table></td><td>• Used for classification of different attributes.
• The table shows the four possible combinations for the two attributes.
• Similar to a Venn Diagram.</td></tr>
<tr><td>Colour Tiles</td><td>  </td><td>• Square tiles in 4 colours (red, yellow, green, blue).
• Available in a variety of materials (plastic, wood, foam).</td></tr>
<tr><td>Counters (two colour)</td><td>  </td><td>• Counters have a different colour on each side.
• Available in a variety of colour combinations, but usually are red & white or red & yellow.
• Available in different shapes (circles, squares, bean).</td></tr>
<tr><td>Cubes (Linking)</td><td>  </td><td>• Set of interlocking 2 cm cubes.
• Most connect on all sides.
• Available in a wide variety of colours (usually 10 colours in each set).
• Brand names include: Multilink, Hex-a-Link, Cube-A-Link.
• Some types only connect on two sides (brand name example: Unifix).</td></tr>
<tr><td>Cuisenaire Rods®</td><td>  </td><td>• Set includes 10 different colours of rods.
• Each colour represents a different length and can represent different number values or units of measurement.
• Usual set includes 74 rods (22 white, 12 red, 10 light green, 6 purple, 4 yellow, 4 dark green, 4 black, 4 brown, 4 blue, 4 orange).
• Available in plastic or wood.</td></tr>
</table>

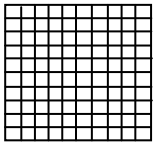
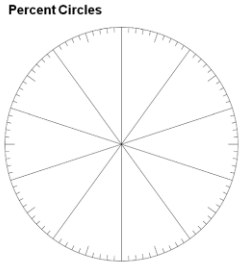
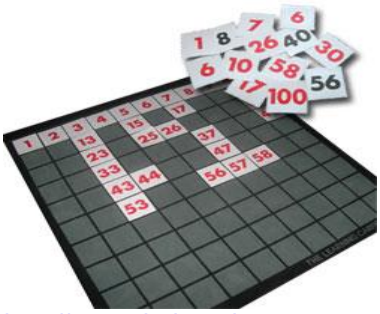
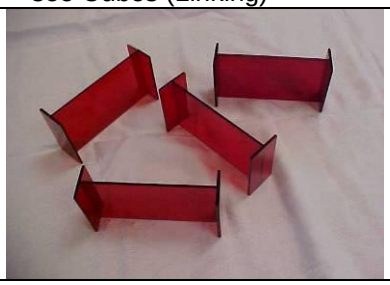
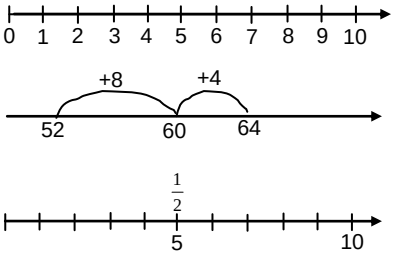
Dice (Number Cubes)		• Standard type is a cube with numbers or dots from 1 to 6 (number cubes).
		• Cubes can have different symbols or words.
		• Also available in:
		  ○ 4-sided (tetrahedral dice)
		  ○ 8-sided (octahedral dice)
		  ○ 10-sided (decahedra dice)
		  ○ 12-sided, 20-sided, and higher
		  ○ Place value dice

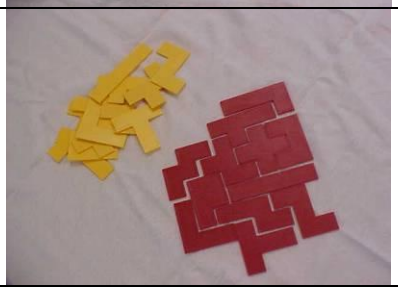
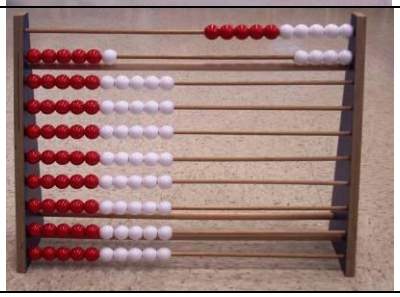
Dominoes		• Rectangular tiles divided in two-halves. • Each half shows a number of dots: 0 to 6 or 0 to 9. • Sets include tiles with all the possible number combinations for that set. • Double-six sets include 28 dominoes. • Double-nine sets include 56 dominoes.
Dot Cards		• Sets of cards that display different number of dots (1 to 10) in a variety of arrangements. • Available as free Blackline Master online on the "Teaching Student-Centered Mathematics K-3" website (BLM 3-8).
Decimal Squares®		• Tenths and hundredths grids that are manufactured with parts of the grids shaded. • Can substitute a Blackline Master and create your own class set.
Double Number Line	☞ see Number lines (standard, open, and double)	
Five-frames	☞ see Frames (five- and ten-)	
Fraction Blocks		• Also known as Fraction Pattern blocks. • 4 types available: pink "double hexagon", black chevron, brown trapezoid, and purple triangle. • Use with basic pattern blocks to help study a wider range of denominators and fraction computation.
Fraction Circles		• Sets can include these fraction pieces: $1, \frac{1}{2}, \frac{1}{4}, \frac{1}{3}, \frac{1}{5}, \frac{1}{6}, \frac{1}{8}, \frac{1}{10}, \frac{1}{12}$ • Each fraction graduation has its own colour. • It is helpful to use ones without the fractions marked on the pieces for greater flexibility (using different piece to represent 1 whole).

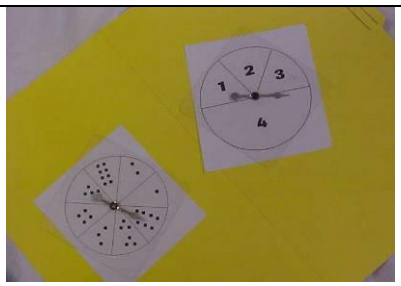
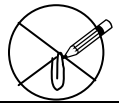
Fraction Pieces		• Rectangular pieces that can be used to represent the following fractions: $\frac{1}{2}, \frac{1}{4}, \frac{1}{3}, \frac{1}{5}, \frac{1}{6}, \frac{1}{8}, \frac{1}{10}, \frac{1}{12}$ • Offers more flexibility as different pieces can be used to represent 1 whole. • Each fraction graduation has its own colour. • Sets available in different quantities of pieces.
Frames (five- and ten-)		• Available as a Blackline Master in many resources or you can create your own. • Use with any type of counter to fill in the frame as needed.

Geoboards		• Available in a variety of sizes and styles.
		  ○ 5 × 5 pins
		  ○ 11 × 11 pins
		  ○ Circular 24 pin
		  ○ Isometric
		• Clear plastic models can be used by teachers and students on an overhead.
		• Some models can be linked to increase the size of the grid.

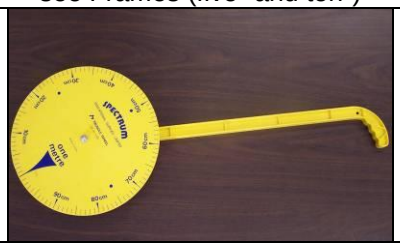
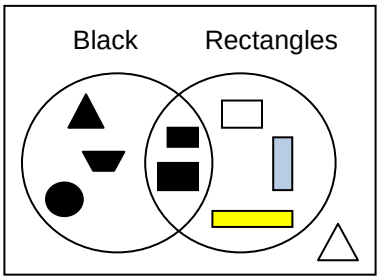
Geometric Solids		• Sets typically include a variety of prisms, pyramids, cones, cylinders, and spheres. • The number of pieces in a set will vary. • Available in different materials (wood, plastic, foam) and different sizes.
Geo-strips		• Plastic strips that can be fastened together with brass fasteners to form a variety of angles and geometric shapes. • Strips come in 5 different lengths. Each length is a different colour.
Hundred Chart	 Name: _____ Date: _____ Line Master 2 **100-Chart** 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100	• 10 × 10 grid filled in with numbers 1-100 or 0 - 99. • Available as a Blackline Master in many resources or you can create your own. • Also available as wall charts or “Pocket” charts where cards with the numbers can be inserted or removed.

Hundred Grid		• 10 × 10 grid. • Available as Blackline Master in many resources.
Hundredths Circle		• Circle divided into tenths and hundredths. • Also known as “percent circles”.
Learning Carpet®	 http://www.thelearningcarpet.ca	• 10 × 10 grid printed on a floor rug that is six feet square. • Number cards and other accessories are available to use with the carpet.
Linking Cubes	☞ see Cubes (Linking)	
Mira®		• Clear red plastic with a bevelled edge that projects reflected image on the other side. • Other brand names include: Reflect-View and Math-Vu™.
Number Cubes	☞ see Dice (Number Cubes)	
Number Lines (standard, open, and double)		• Number lines can begin at 0 or extend in both directions. • Open number lines do not include pre-marked numbers or divisions. Students place these as needed. • Double number lines have numbers written above and below the line to show equivalence.
Open Arrays	☞ see Arrays and Open Arrays	
Open Number Lines	☞ see Number Lines (standard, open, and double)	
Pan Balance	☞ see Balance (pan or beam)	

Pattern Blocks		• Standard set includes: Yellow hexagons, red trapezoids, blue parallelograms, green triangles, orange squares, beige parallelograms. • Available in a variety of materials (wood, plastic, foam).
Pentominoes		• Set includes 12 unique polygons. • Each is composed of 5 squares which share at least one side. • Available in 2-D and 3-D in a variety of colours.
Polydrons		• Geometric pieces snap together to build various geometric solids as well as their nets. • Pieces are available in a variety of shapes, colours, and sizes: Equilateral triangles, isosceles triangles, right-angle triangles, squares, rectangles, pentagons, hexagons • Also available as Frameworks (open centres) that work with Polydrons and another brand called G-O-Frames™.
Power Polygons™		• Set includes the 6 basic pattern block shapes plus 9 related shapes. • Shapes are identified by letter and colour.
Rekenrek		• Counting frame that has 10 beads on each bar: 5 white and 5 red. • Available with different number of bars (1, 2, or 10).

Spinners		• Create your own or use manufactured ones that are available in a wide variety:
		  ○ number of sections;
		  ○ colours or numbers;
		  ○ different size sections;
		  ○ blank.
		• Simple and effective version can be made with a pencil held at the centre of the spinner with a paperclip as the part that spins.
		 

Tangrams		• Set of 7 shapes (commonly plastic):
		  ○ 2 large right-angle triangles
		  ○ 1 medium right-angle triangle
		  ○ 2 small right-angle triangles
		  ○ 1 parallelogram
		  ○ 1 square
		• 7-pieces form a square as well as a number of other shapes.
		• Templates also available to make sets.

Ten-frames	☞ see Frames (five- and ten-)	
Trundle Wheel		• Tool for measuring longer distances. • Each revolution equals 1 metre usually noted with a click.
Two Colour Counters	☞ see Counters (two colour)	
Venn Diagram		• Used for classification of different attributes. • Can be one, two, or three circles depending on the number of attributes being considered. • Attributes that are common to each group are placed in the interlocking section. • Attributes that don't belong are placed outside of the circle(s), but inside the rectangle. • Be sure to draw a rectangle around the circle(s) to show the "universe" of all items being sorted. • Similar to a Carroll Diagram.

List of Kindergarten Specific Curriculum Outcomes

Number (N)

1. Say the number sequence by 1s starting anywhere from 1 to 10 and from 10 to 1.
2. Recognize, at a glance, and name familiar arrangements of 1 to 5 objects or dots.
3. Relate a numeral, 1 to 10, to its respective quantity.
4. Represent and describe numbers 2 to 10, concretely and pictorially.
5. Compare quantities, 1 to 10, using one-to-one correspondence.

Patterns & Relations (PR)

(Patterns)

1. Demonstrate an understanding of repeating patterns (two or three elements) by: identifying; reproducing; extending; creating patterns using manipulatives, sounds and actions.

(Variables and Equations)

Shape and Space (SS)

(Measurement)

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

(3-D Objects and 2-D Shapes)

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

(Transformations)

Statistics and Probability (SP)

(Data Analysis)

(Chance and Uncertainty)

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