hands-on mathematics

Grade 1

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Introduction to *Hands-On Mathematics*

Program Introduction

Hands-On Mathematics focuses on developing students' knowledge, skills, and attitudes through active inquiry, problem solving, and decision making. Throughout all activities, students are encouraged to explore, investigate, and ask questions in order to heighten their own curiosity about and understanding of the world of mathematics.

Program Principles

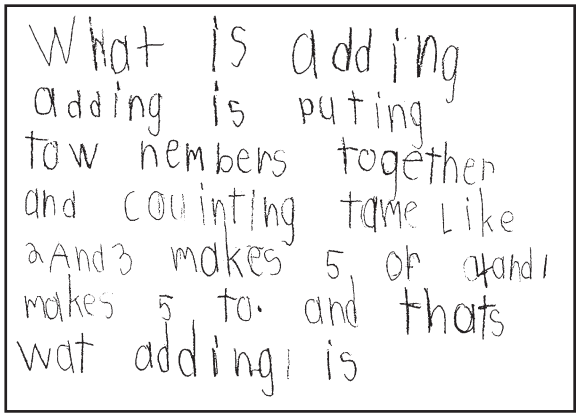
1. Effective mathematics programs involve students actively building new knowledge from experience and prior knowledge.
2. The development of students' understanding of concepts, flexibility in thinking, reasoning, and problem-solving skills/strategies form the foundation of the mathematics program.
3. From a young age, children are interested in mathematical ideas. This interest must be maintained, fostered, and enhanced through active learning.
4. Mathematics activities must be meaningful, worthwhile, and relate to real-life experiences.
5. The teacher's role in mathematics education is to actively engage students in tasks and experiences designed to deepen and connect their knowledge. Children learn best by doing, rather than by just listening. The teacher, therefore, should focus on creating opportunities for students to interact, in order to propose mathematical ideas and conjectures, to evaluate their own thinking and that of others, and to develop mathematical reasoning skills.
6. Mathematics should be taught in correlation with other school subjects. Themes and topics of study should integrate ideas and skills whenever possible.
7. The mathematics program should encompass, and draw on, a range of educational resources, including literature and technology, as well as people and places in the local community.
8. Assessment of student learning in mathematics should be designed to focus on performance and understanding, and should be conducted through meaningful and varied assessment techniques carried on throughout the modules of study.

The Big Ideas of Mathematics

In order to achieve the goals of mathematics education and to support lifelong learning in mathematics, students must be provided with opportunities to encounter and practice critical mathematical processes. These processes are as follows:

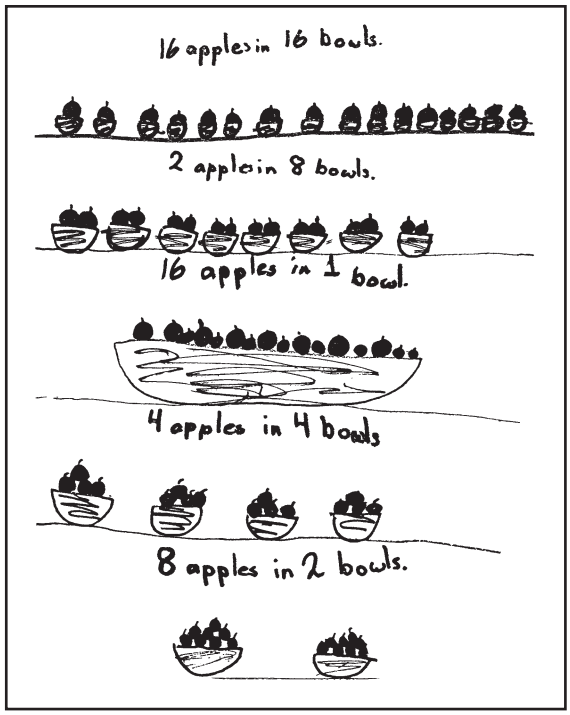
Communication

Students need to be given opportunites to communicate their mathematical ideas through the use of oral language, reading and writing, diagrams, charts, and tables. For example:



As another example:

Show different ways the apples could be put into bowls.
There are 16 apples.
The apples are in bowls.
Each bowl has the same number of apples in it.



At the grade-one level, communication also involves activities such as illustrating a pattern, completing a Venn diagram to show a sorting rule, or using a chart to show the number of legs on various animals. Examples of these types of activities can be found throughout the ***Hands-On Mathematics*** program.

Connections

Teachers need to ensure that connections are made between the various modules, or strands, of the curriculum. It is also important to make connections between concrete, pictorial, and symbolic mathematical representations. Further, concepts and skills should be connected to everyday life and to other curricular areas.

The ***Hands-On Mathematics*** program offers many ways to connect mathematics to children's literature, through the use of storybooks in lessons. Many lessons begin with a springboard activity, which involves reading a book that relates to the concepts focused on in the lesson. The books suggested are well known and are usually available in school or public libraries.

Before beginning each module, teachers are encouraged to review the lessons, as well as the list of suggested children's books, and acquire the recommended books. If, however, a suggested book is not available, you can substitute another similar book, or you can simply move ahead to the next part of the lesson.

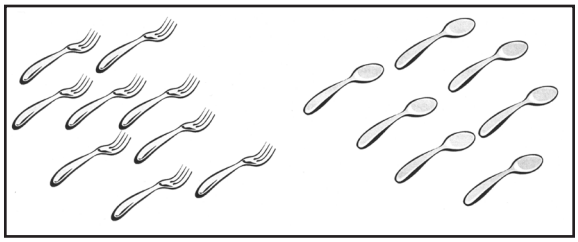
Mental Math and Estimation

Mental math is a process necessary to many everyday experiences. Students need extensive exposure to activities that encourage them to solve problems mentally, without the use of concrete objects or paper/pencil supports. Students should be encouraged regularly to estimate quantities and measurements. Estimation encourages them to take risks, use background knowledge, and learn from the process. For example:

- **Mental Math:** Students respond quickly to questions phrased in a variety of ways:
  - Double 4
  - Half of 6
  - Two 5s
  - You roll double 3. What's your score?
  - How many shoes in 2 pairs?

Suggestions for Mental Math Strategies can be found on pages 28 and 29.

- **Estimation:** Estimate whether there are enough spoons to go with these forks.



Now, check. Are there too many or too few spoons?

Problem Solving

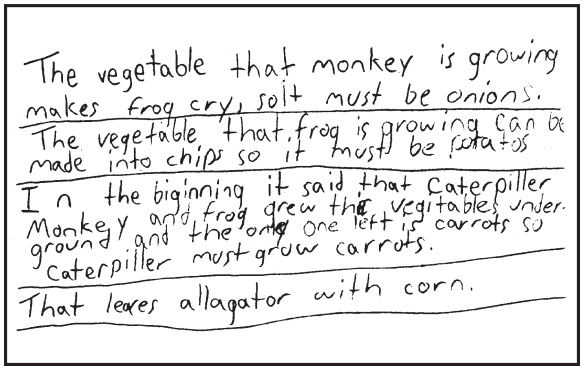
Students are exposed to a wide variety of problems in all areas of mathematics. They explore a variety of methods for solving and confirming their solutions to both routine and non-routine problems. They should also be encouraged to find multiple solutions for problems and to create their own problems.

- **Routine Problems:** These are problems in which the way to a solution is immediately evident. The solution generally involves one or two arithmetic operations. For example:
  - When the cow jumped over the moon, she counted 15 craters in all. If one half of the moon had 5 craters, how many craters were on the other half?
- **Non-Routine Problems:** These problems are more challenging for students. Upon first reading, the path to a solution is not immediately evident. Students draw on a bank of strategies (teacher-presented and student-developed) to solve the problem. Some of these problems can have more than one solution/answer. Others can be solved using a variety of strategies. For example:
  - There are 5 flowers in the basket. If the flowers are pink, yellow, and lavender, how many of each colour could there be? Find all of the combinations. (Draw a diagram, use materials, act it out.)
  - Tina makes snow people out of 3 snowballs. Kim uses 2 snowballs for her snow people. The girls made 5 snow people altogether. They used 13 snowballs. What did their snow people look like? (Draw a diagram.)

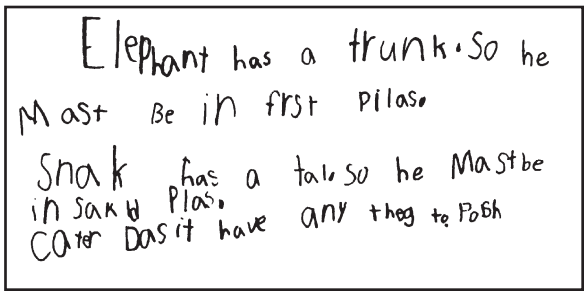
Reasoning

Mathematical reasoning involves informal thinking, conjecturing, and validating. Students should be encouraged to justify their solutions, thinking processes, and hypotheses. Good reasoning is as important as finding correct answers, so students need many opportunities to think about, describe orally, and record their mathematical activities and ideas. For example:

- **Logic Problems:**
  - (a) Monkey, Frog, Caterpillar, and Alligator are growing onions, carrots, corn, and potatoes in their garden. Follow the clues to match the animals with the vegetables they are growing.
    - (1) The vegetables that Monkey, Frog, and Caterpillar are growing all grow underground.
    - (2) The vegetable that Monkey is growing makes Frog cry.
    - (3) The vegetable that Frog is growing can be made into chips.



  - (b) Snake, Caterpillar, and Elephant had a swinging contest. They each took a turn and then decided who won first place, who won second place, and who won third place.
    - (1) Snake said, "Of course Elephant was higher than I was. He used his trunk to help."
    - (2) "I could hardly get my swing to move. How did you get going, Snake?" asked Caterpillar.



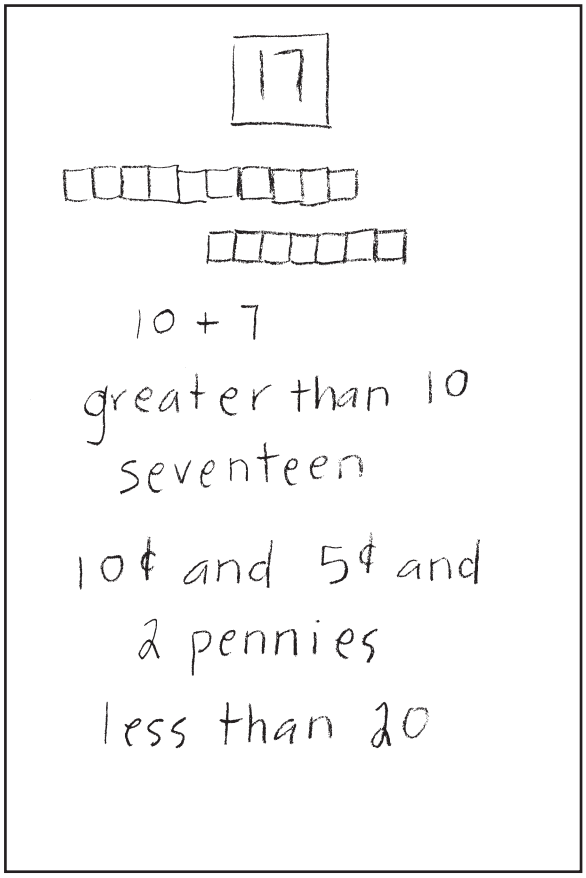
Technology

The use of calculators is recommended, to enhance problem solving and to encourage discovery of number patterns. However, calculators must not replace the development of students' number concepts and skills. Other technologies such as computer software and web sites can provide valuable resources for students and teachers.

Visualization

These are the mental images needed to develop concepts and understand procedures. Visualizations help students clarify their understanding of mathematical ideas. For example:

- Show all you know about the number 17. Use pictures, diagrams, and words in your answer.



Hands-On Mathematics Learning Outcomes, Grade 1

Note: The following learning outcomes have been established by the Western and Northern Canadian Protocol (WNCP) as outlined in the document *The Common Curriculum Framework for K–9 Mathematics* (May, 2006).

Processes Key

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

MODULE 1: PATTERNS AND RELATIONS

PATTERNS

General Outcome

Use patterns to describe the world and solve problems

Specific Outcome

1. Demonstrate an understanding of repeating patterns (two to four elements) by:
   - describing
   - reproducing
   - extending
   - creating patterns using manipulatives, diagrams, sounds and actions
   [C, PS, R, V]
2. Translate repeating patterns from one representation to another [C, R, V]

VARIABLES AND EQUATIONS

General Outcome

Represent algebraic expressions in multiple ways

Specific Outcomes

3. Describe equality as a balance and inequality as an imbalance, concretely and pictorially (0 to 20) [C, CN, R, V]
4. Record equalities using the equal symbol [C, CN, PS, V]

MODULE 2: SHAPE AND SPACE

MEASUREMENT

General Outcome

Use direct or indirect measurement to solve problems

Specific Outcomes

1. 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
   [C, CN, PS, R, V]

3-D OBJECTS AND 2-D SHAPES

General Outcome

Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them

Specific Outcomes

2. Sort 3-D objects and 2-D shapes using one attribute, and explain the sorting rule [C, CN, R, V]
3. Replicate composite 2-D shapes and 3-D objects [CN, PS, V]
4. Compare 2-D shapes to parts of 3-D objects in the environment [C, CN, V]

MODULE 3: NUMBER

General Outcome

Develop number sense

Specific Outcomes

1. Say the number sequence, 0 to 100, by:
   - 1s, forward and backward, between any two given numbers
   - 2s to 20, forward starting at 0

- 5s and 10s to 100, forward starting at 0 [C, CN, ME, V]

2. Recognize, at a glance, and name familiar arrangements of 1 to 10 objects or dots [C, CN, ME, V]
3. 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 [C, CN, ME, R, V]
4. Represent and describe numbers to 20 concretely, pictorially and symbolically [C, CN, V]
5. Compare sets containing up to 20 elements to solve problems using:
   - referents
   - one-to-one correspondence [C, CN, ME, PS, R, V]
6. Estimate quantities to 20 by using referents [C, ME, PS, R, V]
7. Demonstrate, concretely and pictorially, how a given number can be represented by a variety of equal groups with and without singles [C, R, V]
8. Identify the number, up to 20, that is one more, two more, one less and two less than a given number [C, CN, ME, R, V]
9. Demonstrate an understanding of addition of numbers with answers to 20 and their corresponding subtraction facts, concretely, pictorially and symbolically by:
   - using familiar and mathematical language to describe additive and subtractive actions from their experience
   - creating and solving problems in context that involve addition and subtraction
   - modelling addition and subtraction using a variety of concrete and visual representations and recording the process symbolically [C, CN, ME, PS, R, V]
10. Describe and use mental mathematics strategies (memorization not intended), such as:
    - counting-on and counting back
    - making 10
    - doubles
    - using addition to subtract for the basic addition and subtraction facts to 18 [C, CN, ME, PS, R, V]

Program Implementation

Program Resources

Hands-On Mathematics is arranged in a format that makes it easy for teachers to plan and implement.

Modules comprise the selected topics of study for the grade level, organized into lessons. The modules relate directly to the learning outcomes identified on pages 6 and 7, which complement those established by the Western and Northern Canadian Protocol (WNCP) and outlined in *The Common Curriculum Framework for K-9 Mathematics* (May 2006).

The introduction to each module summarizes the general goals for the module and provides background information for teachers. Each module begins with a list of books for students that relate to the module; a list of related websites (for all modules combined) can also be found on page 48.

Modules are organized into lessons, based on the learning outcomes.

Note: This does not imply that a lesson can be covered in only one lesson period; many will carry over several lesson periods.

The lessons are arranged in the following format:

Background Information for Teachers: Some lessons provide teachers with the basic mathematical knowledge they will need to present the activities. This information is offered in a clear, concise format, and focuses specifically on the topic of study.

Materials: A complete list of materials required to conduct the main activity is provided. It includes classroom materials, equipment, and visuals. The quantity of materials required will depend on how you conduct activities and whether students are working individually or in groups.

Activity: This section details a step-by-step procedure, including higher-level questioning techniques and suggestions for encouraging active inquiry and discussion.

Activity Sheet: Reproducible activity sheets have been designed to correlate with the specific learning outcomes of the activity. Many of these are used during the activity to record results of investigations. Others are used as follow-up to the in-class activities. Students may work independently on these sheets, in small groups, or you may choose to read through them together and complete them in a large group setting. Activity sheets can also be made into overheads or large experience charts. Since it is also important for students to learn to construct their own charts and recording formats, these activity sheets can be used by the teacher as examples of ways to record and communicate ideas about an activity. Students can then create their own sheets rather than use the ones provided.

Note: Activity sheets are meant to be used only in conjunction with, or as a follow-up to, the hands-on activities. The activity sheets are not intended to be the mathematics lesson in itself or the sole assessment for the lesson.

Problem Solving: Many lessons include suggestions for problem-solving activities that are directly related to the lesson's learning outcomes. These problems may be presented orally, acted out with concrete objects, presented pictorially, or written out on chart paper. At the end of each module, many of these problems are presented again on black line masters. Teachers can copy these sheets onto overhead transparencies to present to students as daily problem solving activities. Or, the masters can be copied for students and cut apart, problem by problem. Students can then paste the problems into their math journals or agendas for completion independently.

Extension: Many lessons include optional activities to extend, enrich, and reinforce the learning outcomes.

Activity Centre: Some lessons include independent student activities that focus on the learning outcomes.

Assessment Suggestions: Throughout each module, several suggestions are made for assessing student learning. Again, these assessment strategies focus specifically on the learning outcomes of a particular activity topic. In the next section of the ***Hands-On Mathematics*** program, assessment is dealt with in detail. Keep in mind that the suggestions made within activities are merely ideas to consider; you may use your own assessment techniques or refer to the other assessment strategies on pages 13 and 14.

Classroom Environment

The classroom setting is an important component of the learning process. An active environment – one that gently hums with the purposeful conversations and activities of students – indicates that meaningful learning is taking place. While studying a specific topic, the room should display related objects and materials, student work, pictures and posters, maps, graphs, and charts made during activities, and summary charts of important concepts taught and learned. These reinforce concepts and skills that have been stressed during mathematics activities.

Timelines

No two groups of students will cover topics and material at the same rate. Planning the duration of modules is the responsibility of the teacher. In some cases, the activities described will not be completed during one block of time and will have to be carried over. (Division of modules into "lessons" does not imply that they can be covered in only one lesson period. Many lessons will, in fact, carry over several lesson periods.) In other cases, you may observe that the students are especially interested in one topic, and you may choose to expand upon it. The individual needs of your students should be considered as there are no strict timelines involved in the ***Hands-On Mathematics*** program. It is important, however, to spend time on every module in the program so that students focus on all of the learning outcomes established for their grade level.

Classroom Management

Although active learning is emphasized throughout this program, the manner in which these experiences are handled is up to you. In some cases, you may have all students working with materials and resources individually; in others, you may choose to use small group settings. The latter encourages the development of social skills and enables all students to be active in the learning process; it also means less cost in terms of materials and equipment. Again, classroom management is left up to you, since it is the teacher who ultimately determines how the students in his/her care function best in the learning environment.

Planning Guidelines

Mathematics is a skills-based subject. In order to acquire these skills, students need to visit and revisit them over the course of the school year.

Hands-On Mathematics is organized into strand- or topic-focused modules. This organization allows teachers to follow the development of concepts from introduction to mastery within a given grade level. To ensure that students have opportunities to develop their mathematical skills in all topics throughout the year, it is recommended that teachers address concepts from each of these modules in every reporting period or school term. For example, teachers may choose to begin the year with the module on Patterns and Relations (module 1) but should continue to develop students' skills in this area throughout the entire school year through review, continued practice, and new mathematical challenges. In the same way, although the module on Number Concepts and Operations (module 3) is presented last in the ***Hands-On Mathematics*** program, students should be provided with opportunities to review, practice, and investigate number concepts throughout the school year. Planning in this way gives students the time needed to solidify their understanding and, at the same time, helps to keep the concepts and vocabulary in the forefront throughout the year.

Developing a year plan can help teachers ensure that they address the necessary topics throughout the school year. Teachers can design the plan to meet their students' specific needs and to fit their school calendars. On the following two pages, a year-plan template is provided. Teachers can use the template to record the skills/lessons from each module that they plan to teach each month. On the bottom row of the chart, there is additional space for briefly noting other curriculum connections and themes that may relate to the overall math plan. Teachers can divide up this row according to the expected duration of the topic covered, which may be less than or greater than one month.

Assessment

The *Hands-On Mathematics* Assessment Plan

Hands-On Mathematics provides a variety of assessment tools that enable you to build a comprehensive and authentic daily assessment plan for your students.

Embedded Assessment

Assess students as they work by using the questions provided with each activity. These questions promote higher-level thinking skills, active inquiry, problem solving, and decision making. Anecdotal records and observations are examples of embedded assessment:

- **anecdotal records:** Recording observations during mathematics activities is critical in having an authentic view of a student's progress. The Anecdotal Record sheet, presented on page 15, provides the teacher with a format for recording individual or group observations.
- **individual student observations:** During activities when you wish to focus more on individual students, you may decide to use the Individual Student Observations sheet, found on page 16. This black line master provides more space for comments and is especially useful during conferencing, interviews, or individual student presentations.

Performance Assessment

Performance assessment is planned, systematic observation and assessment based on students actually doing a specific mathematics activity.

- **rubrics:** To assess students' performance on a specific task, rubrics are used in ***Hands-On Mathematics*** to standardize and streamline scoring. A sample rubric and a black line master for teacher use are included on pages 17 and 18. For any specific activity, the teacher selects four criteria that relate directly to the learning outcomes for the specific activity being assessed. Students are then given a checkmark point for each criterion accomplished to determine a rubric score for the assessment from a total of four marks. These rubric scores can then be transferred to the Rubric Class Record on page 19.

Cooperative Skills

To assess students' ability to work effectively in a group, teachers must observe the interaction within these groups. A Cooperative Skills sheet is included on page 20 for teachers to use while conducting such observations.

Student Self-Assessment

It is important to encourage students to reflect on their own learning in mathematics. For this purpose, teachers will find a Student Self-Assessment sheet on page 21, as well as a Cooperative Skills Self-Assessment sheet on page 22.

In addition, a Math Journal sheet is found on page 23. Teachers can copy several sheets for each student, cut them in half, add a cover, and bind the sheets together. Students can then create title pages for their own journals. For variety, you may also have students use the blank back sides of each page for other reflections. For example, have students draw or write about:

- numbers we see in our homes
- numbers we see in the community
- numbers in books
- favourite math activities
- math-related book reports
- new math terminology

Students will also reflect on their own learning through writing in their math journals.

For young students, self-assessment is best done through oral discussion, reflecting on activities done in class. These conversations can occur as individual student conferences, small-group discussions, or as whole-class discussions.

Portfolios

Select, with student input, work to include in a mathematics portfolio, or in a mathematics section of a multi-subject portfolio. This can include activity sheets, patterning samples, graphs, charts, as well as other written material. Use the portfolio to reflect the student's progress in mathematics over the course of the school year. Black line masters are included to organize the portfolio (Portfolio Table of Contents on page 24 and Portfolio Entry Record on page 25). Students can be assisted in completing these sheets by having an adult scribe for them.

Note: Throughout each module of ***Hands-On Mathematics***, suggestions for assessment are provided for several lessons. It is important to keep in mind that these are merely suggestions. Teachers are encouraged to use the assessment strategies presented in a wide variety of ways and to ensure that they build an effective assessment plan using these assessment ideas as well as their own valuable experience as educators.

Module 1

Patterns and Relations

Introduction

Background Information for Teachers

Pattern is the underlying theme of mathematics. Students need to recognize patterns and use them as tools for problem solving. This skill is extremely important for the development of a student's mathematical understanding.

Patterning should focus on:

- Repeating patterns: e.g., stringing beads by repeating colours (*red, blue, green, red, blue, green, red, blue, green*)
- Growth patterns: e.g., determining the number of wheels on one bicycle (two wheels), two bicycles (four wheels), three bicycles (six wheels).

Patterning activities involve early stages of *algebraic reasoning*, as students investigate both spatial and numerical patterns. Looking at growth patterns is an important first step in developing skills in algebraic reasoning.

The activities in this module give students many hands-on opportunities to experience pattern using visual, auditory, and physical attributes. Each activity is described using manipulatives that are readily available in the classroom or that can be easily obtained. Students will learn to identify, name, reproduce, extend, create, and compare many different patterns while describing them through actions, manipulatives, diagrams, and in spoken terms.

The module ends with an exploration of concepts related to equality and inequality, addressing the "Variables and Equations" component of the Patterns and Relations strand of the WNCP document *The Common Curriculum Framework for K–9 Mathematics* (*May, 2006*).

Mathematics Vocabulary

Throughout this module, teachers should use, and encourage students to use, vocabulary such as: *pattern train, size, shape, circle, triangle, square, rectangle, colour, pattern, attribute, continue, extend, repeat, increase*, *decrease, equal, unequal,* and *equal symbol* (=).

Consider creating a Math Word Wall for new vocabulary that is introduced in ***Hands-On Mathematics***. Put the letters of the alphabet along the top of an otherwise empty bulletin board. As new terms arise in each lesson, write those words on index cards, and attach them to the bulletin board under the appropriate letters.

3 Necklace Patterns

Background Information for Teachers

These activities have students making a variety of necklace patterns using the attribute of size, and then colour. Students then create and describe the patterns in other ways.

Materials

- *A String of Beads*, a book by Margarette S. Reid
- straws cut into two lengths: long and short
- large sheets of graph paper
- coloured construction paper
- scissors
- glue
- one size of pasta in a variety of colours: plain (uncoloured), red, blue, green, purple, and orange. (To colour pasta, place it in a Ziploc bag together with one part food colouring and four parts rubbing alcohol. Shake the pasta and dye until all the pasta is coloured, then pour it out onto absorbent paper and allow it to dry.)

Safety Note: Be sure to do this in a well-ventilated area and not in the school. Students must be told that this pasta is not safe to eat.

- construction paper squares that match the colours of the dyed pasta
- Froot Loops cereal
- string cut into necklace-sized lengths (Tie a large knot at one end; wrap the other end with tape to make it easier for students to string.)
- chart paper
- markers
- crayons
- paper bags

Activity: Part One

Note: For this activity you will need one colour of straws cut into two lengths (long and short).

Read the book *A String of Beads*. Ask:

- How did the girl make necklaces?
- Can you describe how the beads were different from each other? (colour, size, shape)
- How did she make patterns with the beads? (different colours, sizes, shapes)

Explain to students that they will now have an opportunity to make necklaces. Show students the two lengths of straws. Ask:

- How are the straws different from each other?
- How can you make a pattern using the straws? (long and short)
- Can you make an *AB* pattern using the straws?
- Can you name this pattern using words? Using numbers? Actions?
- Can you make another pattern, other than an *AB* pattern, using the straws?

Provide students with string and straw pieces. Have them create necklace patterns, then use Activity Sheet A (1.3.1) to record their patterns.

Activity Sheet A

Directions to students:

Draw a picture of your necklace pattern. Name your pattern using letters. Tell how many long straws and how many short straws you used. Tell whether you used less long straws or short straws (1.3.1).

3

Activity: Part Two

Distribute the students' activity sheets from Activity: Part One. As a class, discuss the kinds of necklace patterns that students created.

On chart paper, make a tally to show the kinds of necklace patterns students made. For example:

AB	𝍸 IIII
AAB	III
ABB	IIII
AABB	𝍸

Ask:

- What pattern did most students make with the long and short straws?
- What pattern did the least students make?
- How many more students made *AB* patterns than *AAB* patterns?

Activity: Part Three

Explain to students that they are going to make Froot Loops necklace patterns using three different colours. Display a small pile of Froot Loops, and have students choose three colours for the demonstration. Write the colours on chart paper (e.g., pink, green, yellow). Ask:

- How many colours of Froot Loops are there in this pile? (six)
- How many colours do we need to make our Froot Loops necklaces? (three)

What can we do with the Froot Loops to make it easier to create a pattern with only three colours? (Sort them, and take away the colours not needed.)

Have students sort the Froot Loops and remove the colours not chosen. Show students how to create a Froot Loops pattern necklace. Ask:

- How can we make a pattern using the three colours?

Using students' suggestions, create the necklace. Ask:

- How can we name this pattern using letters?

Record the letter name for this pattern on chart paper.

Provide each student with a handful or two of Froot Loops, string, Activity Sheet B (1.3.2), and one of the letter pattern cards from the previous lesson (Set B, 1.3.3). Have them sort the Froot Loops according to colour, and choose three colours for their necklace. Once they have created their Froot Loops necklace pattern, have students draw and colour their pattern on their activity sheet. Below their picture, have them identify the number of each colour of Froot Loops they used.

Note: Store these necklaces in a safe place as you will use them again in the following activity.

Activity Sheet B

Directions to students:

Record the letter pattern you made using Froot Loops. Draw and colour a picture of your necklace pattern. Below your picture, write down the number of each colour of Froot Loops you used (1.6.2)

3

Activity: Part Four

Note: For this activity, you will need to prepare a graph, similar to the one found on Activity Sheet C (1.6.3), on chart paper.

Using the model Froot Loops necklace you created in Activity: Part Three, colour the Fruit Loops at the bottom of the graph the same colours you used to make the necklace. Then, demonstrate to students how to graph the number of each colour of Froot Loops you used. Ask:

- How many pink Froot Loops did I use?

Colour that number of rectangles on the graph. Do the same for the other two colours of Froot Loops.

Have students describe the graph. Ask:

- What colour of Froot Loops did I use the most? What colour did I use the least?
- Did I use an equal number of any two colours of Froot Loops? Any three colours of Froot Loops?
- How many more pink Froot Loops than green Froot Loops did I use?

Record the students' answers on chart paper.

Provide students with their Froot Loops necklaces from Activity: Part Three and a copy of Activity Sheet C (1.3.3). Have them construct a graph to record the colours they used for their necklace pattern.

Activity Sheet C

Directions to students:

Colour the three Froot Loops on the chart the same as the colours you used to make your necklace. Record the number of each colour of Froot Loops you used in your necklace pattern. Then, tell two things about your chart (e.g., What colour you used the most. What colour you used the least. How many of each colour you used.) (1.3.3).

Activity: Part Five

This activity has students making growing necklace patterns using colour. The students will use two colours of pasta in a specific growing pattern.

Note: For this activity, you will need pasta dyed blue, red, green, orange, and purple, as well as strings cut into necklace-sized lengths and knotted at one end. You will also need to prepare a graph on chart paper, and have construction paper shapes (to fit the graph) in the same colours as the pasta.

Review with students the different necklace patterns they have made in previous activities. Display two jars of uncooked pasta: one plain (uncoloured) and one dyed blue. Ask:

- What colours of pasta do I have?

Explain to students that you are going to make a necklace using a different pattern than the ones you have already made. Say:

- First, I am going to put one piece of yellow pasta onto the string.
- Then, I will add one piece of blue pasta.
- Now, I will add one piece of yellow pasta, and then two pieces of blue pasta.
- Now, I will add one piece of yellow pasta and then three pieces of blue pasta.
- Now, I will add one piece of yellow pasta and then four pieces of blue pasta.
- Now, I will add one piece of yellow pasta and then five pieces of blue pasta.

Stop here and have students predict what will come next in the pattern. Then, say:

- Finally, I will add one piece of yellow pasta and then six pieces of blue pasta.

Ask students:

- Did I make a pattern?

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Some students may say "yes," and some may say "no." Explain that this is a pattern, but it is different from the ones they have made before. As a class, record the pasta pattern on chart paper. Ask:

- What colour of pasta did I put on first? (yellow)
- How many pieces of yellow pasta did I put on? (1)
- What colour did I put on next? How many? (1 blue)
- What colour did I put on next? How many? (1 yellow)
- What colour did I put on next? How many? (2 blue)

Continue with this questioning, and record the pattern on chart paper, as in the following example:

1 Y
1 B
1 Y
2 B B
1 Y
3 B B B
1 Y
4 B B B B
1 Y
5 B B B B B
1 Y
6 B B B B B B

Have students examine this information carefully. Ask:

- Can you see a pattern?
- Is there a pattern with the yellow pasta?

Circle the numbers representing yellow pasta on the chart paper with a yellow marker. Explain that each time, the pattern repeats with one piece of yellow pasta.

Now, ask:

- Is there a pattern with the blue pasta?

Circle the numbers representing blue pasta on the chart paper with a blue marker. Explain that each time, the pattern repeats with one more piece of blue pasta (1, 2, 3, 4, 5, 6). Ask:

- If I was going to make my pattern longer, how many pieces of yellow pasta would I need next? How many pieces of blue?

Activity: Part Six

Explain to students that they are now going to make their own necklaces using the plain, uncoloured pasta and one other colour. Have each student select a colour of pasta to use for his/her necklace along with the plain, uncoloured pasta.

Focus on the construction of the pasta necklaces. Ask:

- We know what colours you are going to use to make your necklace, but how many pieces of pasta of each colour will you need?

Refer to the recorded pattern you made on chart paper, earlier. Have students count the number of pieces of yellow pasta (six) and the number of pieces of blue pasta (twenty-one). Explain that the students will use the same number of pieces of pasta to create their own necklaces.

Have students make their necklace patterns by using one of the following methods:

- Have each student count out the number of each colour of pasta he/she needs, put the pieces in a bag, and take them back to his/her seat to make a necklace.
- Place a different colour of pasta, along with the plain, uncoloured pasta, at each of five tables and have students go to the table with the colour of pasta they chose.

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Have students record their necklace patterns on Activity Sheet D (1.3.4).

Activity Sheet D

Directions to students:

Draw your necklace pattern on the sheet. Tell how many of each colour of pasta you used. Describe how you made your necklace pattern (1.3.4).

Problem Solving

Devon made a necklace in an *AAB* pattern with red and blue beads. If the first bead she used was blue, what colour was the tenth bead? The fifteenth bead? The twentieth bead?

Note: A reproducible master for this problem can be found on page 137.

Extensions

- Have students create necklace patterns using more than one attribute. Use coloured straws cut into two lengths. Students can create patterns. For example:

  Long red, long blue, short blue, long red, long blue, short blue, and so on

- Have students make beads as described in the book *A String of Beads* by Margarette S. Reid. Use the beads to make friendship bracelets in patterns.

Date: _____ **Name:** _____

Necklace Patterns Using Straws

Draw your necklace pattern

Name your pattern with letters

I used _____ long straws and _____ short straws.

I used less _____ straws than _____ straws.

Date: _____ **Name:** _____

My Froot Loops Necklace

Name your pattern using letters

Draw your pattern here. Colour it.

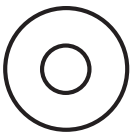
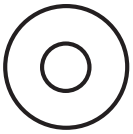
I used ____ _____ **Froot**  **Loops.**

I used ____ _____ **Froot**  **Loops.**

I used ____ _____ **Froot**  **Loops.**

Date: _____ **Name:** _____

How Many Froot Loops Did I Use to Make My Necklace?

Froot Loop Colour	Number of Froot Loops Used
	
	
	

Two things about my chart:

1. _____

2. _____

Date: _____ **Name:** _____

My Pasta Necklace

Draw your necklace pattern

I used _____ pieces of yellow pasta.

I used _____ pieces of _____ pasta.