

High Yield Teaching and Learning Strategies—Numeracy

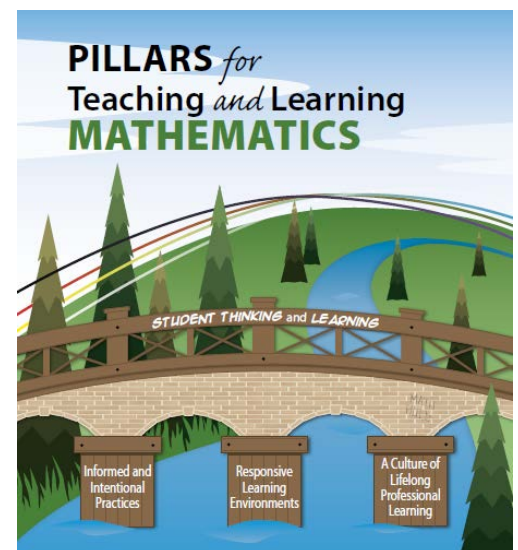
The teaching and learning of mathematics includes posing problems that promote and connect conceptual understanding, problem solving, and reasoning. Additionally, it includes engagement with mathematics in which the goal of learning experiences focuses on students making sense of mathematics so they can learn and use it, both in and outside of school. Establishing connections to the varying knowledge, life experiences, and backgrounds of individual learners is a key component in developing numeracy and sense making of mathematics.

Why? Educators' professional judgments are based on current research about how students learn. These high yield teaching and learning strategies support mathematics and numeracy learning in online learning environments.

How? Short- and long-term planning for mathematics and numeracy learning in online environments require the intentional use of high yield teaching and learning strategies. These strategies, organized by their primary purpose/intent, either directly refer to an online learning context or could easily be adapted for online learning.

Pillars for Teaching and Learning Mathematics is a framework that supports improvement and sustained growth in Kindergarten to Grade 12 mathematics education in Manitoba. The image of a bridge is a reminder for all educators to work together to connect research and powerful practices to enhance mathematics learning for all students. The bridge is supported by three interconnected pillars for teaching and learning mathematics, all of which are necessary to support student thinking and learning. They represent the need to foster

- informed and intentional practices
- responsive learning environments
- a culture of lifelong professional learning



What? The following list includes a variety of high yield numeracy teaching and learning strategies.

Building Community

Students and educators work together to nurture relationships and co-create school, classroom, and online environments to support mathematics learning. When building a community of online learners, wellness is nurtured by creating a sense of safety and belonging for each learner; providing opportunities for all students to build self-confidence and self-efficacy; empowering individuals as self-reflective learners; and valuing each student's voice on the path to becoming an independent, lifelong learner. The following resources provide ideas to help build an online community:

- [Growth Mindset](#)
- [Reclaiming Your Classroom Community Online through Successes and Celebrations Routine](#)
- [Getting to Know Each Other](#)
- [7 Activities to Build Community and Positive Classroom Culture During Online Learning](#)

Collaborative Learning

To be invested in a classroom community, students should be active participants in identifying what it means for them to do math and in identifying the collective norms that allow every student the opportunity to learn. The following resources provide more ideas:

- [Think-Pair-Share Online Version](#)
- [Setting Up Positive Norms in Math Class](#)

Questioning

Using questions allows for a variety of student responses and provides a window into student thinking. Open questions are designed to uncover students' understandings and misconceptions. Examples of open questions include the following:

- Explain your thinking.
- What was your strategy?
- What does that look like?
- How does that compare to _____?
- Can you think of another way to show that?
- Is there a more efficient strategy?
- What could you have done differently?
- Why did you decide to _____?
- If you did this instead, what would happen?
- How could you record your work?
- Is this the only answer? How do you know?
- Can you use another strategy?
- What does this remind you of?

The resource [Asking Effective Questions: Provoking student thinking/deepening conceptual understanding in the mathematics classroom](#) provides more ideas.

Ongoing Feedback

The role of assessment is to guide teaching and to support learning. The ultimate goal of assessment is to help students develop as independent, lifelong learners who regularly monitor and assess their own learning. Providing timely descriptive feedback especially in an online environment will move student learning forward. The following resources provide further ideas:

- [How to Provide Meaningful Feedback Online](#)
- [Feedback in Online Learning Environments](#)
- [Co-constructing Success Criteria](#)
- [Co-Constructing Success Criteria: The What, Why, and How of Sharing Clarity with Learners](#)
- [Knowledge Building in Math: How Do We Help Students to Think Like Mathematicians?](#)
- [How to Do Virtual Parent-Teacher Conferences](#)

Reflection and Metacognitive Strategies

Students need to be asked to communicate and record their strategies and thought processes in order to make connections and reflect upon their learning. See the following resources for information about effective strategies:

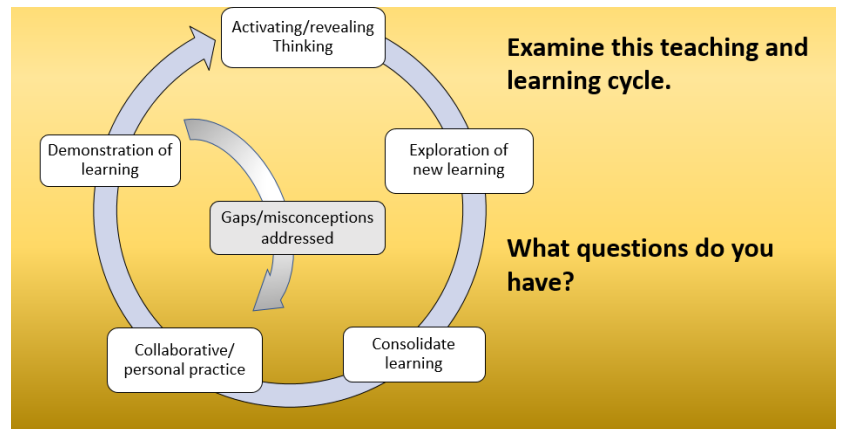
- [Everything You Need to Know about Math Journals](#)
- [Math Journals Boost Real Learning](#)
- [Thinking Aloud in Mathematics](#)

Numeracy Routines

Numeracy routines provide predictable structures and a gateway to meaningful communication about mathematics for students. A routine is a learning experience that occurs on a regular basis over a period of time and builds a classroom community in which students feel safe about communicating their thinking. In remote settings, routines can help with organization and management and can be used to enhance instruction. Effective numeracy routines are organized and structured learning experiences that, when used consistently, can help all students gain confidence and competency with a range of concepts and practices in all strands of the mathematics curriculum. The routines listed below can easily be embedded into mathematics projects for the remote learning repository.

Numeracy routines allow an entryway to formatively assessing students. Within the teaching and learning cycle, routines provide a window into students' mathematical thinking and provide the essential information for planning instructional next steps.

As in the face-to-face classroom, routines are important in online or alternative settings. The following routines are organized into three types to help with managing the teaching and learning of mathematics online.



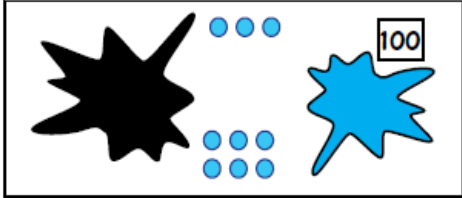



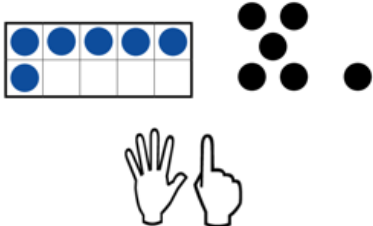
- **Thinking Routines:** Thinking routines encourage students to think and communicate about mathematics and usually take between 5 to 15 minutes. Student discourse is a significant piece of thinking routines.
- **Instructional Routines:** Instructional routines take a longer time to do, but they have a consistent structure. These routines usually involve students solving a problem and communicating strategies.
- **Quick Routines:** Quick routines involve practising or reviewing a math concept. They are short (up to 10 minutes) in duration and concentrate on improving a skill or concept that students are familiar with.

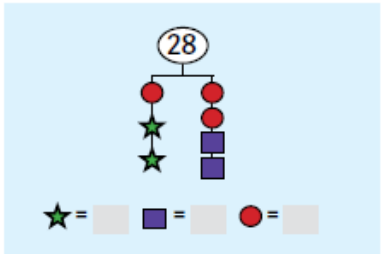
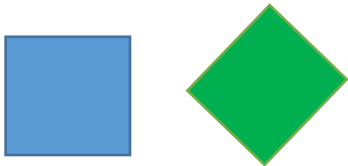
Thinking Routines

Thinking routines focus on encouraging students to reflect on their thinking and then to communicate their thinking to the teacher, other students, or the class. These routines provide a rich opportunity for meaningful discussion in mathematics and a window into student thinking.

Routine	Purpose and Description	Guiding Questions
Number Talks	<p>This is a routine to build number relationships. It helps to develop efficient strategies, flexible thinking, place-value understanding, computation, and an understanding of the properties of operations. Typically, one problem is given, and student responses are recorded along with their strategies. Students share how they solve the problem, with the conversation focusing on making connections between strategies. The following online resources provide further information:</p> <ul style="list-style-type: none"> • "Number Talks" to Grow Mathematical Minds • Number Talks • Number Talks from YouCubed • 6 Fun Ways to Go Digital with Number Talks 	<ul style="list-style-type: none"> • Who would like to share their thinking? • What strategy did you use? • Who did it another way? • What connections do you see among the strategies?
Today's Number	<p>This is a routine to build number sense by having students model different representations of the number.</p>	<ul style="list-style-type: none"> • What can you tell me about your number? • How many ways can you represent the number? • Select two ways to represent the number, and show how they connect. • Write a story problem about the number. • Show how the number is made up of parts. • Show that the number is greater or less than another number. • Show how the number is made up of equal parts. • Make the number easy to identify quickly. • Show that the number is close to a familiar benchmark number. • Show how the number relates to another number.


<p>Which One Doesn't Belong? (WODB)</p>	<p>This is a visual number talk that builds the skills of noticing similarities and differences. The routine supports reasoning and communication goals. Images for this routine can be used to support a variety of concepts from numbers, graphs, shapes, patterns, and so on. See the following resource for more information: Which One Doesn't Belong?</p>	<ul style="list-style-type: none"> • What do you notice? • What makes all the items alike? • What makes them different? • Which one doesn't belong? 
<p>Esti-Mysteries</p>	<p>Students are invited to look at an image. Students are then asked to wonder what number is represented by the image. Clues will appear that allow the students to use math concepts to narrow the set of possibilities. See the following resource for further information: New Esti-Mysteries and Number Sense Resources Every Day for the Rest of the School Year.</p>	<ul style="list-style-type: none"> • How many do you think there are? • What strategy can you use to make an estimate? • How did you use the clues? • Explain why you chose your estimate. 
<p>Ink Splat</p>	<p>This is a visual talk routine that supports subitizing and understanding relationships of addition and subtraction. See the following resource for further information: Splat!</p>	<ul style="list-style-type: none"> • What do you notice? • How many dots do you see? • How many dots have been covered by the ink splats? • Explain how you know. Is there more than one way? 

<p>Would You Rather?</p>	<p>Students use mathematics to explain and justify why they would rather choose one option over another. The routine supports reasoning and communication. See the following resource for further information: Would You Rather Math.</p>	<ul style="list-style-type: none"> • What are you noticing? • Tell me something about this problem. • What is reasonable? What is not reasonable? 
<p>Notice and Wonder</p>	<p>This is a routine to help students communicate mathematically. It can be used to activate a lesson or to encourage reasoning and curiosity. A visual is presented to students and they are asked, “What do you notice?” Give students time to think and have them present their noticing. See the following resources for further information:</p> <ul style="list-style-type: none"> • Number Talk Images • Making Math Visual 	<ul style="list-style-type: none"> • What do you notice? • What do you wonder? • What do you think? <p>What do you notice?</p> 
<p>Choral Counting</p>	<p>This is a counting routine that helps with counting sequences, using patterns for problem solving, understanding place value, and understanding how the number system works. The routine is more than practising rote counting—it unpacks the patterns to the counting system. For more information, see the following resources:</p> <ul style="list-style-type: none"> • Choral Counting • Facilitating the “Choral Counting” Routine Online • Daily Routines to Jump-Start Math Class, Elementary: Videos 	<ul style="list-style-type: none"> • What number will we end up at? • What number will you say? • How did you make your prediction?

<p>Solve Me Mobiles</p>	<p>Students use mental math to balance the mobile puzzle. Students develop their ability to justify their answers and communicate mathematically while they explain their steps for solving the mobile puzzles. See the following resources for more information:</p> <ul style="list-style-type: none"> • SolveMe Mobiles • SolveMe Puzzles 	<ul style="list-style-type: none"> • How did you solve the puzzle? • What strategy did you use? • What if the number at the top changed? • What numbers can you choose to make the puzzle easier/more challenging? • What do you notice about the numbers that make this puzzle more difficult? 
<p>Same or Different?</p>	<p>This is a routine that gives students opportunities to construct arguments for comparing objects, such as numbers or shapes.</p>	<ul style="list-style-type: none"> • What do you notice? • How are these two pictures the same but different? • How will you share your reasoning to justify your answer? 
<p>Big or Small</p>	<p>Students are shown two numbers and they think of a situation when they would be big or small. Students develop an understanding of the reasonableness of numbers. See the following resource: Daily Routines to Jump-Start Math Class: Videos.</p>	<ul style="list-style-type: none"> • How did you determine whether the number was small or big? • How did the situation help you think about the number? <div data-bbox="1049 1386 1477 1583" style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p>45 and 78 are big numbers when they are _____</p> </div> <div data-bbox="1049 1633 1477 1873" style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p>$\frac{3}{4}$ is a big number when it is _____ $\frac{3}{4}$ is a small number when it is _____</p> </div>

Instructional Routines

Instructional routines are classroom-learning experiences that help students deepen their learning about certain big ideas in mathematics. They usually take longer than the usual daily numeracy routines, but they still maintain a consistent structure. They usually engage a group of students communicating their mathematical reasoning to the class. Problem solving and reasoning is at the core of the instructional routines.

Routine	Purpose and Description	Guiding Questions
Counting Collections	<p>Students are given a collection of objects to count. After they count, students are then asked to record how they counted the collection. As students count the collections, teachers can use the time to observe students and question them about their thinking. This time allows an opportunity to see what a child can do in order to guide and plan instructional next steps. In an online environment, have students take pictures of how they counted.</p> <p>Learnings supported by counting collections include the following:</p> <ul style="list-style-type: none">• number names and the order of the counting sequence• flexible counting strategies• counting by ones and counting in groups (such as 2s, 5s, 10s, 25s, 100s, and so on)• counting principles• thinking about and figuring out how many• composing (putting together) and decomposing (taking apart) numbers and quantities• developing number sense• multiplicative thinking (e.g., I have five groups of seven and three more.)• division (and how this is related to multiplication)• fractions and decimals• fostering independence in students and encouraging them to use math language, reasoning skills, and making connections among numbers and math concepts <p>The following resources provide further information:</p> <ul style="list-style-type: none">• Counting Collections• Using Counting Collections School-Wide	<ul style="list-style-type: none">• How did you count?• How many do you have in all?• What strategy did you use to count?• Can you count your collection another way?• What benchmark number is your collection closest to? <div></div> <div><div>Counting Collections</div><div>What I am counting: _____ There are _____.</div><div>Show how you counted.</div></div>

Three-Act Tasks	<p>This is a mathematics task that consist of three parts that build anticipation in students by withholding information.</p> <ul style="list-style-type: none"> • Act One: An engaging visual or video is shown. • Act Two: Give time for students to gather information and strategies for possible solutions. • Act Three: The solution is revealed and time is given to discuss strategies used and to talk about mathematics. <p>See the following resources for more information:</p> <ul style="list-style-type: none"> • 3 Act Math Tasks • Website 3-Act Tasks 	<ul style="list-style-type: none"> • What do you notice? • What do you wonder? • What could be possible strategies to use? • What is your prediction? • Explain if your prediction is reasonable.
Open Middle Math Problems	<p>These are problems that provide opportunities for students to discuss their thinking. Students start with the same problem but generally have multiple ways of approaching and solving the problem. See the following resource for more information: Open Middle: Challenging Math Problems Worth Solving.</p>	<ul style="list-style-type: none"> • What do you notice? • What if the numbers changed?

Quick Routines

Quick routines involve students practising a certain math concept. The routines can be done during a math class or during any part of the day. They are done quickly (in 3 to 10 minutes) and provide opportunities to practise certain skills and concepts familiar to students.

Routine	Purpose and Description	Guiding Questions
Visual Routines (Subitizing)	<p>Students are shown a quick image of quantities to encourage students to use, enhance, and build on their subitizing abilities. See the following resources for further information:</p> <ul style="list-style-type: none"> • Van de Walle Cards Enlarged (PDF in Google Drive) • Using Dot Cards to Build Number Sense • Math Flips • Making Subitizing Count 	<ul style="list-style-type: none"> • What do you see? • How do you see it? • What is one more/two more than the number I flashed? • What is one less/two less than the number I flashed? • How far away is the number I flashed from 10 or 20? • Double the number I flashed.
I Say ____, You Say ____ Count	<p>The teacher says a number in the counting sequence and the class or individual student responds with the number that comes after or before.</p>	<ul style="list-style-type: none"> • How do you know what number to say?
Clothesline	<p>Ask students to pick up numbers and then on the clothesline. Using the clothesline is a visual tool to support students in reasoning proportionally about numbers.</p> <p>Numbers can be represented in multiple ways. The initial introduction of the numberline should be done with a few lessons. See the following resource for more information: Learning Out Loud: Mathematical Clotheslines.</p>	<ul style="list-style-type: none"> • What do you notice about the numbers? • What number is missing? • How do you know? 