CONTENTS

INTRODUCTION

This document will provide teachers with practical strategies for classroom-based assessment.

To implement the Manitoba mathematics curriculum and to ensure that students successfully master the prescribed learning outcomes, teachers must have a plan for instruction and assessment. Planning needs to take place at both the school and the classroom levels. As a community of learners, the school provides an opportunity for staff and students to learn together. Communication among the teachers at various grade levels promotes the discussion of grade level outcomes, student progress related to those outcomes, and strategies for the continued success of all students. Without this communication, teachers are repeatedly starting over with each new class of students. School-based planning helps teachers to see the big picture: the role of mathematics in the whole school and in the community. Using classroom-based assessments and any other testing/assessment tools that are available, teachers are able to see general strengths and weaknesses of both individual students and the program.

Curriculum renewal, increased or changing student needs, research related to how students learn, and a rapidly changing society are just some of the factors affecting teachers today. Teachers cannot do everything themselves. There has never been a greater need for cooperation and collaboration among teachers at all grade levels than there is now in the 21st century.

Cooperative planning allows teachers to share the work. One person can work on the teaching strategies and assessment tasks for a given strand or section of a strand; other team member(s) can work on other strands or sections. This way, a person is able to focus on a narrow portion of the curriculum (perhaps a strength) and develop a comprehensive plan. If this type of planning is not possible, then sharing ideas and assessment tasks can be very beneficial. It is important that students have the opportunity to experience assessment tasks from a variety of sources. Students become comfortable with the presentation format used by their classroom teachers. They need to be exposed to the presentation formats of a variety of teachers.

Mathematics Classroom Assessment

Assessment is a “systematic process of gathering information about what a student knows, is able to do, and is learning to do” (Manitoba Education and Training, *Reporting on Student Progress and Achievement*, 5). Assessment is an integral part of instruction that enhances, empowers, and celebrates student learning.

Meaningful Assessment

The purpose of meaningful assessment is to inform instruction by providing information about student learning. This information can then be used to provide direction for planning further instruction. Assessment should occur in authentic contexts that allow students to demonstrate learning by performing meaningful tasks.

Meaningful content and contexts for assessment help students by engaging their attention and encouraging them to share their work and talk about their

progress. Students need to take an active part in assessment. When students understand assessment criteria and procedures, and take ownership for assessing the quality, quantity, and processes of their own work, they develop self-assessment skills. The ultimate goal of assessment is to develop independent, lifelong learners who regularly monitor and assess their own progress.

The Teacher's Role in Assessment

In the classroom, teachers are the primary assessors of students. Teachers design assessment tools with two broad purposes: to collect information that will inform classroom instruction, and to monitor students' progress towards achieving year-end mathematics learning outcomes. Teachers also assist students in developing self-monitoring and self-assessment skills and strategies. To do this effectively, teachers must ensure that students are involved in setting learning goals, developing action plans, and using assessment processes to monitor their achievement of goals. Teachers also create opportunities to celebrate their progress and successes.

Teachers learn about student learning and progress by regularly and systematically observing students in action, and by interacting with students during instruction. Because students' knowledge and many of their skills, strategies, and attitudes are internal processes, teachers gather data and make judgments based on observing and assessing students' interactions, performances, and products or work samples. Teachers demonstrate that assessment is an essential part of learning. They model effective assessment strategies and include students in the development of assessment procedures, such as creating rubrics or checklists.

Assessment Purposes and Audiences

The quality of assessment largely determines the quality of evaluation. Evaluation is "the process of making judgments and decisions based on the interpretation of evidence gathered through assessment" (Manitoba Education and Training, *Reporting on Student Progress and Achievement*, 39). Valid judgments can be made only if accurate and complete assessment data are collected in a variety of contexts over time. Managing assessment that serves a multitude of purposes and audiences is a challenging task. Teachers must continually balance the assessment of their students' progress in the development of knowledge, skills, strategies, and attitudes with the purposes and audiences for the information collected.

ASSESSMENT TO ASSIST LEARNING AND INFORM INSTRUCTION

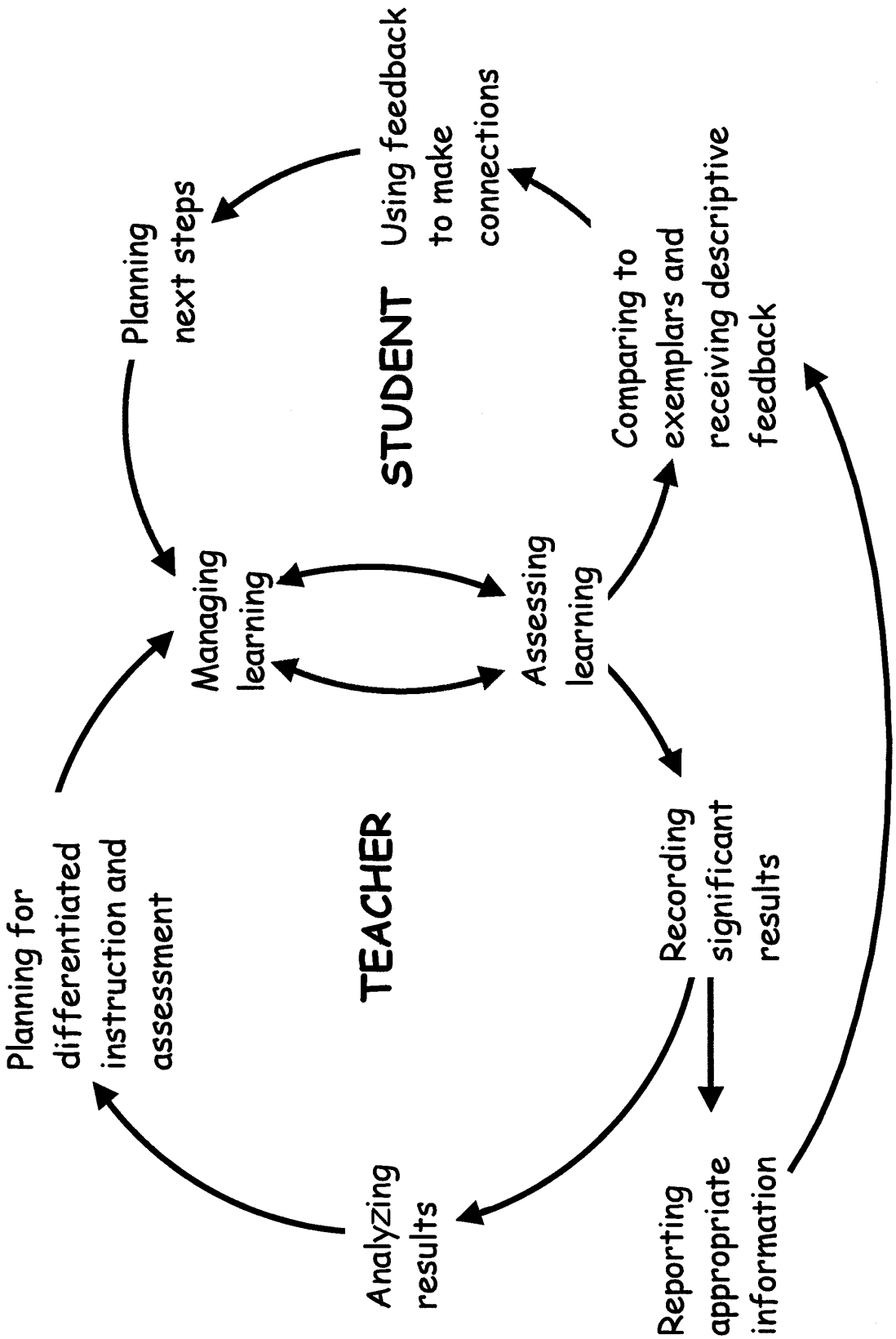
Principles of Assessment

1. An Integral Part of Instruction and Learning	2. Continuous and Ongoing	3. Authentic and Meaningful Mathematics Learning and Contexts
Assessment… • is meaningful to students • leads to goal setting • fosters transfer/integration with other curricular areas and application to daily life • reflects instructional strategies used • uses a wide variety of strategies and tools • reflects a definite purpose	Assessment… • occurs through all instructional activities • occurs systematically over a period of time • demonstrates progress towards achievement of learning outcomes	Assessment… • focuses on connecting prior knowledge and new knowledge (integration of information) • focuses on authentic problem-solving contexts and tasks • focuses on application of strategies for constructing meaning in new contexts
4. Collaborative and Reflective Process	**5. Multidimensional—Incorporating a Variety of Tasks**	**6. Developmentally and Culturally Appropriate**
Assessment… • encourages meaningful student involvement and reflection • involves parents as partners • reaches out to the community • focuses on collaborative review of products and processes to draw conclusions • involves a team approach	Assessment… • uses a variety of authentic strategies, tasks, and tools • is completed for a variety of purposes and audiences • reflects instructional tasks	Assessment… • is suited to students' developmental levels • is sensitive to diverse social, cultural, and linguistic backgrounds • is unbiased
7. Focused on Students' Strengths	**8. Based on How Students Learn**	**9. Offer Clear Performance Targets**
Assessment… • identifies what students can do and are learning to do • identifies competencies in the development of knowledge, skills and strategies, and attitudes • considers preferred learning styles • focuses on celebrations of progress and success • provides for differentiation • provides information to compare a student's performance with his/her other performances	Assessment… • uses sound educational practice based on current learning theory and brain research • fosters development of metacognition • considers multiple intelligences and learning styles • uses collaborative and cooperative strategies • considers research on the role of memory in learning • reflects current models of mathematics learning	Assessment… • encourages student involvement (setting criteria, measuring progress, working towards outcomes and standards) • encourages application beyond the classroom • provides a basis for goal setting • provides students with a sense of achievement • provides information that compares a student's performance to predetermined criteria or standards

Note: These principles of assessment apply to all subject areas.

Adapted from Manitoba Education and Training, *Kindergarten to Grade 4 English Language Arts: A Foundation for Implementation*. Winnipeg, MB: Manitoba Education and Training, 1997, p. 24.

Feedback Planning Model



Planning for Instruction and Classroom Assessment Using Learning Outcomes

Learning outcomes and standards assist classroom teachers and other educators to:

- plan learning activities that support student achievement.
- establish goals for learning, instruction, and assessment.
- monitor student progress in achieving learning outcomes and standards.
- communicate with students, parents, and guardians about student progress.
- develop a mathematics plan for a school.

Planning a Balanced Mathematics Program

Developing a balanced, integrated mathematics program is a dynamic process. The program is shaped by the teaching style and resources of each teacher, by the interests and abilities of the students, and by the needs of the community.

Planning a balanced mathematics program needs to take into account:

- that specific learning outcomes stated are end-of-year learning outcomes. Students may achieve the learning outcomes at any time during the year.
- that learning is recursive and cumulative; many of the learning outcomes need to be addressed in different ways throughout the school year. Students need practice in many meaningful contexts to consolidate new knowledge, skills, and strategies.
- that planning is continuous, informed by ongoing classroom assessment.
- that a variety of instructional approaches, classroom management techniques, assessment practices, tools, strategies, and problem-solving activities are essential.

Some areas of balance to consider in planning are:

- learning outcomes for each grade.
- four strands: Patterns and Relations, Statistics and Probability, Shape and Space, and Number.
- standards of student performance for Grade 3.
- student grouping patterns: individual, pairs, small groups, large groups, whole class, heterogeneous, homogeneous, student-directed, teacher-directed.
- various learning styles and multiple intelligences.
- various rates of student learning, addressed by providing pre-teaching, review, and additional practice for some students, and challenging extension activities for others.

Teachers strive for balance in their classrooms. The following diagram, ‘Planning to Ensure Balance,’ illustrates options to consider in planning instructional and assessment activities.

Planning to Ensure Balance*		
explicit instruction	and	indirect instruction
interactive learning	and	independent learning
vicarious experiences	and	concrete experiences
teacher choices	and	student choices
teacher assessment	and	self/peer assessment
teacher talk	and	student talk

Planning for balance while ensuring sufficient instruction and practice in all outcomes defined for a particular grade is a challenging task. Looking at how the outcomes are related across the grade levels is helpful (see Manitoba Education and Training, *Kindergarten to Grade 4 Mathematics: Manitoba Curriculum Framework of Outcomes and Grade 3 Standards,* 1995). This information can be used to create balanced instructional activities, and to help define areas in which initial teaching and practice are necessary, and those in which practice and maintenance through problem-solving activities are the main emphases. It is important to note that students who have not reached maintenance levels of specific skills will need to continue with scaffolded instruction at their level. Scaffolding refers to "instructional approaches or strategies that provide adjustable and temporary assistance or support to the student in his or her achievement of the learning task" (Manitoba Education and Training, *Success for All Learners*, 12.6).

Themes, integrated units, and learning sequences provide opportunities for explicit instruction of many learning outcomes. Instructional activities such as mini-lessons are necessary to introduce, develop, or reinforce particular skills. In every planning decision, reflective teachers need to ask:

- What is an appropriate balance for my students?
- Am I achieving the balance in my classroom, both in the short term and in the long term?
- Is my instruction helping students achieve the appropriate learning outcomes of my mathematics program?

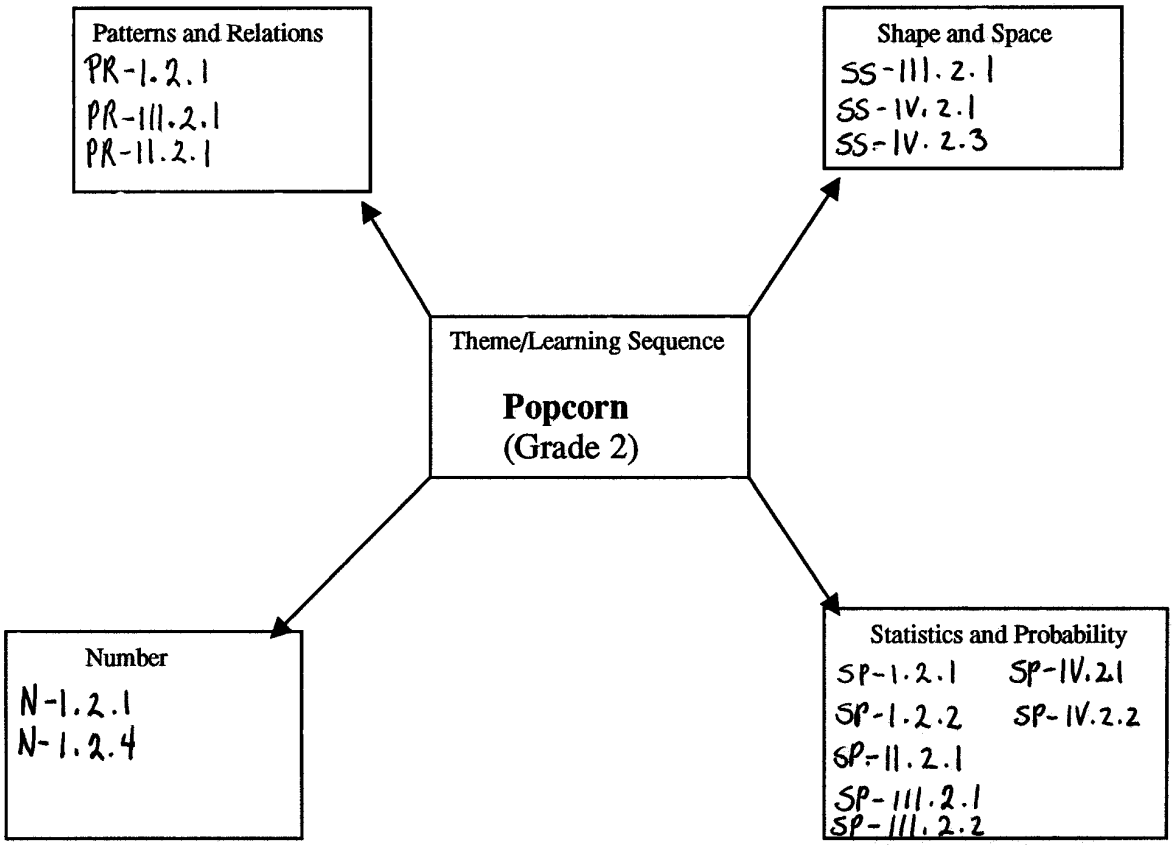
It is important to know whether all the learning outcomes for a particular grade level are being addressed. In order to do this, teachers may find it beneficial to make a list or an outcome map of the learning outcomes for a specific grade level. Many learning outcomes need to be addressed repeatedly and in different ways throughout the year. When used in conjunction with daily planning, learning outcome maps help teachers assess whether all learning outcomes have been addressed in sufficient depth for all students to be successful. They also assist teachers in tracking and monitoring the balance of each strand in the mathematics curriculum. Learning outcome maps may also be

* Adapted from Manitoba Education and Training, *Kindergarten to Grade 4 English Language Arts: A Foundation for Implementation*. Winnipeg, MB: Manitoba Education and Training, 1997, p. 29.

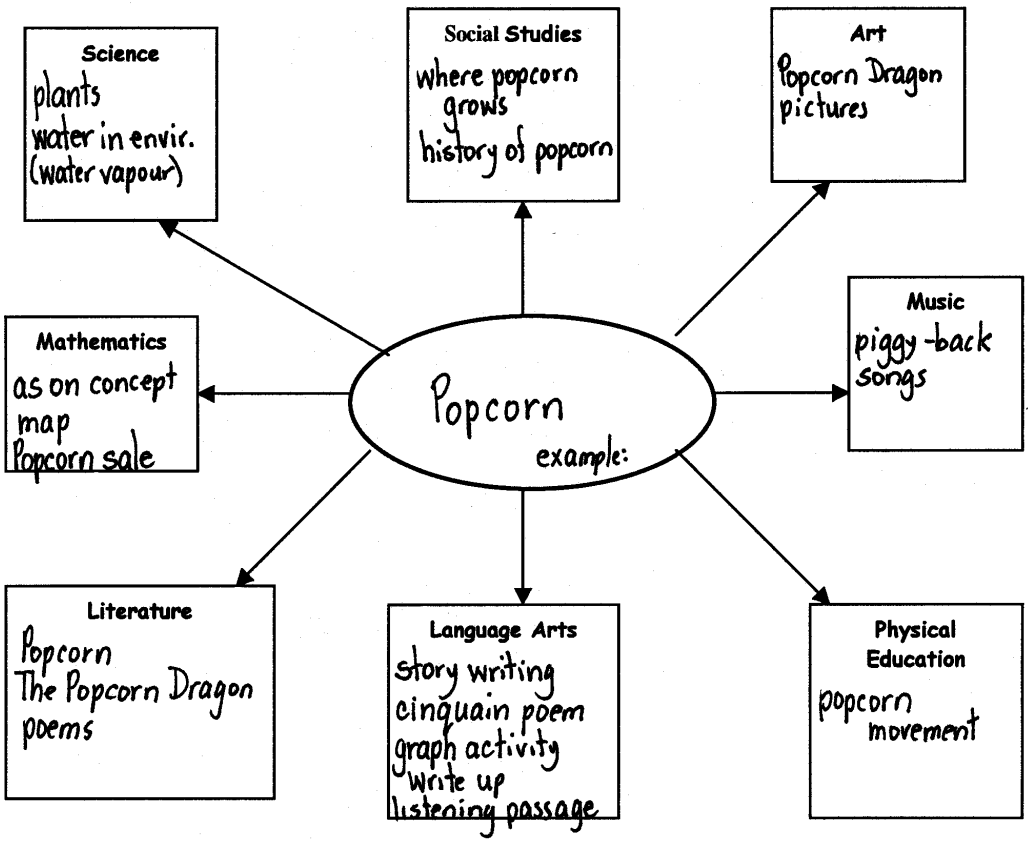
used in conjunction with learning outcomes from other disciplines to assist in interdisciplinary planning. As planning takes place, outcomes that are addressed may be highlighted or underlined. In this way, teachers can see whether certain outcomes have been overlooked or have been revisited many times.

Examples:

Concept Planning Map – Strand Integration



Concept Planning Map – Subject Integration



Checklist

Learning Outcome	Formative Assessment	Summative Assessment
selects the most appropriate standard unit (cm, dm, m), and estimates, measures, records, compares, and orders objects by length, height, and distance around (SS-I.2.1)	Jan. 7 investigation Jan. 9 science investigation Jan. 13	Jan. 20 interview
constructs items of specific lengths, including cm. dm, and m (SS-I.2.2)	Jan. 11 Jan. 21 Jan. 15	Jan. 23 paper-and-pencil
estimates, measures, records and compares the area of shapes, using non-standard units (SS-II.2.1)	Jan. 15 Jan. 22 Jan. 29	Jan. 30

Popcorn Activity — Links to Strands and Outcomes

Patterns & Relations	Statistics & Probability	Shape & Space	Number
• sorting puffs according to shape (round, jagged) • sorting coloured popcorn	• survey questions such as: "How do you pop your popcorn: microwave, stove-top, hot-air popper?" "What is your favourite flavour of popcorn?", etc.	• estimating and measuring the volume of puffs resulting from different brands of microwave popcorn	• counting out kernels to pop and then counting the resulting puffs • calculating the difference between them
• creating and extending patterns using puffs and kernels (puff, kernel, kernel, puff, kernel, kernel, etc.) Note: coloured popcorn could also be used	• collecting and recording data • organizing data • displaying data in a graph • generating new questions from data, e.g., "What is your favourite brand of microwave popcorn?"	• comparing the mass/weight of a given measure of kernels with the resulting popped puffs • estimating the mass/weight of popcorn kernels/puffs	• grouping the kernels/puffs into tens and hundreds • using kernels as ones, puffs as tens, and little bundles of 10 puffs as hundreds for place value activities
• translating patterns above into other modes (ABBABB)	• describing the likelihood of all 100 kernels popping in the hot-air popper (carry out several trials)	• working with money (counting, giving change, etc.) at popcorn sale	• calculating costs, profits for popcorn sale

When planning to assist students to achieve learning outcomes, it is important that the teacher read each specific learning outcome carefully and clarify the types of learning that are expected of the student. This will provide guidance for developing appropriate instructional activities to help students meet the expectations of the mathematics curriculum.

Note: The Curriculum Information Technology Integration project (CITI) will allow teachers to integrate their planning in mathematics, science, and language arts.

Before teachers choose assessment tasks, tools, and strategies, it is critical to define the reasons for assessing, the audience who will use the information, and the ways in which results will be used. Appropriate assessment activities must focus on tasks that allow students to demonstrate their competence in applying learning in authentic ways.

Questions to Guide Results-Based Planning

1. *What do we want students to know and be able to do?*
   This question can be answered by reading the learning outcome to determine the knowledge, skills, and strategies that it includes.
2. *What do students already know?*
   This question can be answered by having students work through activities that demonstrate their prior knowledge related to particular outcomes. Using strategies such as KWL Charts, word cycles, and concept maps would also help to provide information on prior knowledge.
3. *What instructional methods, materials, and strategies will help students develop these competencies?*
   These will be drawn from teachers' experiences, professional resources, or instructional suggestions provided in the *Kindergarten to Grade 4 Mathematics, A Foundation for Implementation* document (Manitoba Education and Training, 1996).
4. *What is the purpose for assessment? How will the assessment be used?*
   Various assessment audiences and purposes are suggested on pages 11 to 13 and in the chart 'Principles of Assessment' on page 3.
5. *What assessment tasks will allow students to demonstrate their understanding in authentic ways?*
   Assessment tasks will be drawn from teachers' experiences, professional resources, or suggestions provided in the *Kindergarten to Grade 4 Mathematics, A Foundation for Implementation* document.

Planning With the End in Mind

To plan effectively, teachers need to have a clear sense of the purpose of instruction. The primary purpose of mathematics education is for the students to attain the mathematics learning outcomes identified and mandated for each grade level. The learning outcomes are not a checklist of what the teacher will teach. They are a description of the knowledge, skills and strategies, and attitudes that students are expected to demonstrate.

Placing the focus on student learning in this way means that all instructional planning must begin with students' present levels of performance. Teachers cannot decide on the first priorities for instruction until they know what knowledge, skills and strategies, and attitudes students bring into the class. Teachers are better able to make appropriate choices of topics, learning resources, groupings, and instructional strategies when they know the students as individuals. For this reason, teachers need to gather as much information about students as possible.

Using Initial Assessment for Planning

Before beginning work on a group of learning outcomes, teachers should gather information about the learning of both the class as a whole and the individual students. Reflecting on these data is an essential part of the process when making decisions for future instruction, assessment, and student learning. Teachers need to ask:

- What have I learned about the class as a whole?
- What implications does this have for instruction? For assessment?
- For which students are these generalizations not accurate?
- How do I need to differentiate instruction to meet the learning requirements of those particular students?

Purposes of Initial Assessment

Initial assessment helps teachers decide:

- how much time to allocate to various learning outcomes.
- which learning outcomes to focus on first.
- which materials and learning resources are most appropriate.
- which teaching and learning strategies to use.

Phases of Learning

When preparing instructional plans and goals, teachers should consider three learning phases:

- activating (preparing for learning)
- acquiring (integrating and processing learning)
- applying (consolidating learning)

These phases are not entirely linear, but are a useful way of thinking and planning. A variety of activating, acquiring, and applying strategies are discussed in *Success for All Learners: A Handbook on Differentiating Instruction* (Manitoba Education and Training, 1996).

Preparing for Learning

Activating (Preparing for Learning)

One of the strongest indications of how well students will comprehend new information is their prior knowledge of the subject. Some educators observe that more student learning occurs during the activating phase than at any other time. In planning instruction and assessment, teachers develop activities and select strategies for activating students' prior knowledge. These activities provide information about the extent of students' prior knowledge of the topic to be studied, and about their knowledge of and proficiency in applying skills and strategies needed for learning in this topic area.

Prior knowledge activities:

- help students relate new information, skills, and strategies to what they already know and can do.
- allow teachers to correct misconceptions that might otherwise persist and make learning difficult for students.

- allow teachers to augment and strengthen students' knowledge bases in cases where students do not possess adequate prior knowledge and experience to engage with new information and ideas.
- help students recognize gaps in their knowledge.
- stimulate curiosity, and initiate the inquiry process that will direct learning.

Integrating and Processing Learning

Acquiring (Integrating and Processing Learning)

In the second phase of learning, students absorb new information and integrate it with what they already know, adding to and revising their previous knowledge. Part of the teacher's role in this phase is to present this new information, or to help students access it from other sources.

Because learning is an internal process, facilitating learning requires more of teachers than the simple presentation of information. In the acquiring phase, teachers instruct students in strategies that help them make meaning of information, integrate it with what they already know, and express their new understanding. In addition, teachers monitor these processes to ensure that learning is taking place, using a variety of instruments, tools, and strategies such as observations, interviews, and examination of student work.

Consolidating Learning

Applying (Consolidating Learning)

New learning that is not reinforced is soon forgotten. Teachers need to move students beyond guided practice and into independent practice. The products and performances by which students demonstrate new learning are not simply required for assessment; they have an essential instructional purpose in providing students with opportunities to demonstrate and consolidate their new knowledge, skills and strategies, and attitudes.

Students also need opportunities to reflect on what they have learned and to consider how new learning applies to new situations. By restructuring information or integrating what they have learned in one strand with other strands or subject areas, students strengthen and extend learning.

Purposes of Ongoing Assessment*

Ongoing assessment helps teachers decide:

- whether students have mastered certain learning outcomes.
- whether they are making progress in attaining other learning outcomes.
- which learning outcomes need to be the focus of further instruction and assessment.
- whether instructional resources, activities, and strategies need to be modified.
- which tools would be most appropriate for assessment.
- whether individual students need alternative learning experiences or further support.

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* Adapted from Manitoba Education and Training, *Senior 2 English Language Arts: A Foundation for Implementation*. Winnipeg, MB: Manitoba Education and Training, 1998, p. Planning–19.

Formative Assessment

Formative assessment is data collected about the individual students and/or the whole group during classroom instruction.

Formative assessment is designed to guide instruction and to improve student learning. This is done by:

- identifying specific learning needs.
- providing feedback describing students' performance.

The instruments used in formative assessment provide information or data that teachers, parents, and students may use to identify factors that facilitate or hinder student learning.

Possible assessment strategies/tools that can be used for formative assessment include:

- observations recorded on checklists or in teacher notes
- performance tasks with scoring rubrics
- diagnostic interviews
- group/peer assessments
- self-assessment
- paper-and-pencil tasks
- student journal/learning log entries

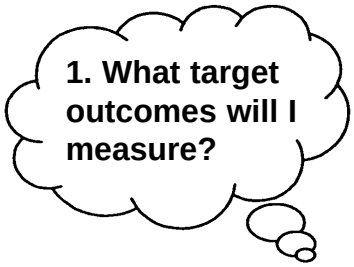
Note: "The thrust of formative assessment is toward improving learning and instruction. Therefore, the information should not be used for assigning marks as the assessment often occurs before students have had full opportunities to learn content or develop skills" (Manitoba Education and Training, *Reporting on Student Progress and Achievement,* 9).

Summative Assessment

Summative assessment occurs after students have had an opportunity to practise their learning independently. It often occurs during reporting times and is used to describe individual progress towards meeting the learning outcomes.

A GRADE 2 TEACHER'S PLANNING AND ASSESSMENT PROCESS

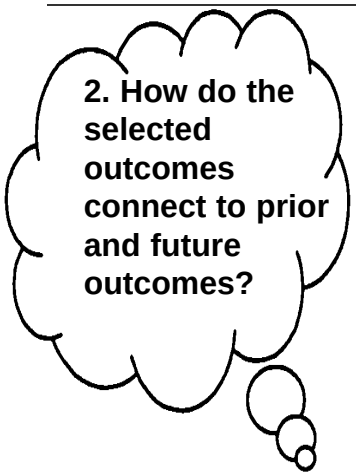
The following section attempts to demonstrate the planning and assessment process by highlighting the questions considered by a Grade 2 teacher as he or she plans for mathematics instruction. The questions are expanded upon and supported through concrete examples from *Kindergarten to Grade 4 Mathematics, A Foundation for Implementation* and actual student samples.



I would like to begin working on linear measurement in Shape and Space.

- Looking at the outcomes, there are two that are closely linked. SS-I.1.2: selects the most appropriate standard unit (cm, dm, m) and estimates, measures, records, compares, and orders objects by length, height, and distance around; and SS-I.2.2: constructs items of specific lengths, including cm, dm, and m.
- These particular outcomes can be taught in an integrated way, rather than in discrete parts, because they are basically dealing with the same concepts.
- At times, it is possible to integrate two or more outcomes, both within the strand itself and among the strands. This integration helps students see the connections among the different areas in mathematics.

Note: The outcomes chosen will depend on the theme or learning sequence being planned. It is important to remain focused on, and to track, the specific learning outcomes for the grade. In this way, teachers can be confident that curriculum expectations are being met.



I notice that in Grade 1, students are selecting, measuring, recording, comparing, and ordering objects by length, height, and distance around.

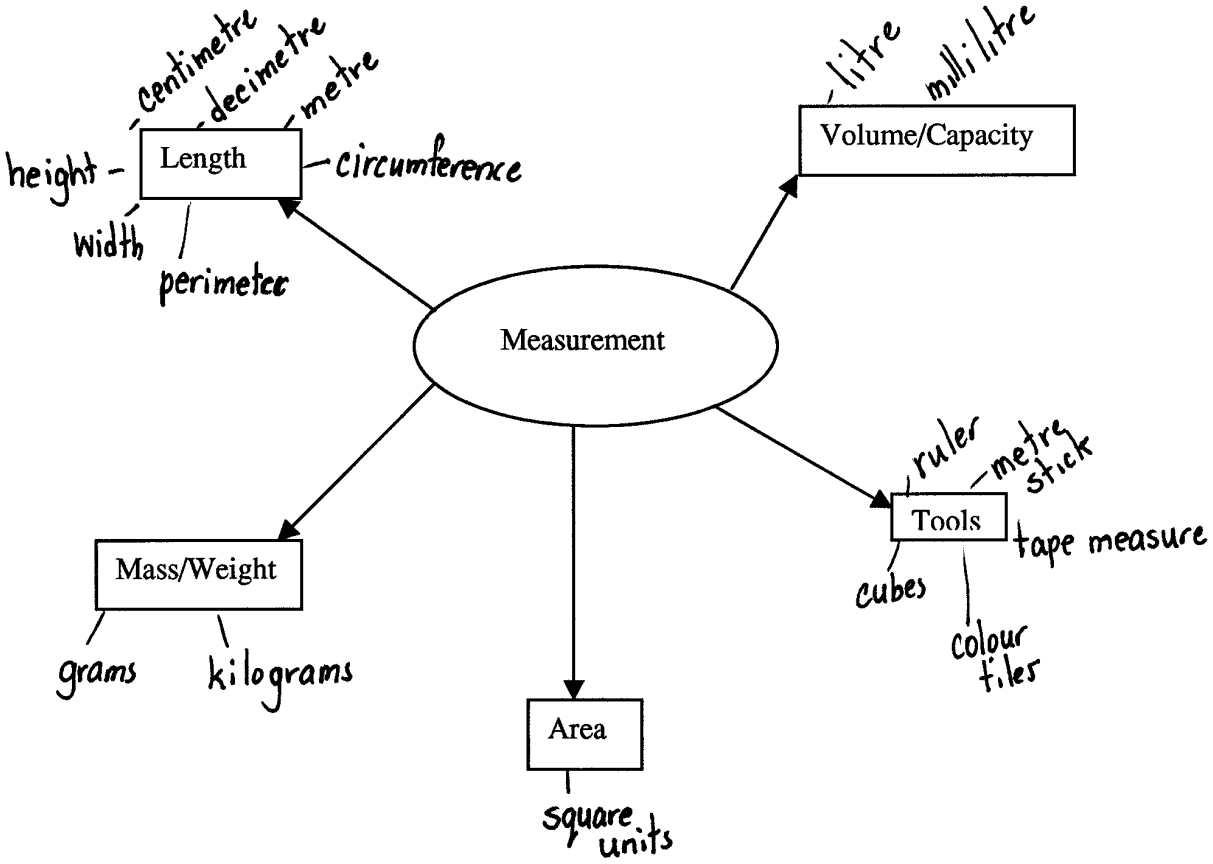
- In Grade 2 they use standard rather than non-standard units.
- In Grade 3 they will be using kilometres, and the term 'perimeter' will take the place of 'distance around.'

Grade 1	Grade 2	Grade 3
Selects an appropriate non-standard unit, and estimates, measures, records, compares, and orders objects by length, height, and distance around. *(SS-I.1.1)*	**Selects the most appropriate standard unit (cm, dm, m),** *and estimates, measures, records, compares, and orders objects by length, height, and distance around.* *(SS-I.1.2)*	Selects the most appropriate standard unit, including km, and estimates, measures, records, compares, and orders objects by length, height, and perimeter. *(SS-I.1.3)*

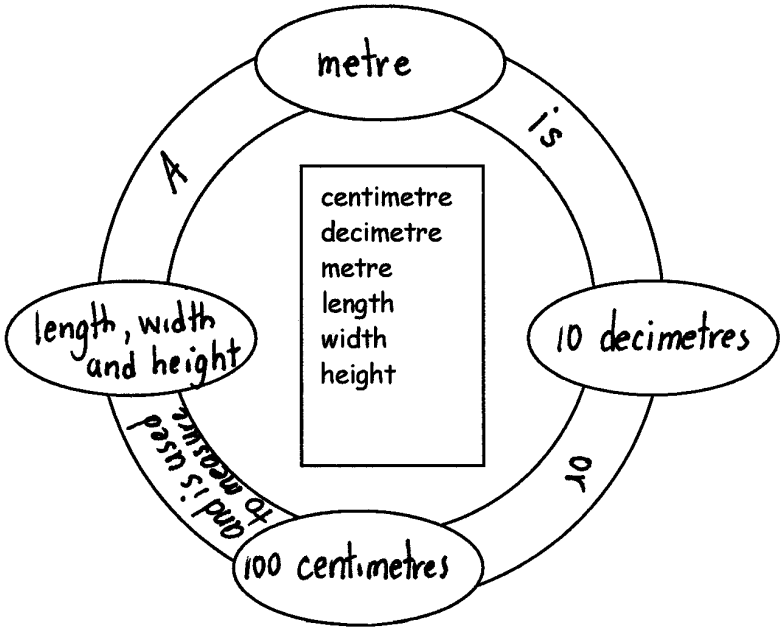
- Identify and model new vocabulary that students need to know as they attain these outcomes. Key words can be selected from *Kindergarten to Grade 4 Mathematics, Manitoba Curriculum Framework of Outcomes and Grade 3 Standards* (Manitoba Education and Training, 1995), or *Kindergarten to Grade 4 Mathematics, A Foundation for Implementation*.
- Use strategies for introducing, developing, and maintaining vocabulary such as those suggested in *Success for All Learners*. Examples include: Word Cycle, Three Point Approach, Concept Map, and Sort and Predict.

Note: It is important to know how a specific outcome is developed throughout the grade levels. This allows teachers to determine where students may have gaps in their learning and what they already know. It also helps teachers set standards of achievement related to their grade level outcomes by knowing what is expected of students at the next grade levels.

Concept Map



Word Cycle

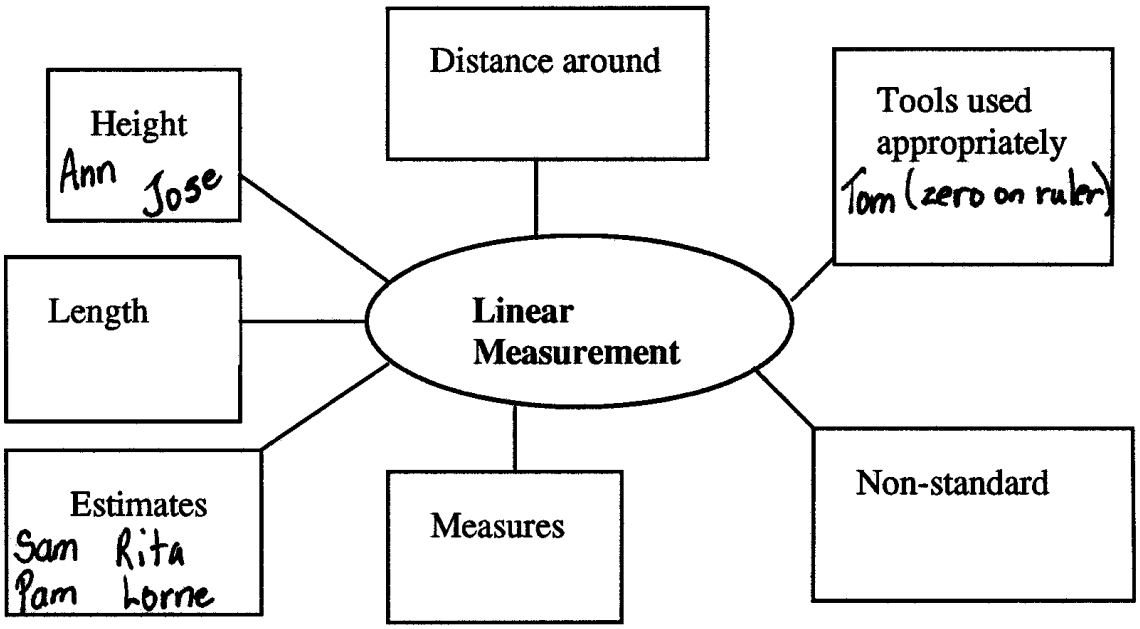


Adapted Word Cycle: From *Reading — A Novel Approach*. Text by Janice Szabos. Illustrations by Vanessa Filkins © 1984 by Frank Schaffer Publications. Used by permission

3. What do my students already know?

Rather than giving them a pretest to determine what they know, I think that I will use the investigation listed on page D-56 in the *Kindergarten to Grade 4 Mathematics, A Foundation for Implementation* document. This should provide me with information about what students already know.

- This activity can show how students estimate and measure, how they use the language of measurement, and how they select and use an appropriate non-standard unit. Most importantly, it will allow the teacher to observe students showing their understanding of length, height, and distance around. This is also more interesting for students and less threatening than a pretest.
- During and following the investigation, focus on those students who are missing prior knowledge. Appropriate instructional strategies can be found in *Kindergarten to Grade 4 Mathematics, A Foundation for Implementation*.
- Teachers may want to use a map such as the following to note those students who have specific gaps in skills and/or knowledge.



Note: Outcomes in each grade build on prior knowledge. Therefore, teachers need to be aware of what students already know so that they can plan appropriate instructional and assessment strategies. This data gathering is most effective if it can be done through a meaningful and engaging activity that requires little or no teacher support. This frees teachers to make observations.

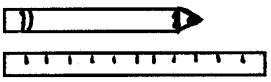
4. How will students demonstrate achievement of the learning outcomes?

I feel that it is important that students know when they have been successful. The class and I will set expected performance criteria so that everyone is aware of the expectations. This will allow students to assess their own learning. Perhaps we could develop together a rubric or chart that lists expectations. I will ask the students what makes a good measurer and then post their responses so that they can be used as a basis for self-assessment.

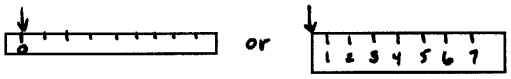
- One goal of assessment is to have students reflect on their learning and to self-assess. In order to help students begin to self-assess, they need to be involved in the development of criteria related to the outcome.

  Example: Ask students, "What makes a good measurer?" Record their responses and then select the key elements for the "Five Star Measurer" chart criteria.

  — I used a strategy to estimate the length (I used my baby finger).

  — I started measuring at one end. 

  — I started measuring at the zero mark on the ruler.

  — I recorded both the number and unit.

  — I explained how I knew I was correct.

- As students work through the learning task, additional expectations or criteria may be uncovered. Example: "No gaps or overlaps when using the decimetre strip."
- The Grade 3 standards shown in *Kindergarten to Grade 4 Mathematics Curriculum Framework of Outcomes and Grade 3 Standards* can be used as a model for developing standards at other grade levels.
- The *Kindergarten to Grade 4 Mathematics, A Foundation for Implementation* document has checklists to help with this development. Example: page D-57

  Checklist:

  ❑ Uses terms of comparison (e.g., longer, nearer).

  ❑ Compares measurements directly.

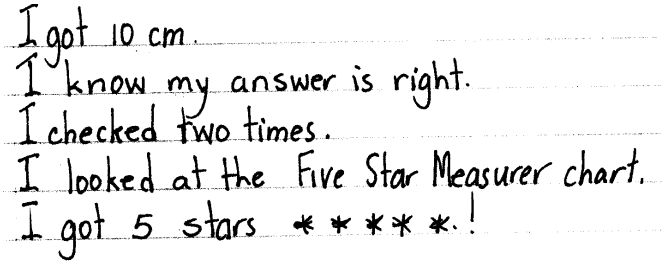
  ❑ Orders three or more objects by length.

  ❑ Uses standard and non-standard units as appropriate.

  ❑ …

- It is important that students be able to demonstrate a skill (in this case measuring), but they must also be able to explain how they know they have been successful.

Example:



Setting Criteria

"Criteria are, simply, the standards by which something can be judged or valued." (Gregory et al., 1997, 7)

Setting criteria with the students helps them to understand what is expected of them. When the expectations are clearly defined, students can use the criteria to self-assess. While they are working, they are able to make adjustments based on the criteria and can accomplish the task successfully.

Suggested Steps:

1. **Brainstorm:**
   Pose a question such as, "In problem solving, what makes a good answer?" and have students brainstorm possible criteria. Record their responses. Take part in the brainstorming and contribute some of your own ideas. This helps ensure that the related outcomes are reflected in the criteria.
2. **Sort and Categorize**
   It is important to limit the criteria to three to five points. Have students group the suggestions that fit together. Decide on a heading that best describes the group.
3. **Post**
   Write the criteria clearly on a chart and post it in the classroom where it can be seen easily by all students. If space is not available, provide individual or group copies of the criteria.
4. **Add, Revise, Refine**
   Criteria evolve as students learn new concepts and skills.
   Note: When appropriate, have a discussion of the performance criteria that would be considered 'beyond expectations.'

Note: In order for students to be successful 'self-assessors,' they need to understand the process. Students must know how they are doing in relation to the outcomes. We want students to be involved in the assessment process. "Self-assessment in education means taking the time to understand who and where one is as a learner. When students reflect on their learning experience, noting what happened, what they learned, how it was different from other learning experiences, what was confusing, in what parts of the experience they had the greatest success, they are engaged in self-assessment" (Moon et al., 1995, 105). Self-assessment empowers children with reflective strategies that enable them to understand themselves as learners. Teachers need to model the process for the students and have them practise with a partner before getting them to assess themselves.

I have read many suggestions for assessment data gathering and recording in the *Kindergarten to Grade 4 Mathematics, A Foundation for Implementation* document. I think that I will use a checklist to record the data I collect. After I model the process myself, I will also have students use a "Five Star Measurer" chart to self-check their performance as measurers.

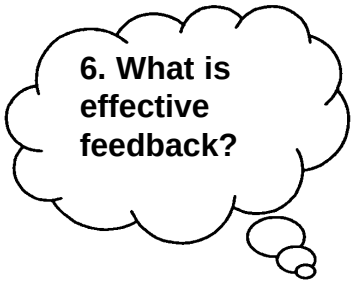
- Immediate feedback, such as correcting each other's work based on the given criteria or expectations, will improve learning if the students are given the opportunity to correct the error(s).
- Students can work in cooperative learning groups. Students within the group can use criteria to check each other's measurement skill.
- The teacher needs to note:
  — who is struggling and with which expectation.
  — who has met the expectations and who can be challenged.
- It is important to allow students who have met the expectations to extend their thinking and learning. In this manner, all students are engaged in meaningful learning activities.

It is important to document student performance in order to create a picture of student learning over time. It allows the teacher to identify students' strengths and weaknesses. This information helps teachers support learning.

Knowing in advance how this information is going to be gathered helps to ensure that the data gathering actually takes place. For example, in order to track observations about student progress related to a particular outcome or group of outcomes, a teacher might use a class list and highlight the students that he or she will observe that day. On the next day, the next group of students is highlighted. In this way, the teacher is able to systematically observe all students over a period of time.

As teachers invest in the documentation process, they often find they:

- see patterns emerging within a child's learning style that would otherwise have gone unnoticed.
- diagnose student difficulties better, and are then able to provide more appropriate learning experiences.
- communicate better with parents about their child's learning by providing specific anecdotal examples.
- find it easier to talk with students about their learning because they can relate it to actual classroom events.
- find it easier to see the connection between their instruction and student evaluation (assessment) (Moon et al, 1995, 53–54).



If students are working toward meeting outcomes and have worked together in establishing criteria, should my comments be linked to these efforts in some way? I think that when I am observing the measurement activity, I should make comments directing their attention to the criteria.

- Feedback is information that provides the student with direct, useable insights into their learning. This information is based on observable differences between what learning they exhibit now, and the learning expected as outlined in an exemplar, goal, or standard.
- The feedback should be matched to the criteria.

  Examples for a "Five Star Measurer":

  — I heard you carefully counting the number of centimetres.

  — I see that you are starting to measure at one end of the book.

  — I counted a different number of decimetres. Try counting more than once to double-check your count.

  — I see that you have recorded the number to show the length of the book but I am not sure what unit you were using.

  — I see that you used your hand span to estimate the length.

Effective Stems	Ineffective Stems
I saw …	Good work …
I heard …	Fix that …
How can…	Try harder …

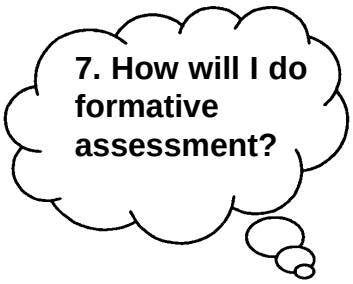
Correcting student work can be an overwhelming task. Teachers need to consider the following:

- Decide on the purpose of your correcting, and follow through.
- Correcting for accountability is fine, but the first accountability is to the child who has done the work and to his or her improved learning. To achieve the latter, feedback to the child and "feed forward" to the next learning task are what matters.
- Your ultimate aim is to offer pupils clear, descriptive feedback that will help them to improve their learning.

Examples:

1. During the last 15 minutes of a class, have students do one question and hand it in to be corrected.
2. On a homework assignment, decide ahead of time what two or three questions you are going to correct and focus only on those questions.

Feedback and correct answers should be given as soon as possible.



I think that it is important to use a variety of strategies for my formative assessment. I am going to gather evidence from a combination of self-assessment, peer assessment, and teacher assessment.

- Students can check their work against the criteria. Students should self-assess using the "Five Star Measurer."

  Example: How do you know you are a good measurer?

  "I am a good measurer because I used my baby finger to estimate the length of the book. I started measuring at the edge of the book and I recorded the number of centimetres. I explained in my journal how I knew I was correct."

- Peer assessment is a valuable assessment strategy. Partners should be able to observe each other during the measuring process and make comments based on the "Five Star Measurer" criteria.

  Example: "You used a good strategy for estimating but I noticed that you didn't start at the edge of the book. Why don't you try measuring it again?"

- Teachers assess individual progress so that they can plan their instruction to meet the needs of all students. To assess the skills related to measurement, teachers might choose to observe a child as he or she completes a measurement task or to conduct an interview with the child.

  Example: "I would like you to measure this book for me."

  1. "First of all, I would like you to estimate the length of the book in centimetres. Can you tell me what strategy you used to make your estimate?"
  2. "Now go ahead and measure."

     ❑ starts at the edge

     ❑ starts at zero or the beginning of the ruler

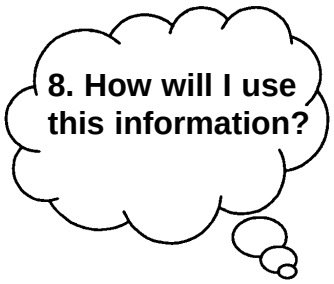
     ❑ measures accurately

     ❑ …

Self-assessment behaviours must be modelled. This modelling helps students construct a foundation on which they can build their self-assessment skills. Using a series of questions to guide the self-assessment process provides students with a scaffolding on which to base their own self-assessment.

Examples: What did you learn? What was hard for you? Why do think that was hard? What was easy for you? When did we do something like this before? How is this different from what we did before?

By hearing these questions repeatedly, students will learn to apply them to any learning experience. Students are then able to ask similar questions of themselves as their self-assessment skills strengthen (adapted from Moon et al., 1995, 109–110).



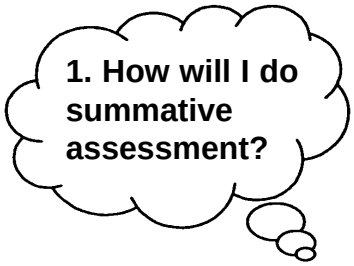
I need to look at the information gathered and decide what I need to do next in terms of helping my students move toward meeting the outcomes. I think that I will involve the students in this process.

- Students and/or the teacher can determine what task(s) are needed to improve learning.

  Example: The student has immediate opportunities to do more measurement tasks and/or takes a task to complete at home.

- Students can be involved in the recording of their progress related to the outcomes. Teachers do not have to record all this information.

SUMMATIVE ASSESSMENT



The latest formative assessment(s) seems to indicate that the majority of the students have acquired the skills necessary to meet the two measurement outcomes. I am now ready for a summative assessment task to determine how well the outcomes have been achieved. An interview is given on page D-65 of *Kindergarten to Grade 4 Mathematics: A Foundation for Implementation*. It addresses SS-I.1.2 and I can add some additional questions to address SS-I.2.2.

Summative assessment is usually conducted at the end of a block of instruction and is designed to determine to what extent students have attained learning outcomes. It is primarily used for assigning marks (Manitoba Education and Training, *Reporting on Student Progress and Achievement*, 10).

Summative assessment may take many forms, e.g., paper-and-pencil tasks, interviews, performance tasks, journal entries, et cetera.

- Performance tasks are tasks designed to provide students with an opportunity to apply mathematical concepts, skills, and processes. While students are engaged in the task, the teacher observes students individually, gathering information about the ways in which they assess personal performance, apply mathematical concepts to the tasks, solve problems, and make connections with other knowledge and skills.
- Structured interviews along with a performance task(s) provide teachers with a great deal of information about what a student is able to do. A structured interview usually begins and ends with easy questions. At the beginning, an easy question will put the child at ease, and at the end it allows the child to finish with a sense of accomplishment. To begin the interview on page D-65, the teacher might begin by asking the child to estimate how many toothpicks are needed to measure the length of the child's hand. The interview could end by asking the child to measure a small item, using a toothpick or a ruler.

  Example from page D-65

  a) "Given the size of a toothpick, estimate how many toothpicks make up the perimeter of the desk. Write your estimate on paper."
  b) "Now measure the desk with toothpicks and record your measurement."
  c) "Were toothpicks a good unit for measuring a desk? Why or why not?"
  d) "Estimate the perimeter of the desk to the nearest centimetre or decimetre. Record your estimate."
  e) "Which would be better for measuring the perimeter of a desk: centimetres or decimetres?"
  f) "How do you know your measurements are right?"

  Interviews require specific classroom management. While the teacher is working with one student, the rest of the class must be working independently. Consider having students work on activities in small groups so that group members can field some of the questions normally dealt with by the teacher. The activities could be math-related or could be related to other subject areas. For example, students could be working on literacy centres while the teacher is doing the

math-related interview. The activities should be ones in which the students have had previous experience, not activities that require new teaching.

Remember: Keep interviews as short as possible. Be non-judgmental and avoid engaging in instruction. Questions should focus directly on the outcomes being assessed.

To assist with the monitoring of the students involved in activities, help may be provided by:

— parent volunteers
— administrators
— student teachers
— educational assistants
— other non-classroom teachers
— responsible students from a higher grade level

Note: The availability of extra help will vary, depending on each school's particular situation. In some situations it may be possible to interview two or three students at a time. Two students could sit back to back and the teacher could observe both students as they performed the tasks. The questions could be directed to each student in turn. Three students could be observed if the interview mainly required a hands-on demonstration of skills or concepts.

Creating a Rubric

Once students have demonstrated the performance, it is appropriate to use a rubric. A rubric is a set of scoring guidelines that describe student performance. It can be developed from criteria like that used in formative assessment.

A typical rubric:

- contains a scale of points to be assigned: for example, 1 to 4.
- describes the characteristics of a response for each possible score.

Samples of student work can be used to determine the descriptors for each level of performance. It is important to keep the identity of the students confidential. It is better if the teacher uses the students' examples and rewrites them on large chart paper.

Using the samples, students can then determine what would be needed to attain each performance level of the rubric for each of the criteria.

Note: If you have developed a rubric before having student samples or exemplars, it may be necessary to adjust the performance descriptors after looking at student work.

Rubrics are generally used to assess performance tasks and open questions.

Open Questions

Open questions are designed to prompt students to apply concepts, solve problems, and make mathematical connections. There are no prescribed methods for responding to these questions that are open-ended, open-development, or open-process. Because of this feature, teachers are able to observe the strategies, skills, logic, concepts, and connections students make as they work their way through the questions.

Examples:

1) Write a math story problem. The answer is 45. Try to use more than one number operation (+ – x ÷).
2) Meg has 50 cents in her pocket. What coins could she have? Show eight different possible combinations.

ASSESSING MATHEMATICAL PROCESSES

Mental Math

Mental math consists of a collection of strategies that enable a person to estimate, visualize, and manipulate numbers in his or her head. Mental math strategies allow students to apply their knowledge of basic facts to compute problems that involve larger numbers.

There are specific methods and procedures that can be taught and practised in the same way that pencil-and-paper algorithms are taught and practiced. It is important to teach mental math computation and strategies before children become totally dependent on paper-and-pencil algorithms. Mental math should begin when students enter school and continue through to the end of high school.

Some mental math strategies that students could be expected to know by the end of Grade 4 are:

- adding to make 10
- doubles
- doubles plus 1 or 2 (or minus 1 or 2)
- counting on
- thinking addition
- subtract 10 and adjust
- add 10 and adjust

These strategies could be put on a checklist so the teacher can note their frequency of use. If a strategy is not being used the teachers will need to discover if the strategy simply requires more practice or needs to be taught.

In assessing mental math strategies, teachers should look for both oral and written evidence. For example, when asked how they solved the question 6 + 7, a student could answer "I used the doubles-plus-1 strategy. I knew that 6 + 6 = 12 and 7 is one more than 6 so the answer is 12 + 1 or 13." The student could have also used counting on (6, 7, 8, 9, 10, 11, 12, 13), adding to make 10 (6 + 4 = 10, 7 – 4 = 3, 10 + 3 = 13), et cetera. Students should be able to describe more than one way to answer a question.

Example:

As you solve the following question, describe the mental math strategies that you are using.

$$\begin{array}{rr} & 937 \\ + & 534 \\ \hline & \end{array}$$

"For the 7 + 4, I used adding to make 10.
For the 3 + 3, I used doubles plus 1.
For the 9 + 5, I used counting on."

Note: Once strategies have been taught, they must be practised. This can be done through number card and number cube games. Teachers can observe the mental math strategies being used as students play the games.

Paper-and-pencil tests can be used to assess mental math. The tests need to be time-restricted to ensure that students are applying mental math strategies.

Estimation

Estimation is the skill of making a reasonably accurate inference based on prior knowledge or experience. Estimation experiences provide a broad practical context for continued development of the children's concept of number, size, and quantity.

In estimating answers to numerical questions, students apply their understanding of place value, mental math strategies, and algorithms. Example:

- 675 – 236 = ___

  "I estimate that the difference will be about 500. First, I rounded 675 to the nearest hundred and got 700. Then, I rounded 236 to the nearest hundred and got 200. Then I subtracted the rounded numbers 700 – 200 and got the answer 500."

When estimating size or quantity, students apply their understanding of length, area, capacity/volume, mass, time, money, temperature, and angles. Students need additional strategies for this type of estimation. These strategies include:

a) **Referents or anchors:** This involves using a known measurement to help the student more accurately estimate an unknown measurement. Example:

- How long do you think this book is?

  "I think that the book is 22 cm. I know that my pinky finger is about one cm wide so I used it to measure the book."

  Note: The referent can also be provided by the teacher.

b) **Chunking:** This involves breaking a measurement problem into smaller problems. Example: Finding the area of the classroom by estimating the cloakroom separately from the main room and adding the two measurements together.

c) **Unitizing:** This involves mentally breaking the entire measurement into smaller parts equal to a known measurement. Example: Pouring 250 mL into a large container, then estimating how many 250 mL units are in the whole container to determine the capacity of the container.

Estimation skills, like mental math skills, can be assessed through oral or written work using pictures, diagrams, and words. The teacher can use a checklist to note the presence of the skills and the frequency of their use. In addition, students need to become proficient self-assessors of their estimation skills by using forms that make them set goals.

Example:

- How many popcorn kernels will fit in a unifix cube?

  My estimate _____

  Actual number _____

  My estimate was (Circle one.)

  too high just right too low

  Next time I will _____

  _____

Connections

Students can identify how mathematical concepts are related to one another, to other subject areas, and to everyday life.

They need to make connections among the concrete, pictorial, and symbolic representations of a concept.

Example:

Five groups of three coloured tiles equals 15

❑❑❑
❑❑❑
❑❑❑ equals 15
❑❑❑
❑❑❑
5 x 3 = 15

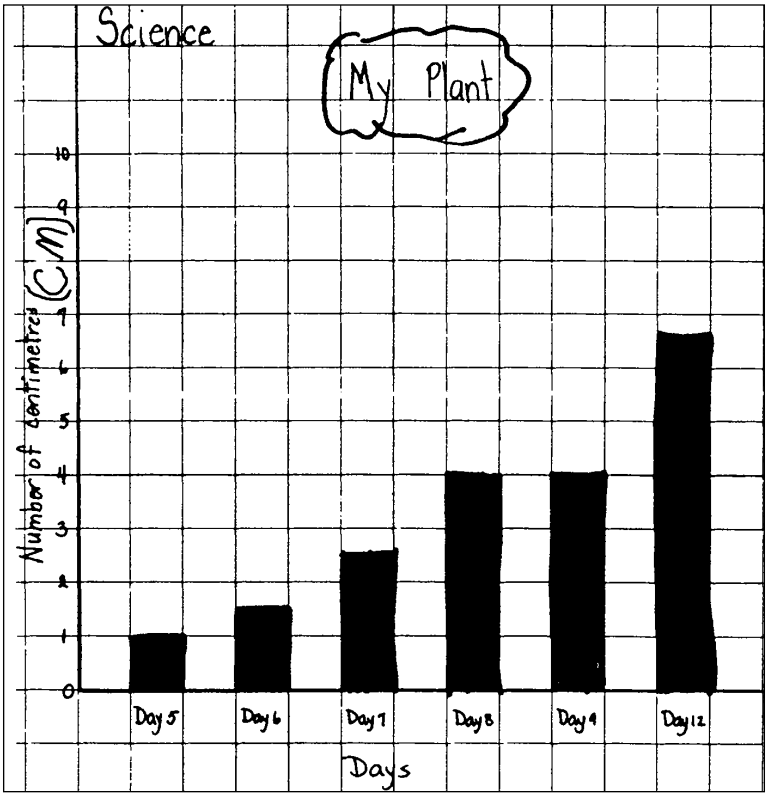
As an extension, have students complete a Three-Point Approach chart (see *Success for All Learners*, p. 6.36).

Example:

Definition:	Word or Concept:	Diagram:
_____ _____ _____ _____ _____	Synonym/Example	

If students can represent a concept in many different ways, they demonstrate that they understand that concept.

- Students also need to recognize that mathematical concepts are applicable to other subject areas. Students should be able to transfer and apply their mathematical skills to different situations and contexts. Example: In science, students will be measuring, collecting and recording data, displaying data, interpreting data, estimating, recognizing patterns, et cetera.
- Teachers can assess students' progress related to connections by using work in other subject areas to collect assessment data for mathematics. Work in other subject areas helps to provide students with meaningful contexts in which to apply their mathematical skills.



Teachers could suggest students use a self-assessment checklist such as one that could have been developed in Data Analysis. Example:

Self Assessment Checklist

My graph has

- ❑ a title
- ❑ spaces between the bars
- ❑ bars the same width
- ❑ bars with names
- ❑ a label on the side
- ❑ a label on the bottom
- ❑ numbers on the lines
- ❑ evenly spaced numbers

Reasoning

- Students need to have a real understanding of mathematics. They need to move beyond memorizing sets of rules and procedures, and into investigations that answer the "why" questions. In order to do this, students must be provided with many opportunities to explain, justify, and refine their thinking. Listening to the explanations of their peers and being able to share their own thinking in a safe environment that fosters risk-taking will help them solidify their understandings. Sharing in this way will also help to identify and eliminate some of their misconceptions.
- Progress related to reasoning can be assessed by having students construct, illustrate, write, and present their ideas, conceptualizations, and conclusions.

Note: A more detailed description of this will take place in the Communication section.

Problem Solving

- Problem solving is the process in which students apply their understanding of mathematical concepts and skills. This process involves both mathematical investigations and open problems.
- Teachers need to look at four main areas in problem solving and to assess students' progress within each area.

  1) **Understanding the problem:** Before students can begin to solve a problem, they must first be able to interpret its meaning. Teachers can assess a student's understanding of the problem by using one of the following strategies.

     Have the student:

     — illustrate the problem and identify the question.
     — highlight the relevant information in one colour and the question in another.
     — sort sentence strips from the problem into three groups: needed information, extra information, and the question.

  2) **Using appropriate strategies:** Students need opportunities to evaluate the effectiveness of different strategies addressing the same problem. In this manner, they are able to move beyond one or two favoured strategies. Teachers can assess the use of strategies by having students explain or show how they solved the problem. A checklist can be used to assess the explanation and the answer.

     Example: Ask, "What do you see in your mind when you hear the problem?"

     Make sure:

     — the chosen strategy is appropriate for the question.
     — the strategy is applied correctly.
     — the answer is correct.
     — the explanation is clear.
     — the student states the strategy that is used or gives evidence of the strategy.

  3) **Verifying solutions:** Students should self-assess by checking their work or by using another strategy.

  4) **Formulating their own problems:** After students have had practice interpreting problems and working with various strategies, they should be able to develop problems of their own. Teachers can assess the problems by using a rubric that is developed together with the students.

Example for story problem:

Stars	Criteria
☆ ☆ ☆	— makes sense — is written as a story problem — answer is possible based on the information given — uses two or more steps
☆ ☆	— makes sense — is written as a story problem — answer is possible based on the information given — uses one step
☆	— is written as a story problem but is difficult to follow — answer may or may not be possible based on the information given — uses one step

Another way of assessing problem solving is to use criteria such as the following: (1 mark for each criterion met)

- appropriate unit used
- reasonable estimate
- correct strategy
- accurate measurement

Student Sample:

Problem : Measure the line below in centimetres.

Explain how you got your answer.

Tell how you know that your answer is correct.

First I tried my pinky finger.
I got 12 cm.
Then I used a string.
I put it on the line and I cut it
at the end.
Then I mesured it on my ruler.
I got 16 cm.

This response meets all criteria.

Communication

Students should be able to communicate, both orally and in written form, about their mathematical understanding. The student should be able to use his or her own language to explain and clarify in such a way that others can understand.

The student should be:

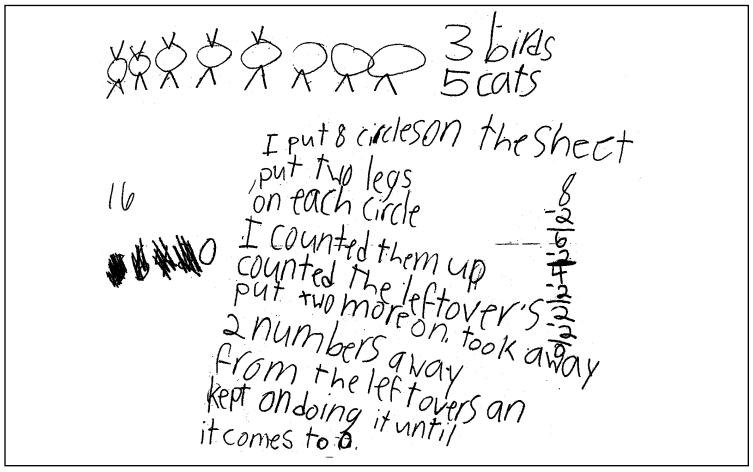
- using mathematical language and concepts.
- explaining reasoning.
- reporting evidence.
- stating a conclusion.
- drawing and labeling.
- reflecting on their learning.

Example:

Judy has eight pets.

Some are cats and some are birds.

If she counts 24 legs altogether, how many birds does she have?



This problem could be assessed using previously developed criteria and a form such as the following:

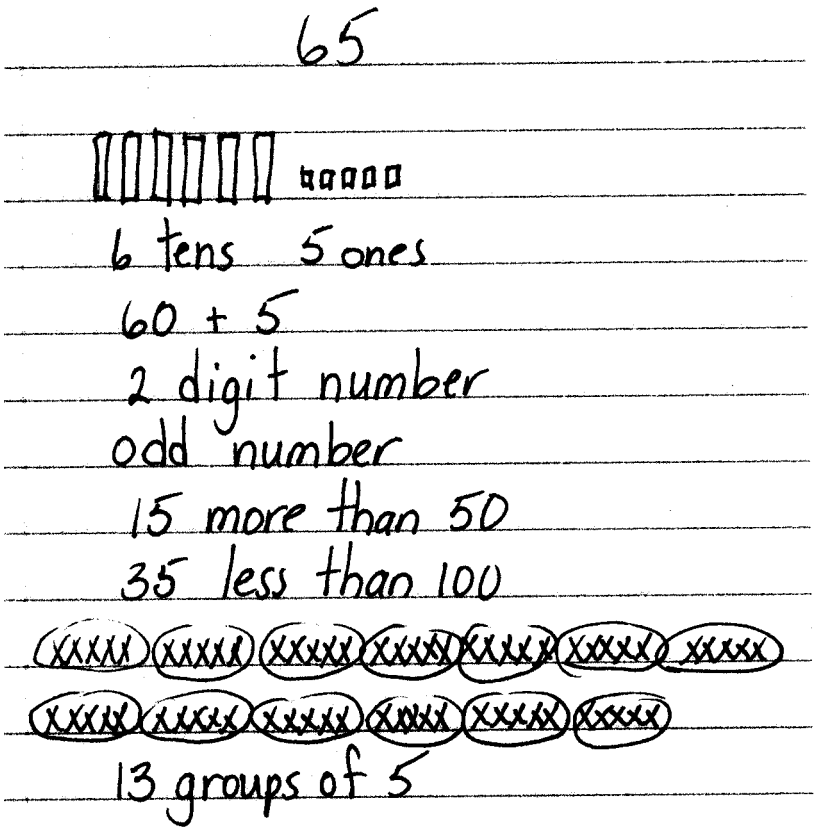
Criteria	Comment
☑ uses appropriate mathematical language correctly	
☑ explains reasoning	clear ☺
☑ shows calculations	
❑ correct answer	count the legs again

This can be returned to the student, so he/she can redo the question. A rubric could also be developed from the criteria (p. 25).

Visualization

- Visualization is the construction of mental models and/or images of mathematical concepts and processes. Visualization of mathematical concepts can be demonstrated by building, drawing, and describing. Students should also be able to identify mathematical concepts in the models and images around them. Therefore the assessment of visualization is not done separately but rather is an integral part of the assessment of mathematical concepts.

  Example: What do you know about the number 65? Use pictures, diagrams, and words in your answer.



BASIC FACTS

An automaticity in basic facts, both aural and oral recall, at the Early Years level is necessary. This automaticity is developed through the use of a variety of techniques, such as games, activities, and oral work.

The following continuum shows the facts that represent the learning outcomes at each grade level.

	Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4
Addition and Subtraction			Facts to 10	Facts to 18	Maintain facts to 18
Multiplication and Division				Facts to 49 (7x7 grid)	Facts to 81 (9x9 grid)

Grade 2 Addition Facts

0+0	1+0	2+0	3+0	4+0	5+0	6+0	7+0	8+0	9+0	10+0
0+1	1+1	2+1	3+1	4+1	5+1	6+1	7+1	8+1	9+1	
0+2	1+2	2+2	3+2	4+2	5+2	6+2	7+2	8+2		
0+3	1+3	2+3	3+3	4+3	5+3	6+3	7+3			
0+4	1+4	2+4	3+4	4+4	5+4	6+4				
0+5	1+5	2+5	3+5	4+5	5+5					
0+6	1+6	2+6	3+6	4+6						
0+7	1+7	2+7	3+7							
0+8	1+8	2+8								
0+9	1+9									
0+10										

Grade 2 Subtraction Facts

10-0	9-0	8-0	7-0	6-0	5-0	4-0	3-0	2-0	1-0	0-0
10-1	9-1	8-1	7-1	6-1	5-1	4-1	3-1	2-1	1-1	
10-2	9-2	8-2	7-2	6-2	5-2	4-2	3-2	2-2		
10-3	9-3	8-3	7-3	6-3	5-3	4-3	3-3			
10-4	9-4	8-4	7-4	6-4	5-4	4-4				
10-5	9-5	8-5	7-5	6-5	5-5					
10-6	9-6	8-6	7-6	6-6						
10-7	9-7	8-7	7-7							
10-8	9-8	8-8								
10-9	9-9									
10-10										

Grade 3 Addition Facts: At the Grade 3 level, students are to maintain the Grade 2 facts and add the following:

0+11	1+10	2+9	3+8	4+7	5+6	6+5	7+4	8+3	9+2	10+1	11+0	12+0	13+0	14+0	15+0	16+0	17+0	18+0
0+12	1+11	2+10	3+9	4+8	5+7	6+6	7+5	8+4	9+3	10+2	11+1	12+1	13+1	14+1	15+1	16+1	17+1	
0+13	1+12	2+11	3+10	4+9	5+8	6+7	7+6	8+5	9+4	10+3	11+2	12+2	13+2	14+2	15+2	16+2		
0+14	1+13	2+12	3+11	4+10	5+9	6+8	7+7	8+6	9+5	10+4	11+3	12+3	13+3	14+3	15+3			
0+15	1+14	2+13	3+12	4+11	5+10	6+9	7+8	8+7	9+6	10+5	11+4	12+4	13+4	14+4				
0+16	1+15	2+14	3+13	4+12	5+11	6+10	7+9	8+8	9+7	10+6	11+5	12+5	13+5					
0+17	1+16	2+15	3+14	4+13	5+12	6+11	7+10	8+9	9+8	10+7	11+6	12+6						
0+18	1+17	2+16	3+15	4+15	5+13	6+12	7+11	8+10	9+9	10+8	11+7							

Grade 3 Subtraction Facts: At the Grade 3 level, students are to maintain the Grade 2 facts and add the following:

18-0	17-0	16-0	15-0	14-0	13-0	12-0	11-0
18-1	17-1	16-1	15-1	14-1	13-1	12-1	11-1
18-2	17-2	16-2	15-2	14-2	13-2	12-2	11-2
18-3	17-3	16-3	15-3	14-3	13-3	12-3	11-3
18-4	17-4	16-4	15-4	14-4	13-4	12-4	11-4
18-5	17-5	16-5	15-5	14-5	13-5	12-5	11-5
18-6	17-6	16-6	15-6	14-6	13-6	12-6	11-6
18+7	17-7	16-7	15-7	14-7	13-7	12-7	11-7
18-8	17-8	16-8	15-8	14-8	13-8	12-8	11-8
18-9	17-9	16-9	15-9	14-9	13-9	12-9	11-9
18-10	17-10	16-10	15-10	14-10	13-10	12-10	11-10
18-11	17-11	16-11	15-11	14-11	13-11	12-11	11-11
18-12	17-12	16-12	15-12	14-12	13-12	12-12	
18-13	17-13	16-13	15-13	14-13	13-13		
18-14	17-14	16-14	15-14	14-14			
18-15	17-15	16-15	15-15				
18-16	17-16	16-16					
18-17	17-17						
18-18							

Grade 3 Multiplication Facts: Limited to the 7-by-7 grid on a multiplication table.

0x0	1x0	2x0	3x0	4x0	5x0	6x0	7x0
0x1	1x1	2x1	3x1	4x1	5x1	6x1	7x1
0x2	1x2	2x2	3x2	4x2	5x2	6x2	7x2
0x3	1x3	2x3	3x3	4x3	5x3	6x3	7x3
0x4	1x4	2x4	3x4	4x4	5x4	6x4	7x4
0x5	1x5	2x5	3x5	4x5	5x5	6x5	7x5
0x6	1x6	2x6	3x6	4x6	5x6	6x6	7x6
0x7	1x7	2x7	3x7	4x7	5x7	6x7	7x7

Grade 3 Division Facts

49÷7	42÷6	35÷5	28÷4	21÷3	14÷2	7÷1
42÷7	36÷6	30÷5	24÷4	18÷3	12÷2	6÷1
35÷7	30÷6	25÷5	20÷4	15÷3	10÷2	5÷1
28÷7	24÷6	20÷5	16÷4	12÷3	8÷2	4÷1
21÷7	18÷6	15÷5	12÷4	9÷3	6÷2	3÷1
14÷7	12÷6	10÷5	8÷4	6÷3	4÷2	2÷1
7÷7	6÷6	5÷5	4÷4	3÷3	2÷2	1÷1

Grade 4 Addition and Subtraction Facts: Maintain the facts from Grade 3.

Grade 4 Multiplication Facts: Limited to the 9-x-9 grid on a multiplication chart. Maintain the Grade 3 facts and add the following:

0x8	1x8	2x8	3x8	4x8	5x8	6x8	7x8	8x0	9x0
0x9	1x9	2x9	3x9	4x9	5x9	6x9	7x9	8x1	9x1
								8x2	9x2
								8x3	9x3
								8x4	9x4
								8x5	9x5
								8x6	9x6
								8x7	9x7
								8x8	9x8
								8x9	9x9

Grade 4 Division Facts: Maintain the Grade 3 facts and add the following:

81÷9	72÷8	63÷7	54÷6	45÷5	36÷4	27÷3	18÷2	9÷1	9÷0
72÷9	64÷8	56÷7	48÷6	40÷5	32÷4	24÷3	16÷2	8÷1	8÷0
63÷9	56÷8								
54÷9	48÷8								
45÷9	40÷8								
36÷9	32÷8								
27÷9	24÷8								
18÷9	16÷8								
9÷9	8÷8								

Assessing Basic Facts

The learning of basic facts can be more manageable and meaningful if students monitor their own progress. One way this can be accomplished is by administering some preliminary timed test(s) or quiz(es) based on the basic facts appropriate for the grade level. Then provide each student with an addition or multiplication table. Have students shade the facts that they were able to answer correctly in the preliminary testing. This helps students focus on the facts still to be learned. As periodic timed tests are administered, students can shade in the new facts that they have mastered.

Example:

Facts I Already Know

X	1	2	3	4	5	6	7
1	1	2	3	4	5	6	7
2	2	4	6	8	10	12	14
3	3	6	9	12	15	18	21
4	4	8	12	16	20	24	28
5	5	10	15	20	25	30	35
6	6	12	18	24	30	36	42
7	7	14	21	28	35	42	49