Ontario

COMBINED GRADES

Strategies to Reach a Range of Learners in Kindergarten to Grade 6

2007

CONTENTS

Une publication équivalente est disponible en français sous le titre suivant :
Classes à années multiples : Stratégies pour rejoindre tous les élèves

This publication is available on the Ministry of Education's website at:
http://www.edu.gov.on.ca.

INTRODUCTION

This resource document provides suggestions for strategies to support teachers and administrators in the successful management of classes of combined grades in Kindergarten to Grade 6.

A class of combined grades is composed of students from two or more adjacent grades who are grouped with one teacher for instruction. In all classrooms, no matter how they are organized, teachers need to provide for the individual needs of students. To achieve this, they use a variety of methods on a daily basis to assess the needs of each student, and then adjust the focus of instruction for skill development accordingly. In all classrooms, there is a range of students, and a teacher's goal to meet the needs of all learners remains the same regardless of the classroom organization. Also, the focus of instruction for all subjects is on helping students to advance regardless of age, grade, or current level of performance.

Strategies to ensure that the classroom is inclusive also apply to all classrooms. In an inclusive classroom, students' diverse experiences and points of view are reflected in learning materials, discussions, problem solving, and learning applications. The aim is to ensure equity of outcome in all classrooms.

Although classes of combined grades do provide challenges for teachers in managing the distinct content in different disciplines, there can be benefits for students both socially and academically.

Within a class of combined grades, students work towards the achievement of their grade-specific curriculum expectations. When common "big ideas" or skills are involved, all students in the class often work together, but at other times, instruction may be specific to each grade. Assessment, evaluation, and reporting are grade-specific.

Although classes of combined grades do require careful preparation to manage the distinct content in different disciplines, there can be benefits for students both socially and academically. Reviews of research that were conducted in Canada by Naylor (2000) and by Manitoba Education and Youth (2003) show that instruction in classes of combined grades can provide students with increased opportunities for social and emotional growth. Students have been shown to:

- do better in the area of socio-emotional development;
- develop more positive peer interactions;
- have greater development of social skills;
- do more collaborative and independent learning;

- display greater feelings of comfort and security, and a positive self-concept;
- show higher satisfaction with achievements;
- have more opportunities for student leadership within a community of learners.

In a number of Canadian and American studies, students in classes of combined grades were found to perform academically as well as students in single-grade classes. The greatest gains tended to be in language use and reading. Lolli (1998) attributes this higher literacy achievement to the integration of curricula in which students use language skills and strategies as tools to construct meaning and to learn grade-specific cross-curricular content. In mathematics, there are also gains when students are exposed to a greater range of ideas and learning experiences in classes of combined grades. As well, students in the lower grade of the combined grades develop awareness of the learning expectations for the next grade. Furthermore, mathematics programs taught in classes of combined grades provide ongoing opportunities for the development of students' understanding of key mathematical concepts across the grades.

> *"Research indicates that heterogeneous grouping promotes cognitive and social growth, reduces anti-social behaviour, and facilitates the use of research-based, developmentally appropriate instructional practices, such as active learning and integrated curriculum. The wider range of ages and abilities in a multi-age classroom discourages misleading age-graded expectations and helps teachers focus on students' individual learning needs."*
>
> – J. Gaustad, 1997, p. 1

The revised language curriculum for Ontario[1] provides opportunities for teaching language in classes of combined grades by *emphasizing similarities between grades*. The overall expectations remain constant from Grades 1 to 8. The specific expectations indicate increases from grade to grade in the breadth and depth of students' knowledge and understanding, as well as in the level of sophistication in their use of skills in thinking, communication, and the application of knowledge. The specific expectations also indicate increases in difficulty with regard to the level of sophistication and complexity of texts. The focus of instruction in language and literacy in either a single-grade class or a class of combined grades is on helping students to advance regardless of their age or grade.

Likewise, the revised mathematics curriculum for Ontario[2] provides opportunities for teachers to *match common elements in the different grades* – strands, content, mathematical processes, strategies, and manipulatives. It is based on the belief that students learn mathematics most effectively when they are given opportunities to investigate ideas and concepts through problem solving and are then guided carefully to an understanding of the mathematical principles involved. Although the grade-specific curriculum expectations are different for each grade, mathematics programs taught in classes of combined grades can give consideration to ways in which each set of grade-specific curriculum expectations contributes to students' learning and their understanding of the "big ideas" of mathematics.

1. Ministry of Education, Ontario, *The Ontario Curriculum, Grades 1 to 8: Language*, revised (Toronto: Ministry of Education, Ontario, 2006).

2. Ministry of Education, Ontario, *The Ontario Curriculum, Grades 1 to 8: Mathematics*, revised (Toronto: Ministry of Education, Ontario, 2005).

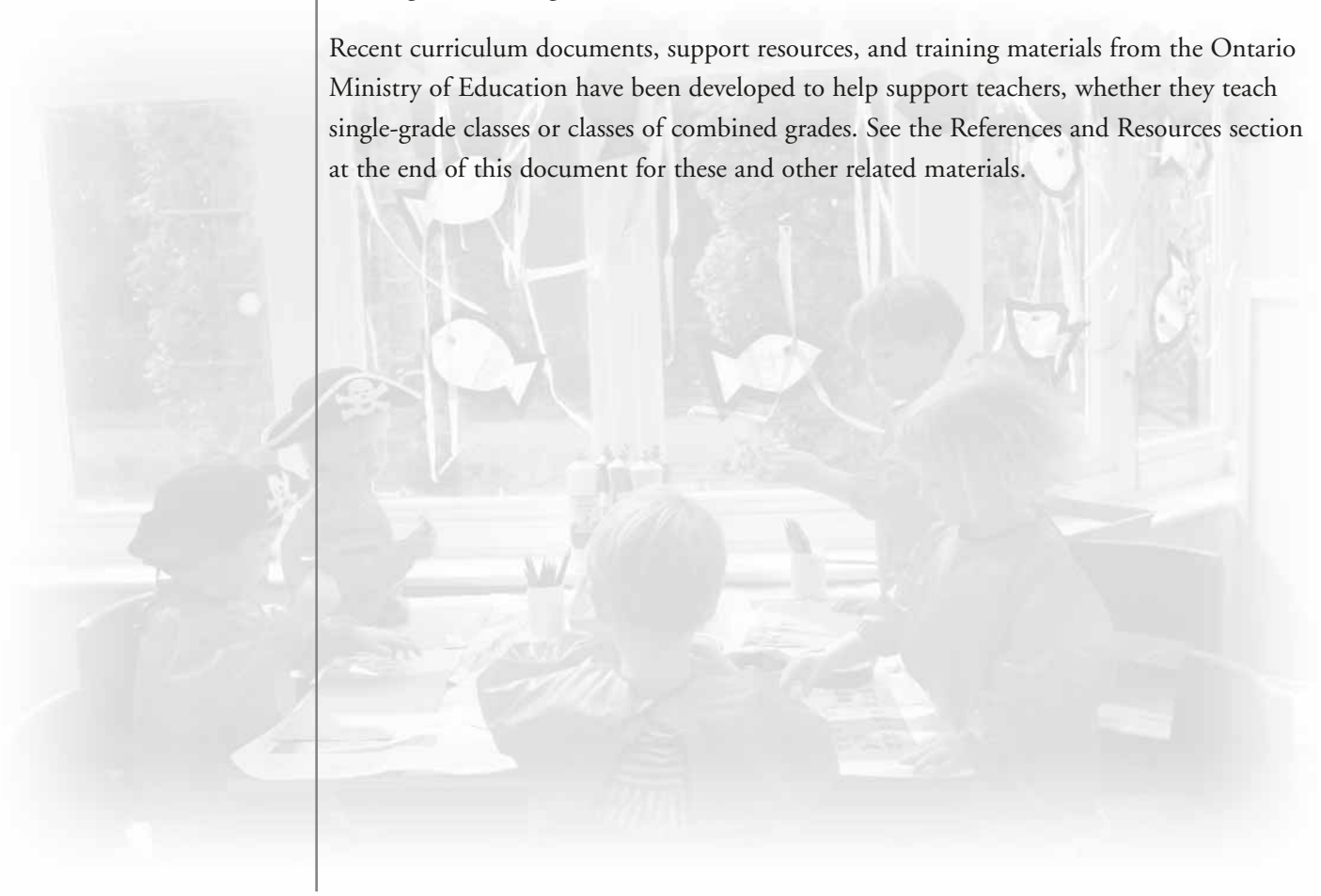
> *"Acknowledging diversity in every group of children and planning for ways to work with it rather than against it allows us to enhance all students' learning. … We create a community that sees 'difference' as an asset."*
>
> – Colleen Politano and Anne Davies, 1994, p. 32

In effective classrooms, emphasis is placed on creating a learning environment in which differences are regarded as assets. The community of learners in any classroom consists of learners with different skills – and different linguistic, cultural, and social backgrounds and perspectives – all working together. A group of students of different ages is necessarily rich in academic, social, and emotional differences. Students begin to see that learning happens over time in different ways for different people, and seeing such variations helps to strengthen the community of learners.

Teachers can also benefit from teaching classes of combined grades. Teachers of these classes have the advantage of seeing the larger picture – for example, seeing how strategies or approaches might work across a longer continuum of learning, as they plan units and lessons over a whole school year for more than one grade.

This resource document provides suggestions for organizing classes of combined grades and for planning instruction in such classes. It also outlines various strategies for teachers to use when teaching students in the literacy and mathematics "learning blocks", which are long periods of uninterrupted time – usually one hour or more – and which are vital for both teaching and learning in these areas.

Recent curriculum documents, support resources, and training materials from the Ontario Ministry of Education have been developed to help support teachers, whether they teach single-grade classes or classes of combined grades. See the References and Resources section at the end of this document for these and other related materials.



GENERAL CONSIDERATIONS FOR PLANNING

PROVIDING SUPPORT FOR TEACHERS OF COMBINED GRADES

> *"It is important for educators to learn together and to share their expertise in professional learning communities that extend across grades, across divisions, across subject areas, and among schools. By sharing their professional learning in a wider community, educators build the system-wide capacity to ensure that all students become successful literacy learners."*
> – *Literacy for Learning*, 2004, p. 103

How people work together as a professional community is of particular importance in the teaching of classes of combined grades. Student learning is the collective responsibility of all staff members. Teachers are supported through opportunities to collaborate with other staff, the sharing of resources, and coordination of timetabling of single-grade classes and classes of combined grades.

Classes of combined grades work effectively when there is common planning time with teachers of the same or adjacent grades. Common planning time gives teachers the opportunity to discuss various issues with other teachers more often, and thus facilitates the professional learning and work of all teachers involved.

Principals may consider the following questions when planning support for teachers:

- How can teachers work as a team to coordinate their timetables to allow the students in classes of combined grades to join single-grade classes for such subjects as social studies and science and technology?
- How can time be arranged in the daily timetable to ensure that such resource staff as the teacher-librarian, the ESL/ELD teacher, and the special education teacher are available to provide additional support for small-group instruction during learning blocks? Also, does the timetable for resource staff provide for flexible support?
- How can additional support be provided for small-group instruction within and outside the classroom when needed?
- Can common planning time be scheduled so that teachers of combined grades can work with single-grade teachers who are teaching one of the same grades?

- Can the timetables of subject-specific teachers (e.g., music, physical education, French as a second language) be coordinated with the timetables of teachers of classes of combined grades so that teachers of combined grades have opportunities to work with one grade while the other grade is with a subject-specific teacher?
- What role does teaching experience play in determining teaching assignments?
- What factors should be considered when combining grades that cross divisions?

> *"Supporting mathematics education and learning is a shared responsibility that encompasses all members of the educational community, including the Ministry of Education, district school boards, principals, … teachers, faculties of education, and parents. All partners play a vital role in ensuring that optimal conditions for learning and the necessary resources and professional development are present at all levels."*
>
> – *Teaching and Learning Mathematics*, 2004, p. 45

- What needs to be considered in a class of combined grades to facilitate the administration of EQAO testing?
- How can the school's literacy resource room be used to provide reading resources at the appropriate levels that appeal to students' interests and broaden their perspectives?
- What provisions can be made for teachers of combined grades to have opportunities for networking within and outside the school?
- How can trained volunteers be used to support specific learning tasks in classes of combined grades?
- How can schools make use of the Tutors in the Classroom program to support classes of combined grades?

In addition, board personnel could consider the following questions:

- What consideration has been given to developing school board guidelines regarding classes of combined grades to provide consistency in grade organization and in communication?
- What opportunities are there for principals to share ideas on effective ways of organizing classes of combined grades and of supporting teachers of combined grades?
- Are curriculum support materials that have been developed by the board available for teachers of classes of combined grades (e.g., social studies materials)?
- Has consideration been given to ensuring that all parents[3] are informed about classes of combined grades (e.g., developing a sample letter to parents and having it translated into the languages used in the community)?

3. In this document, *parent(s)* is used to refer to parent(s) and guardian(s).

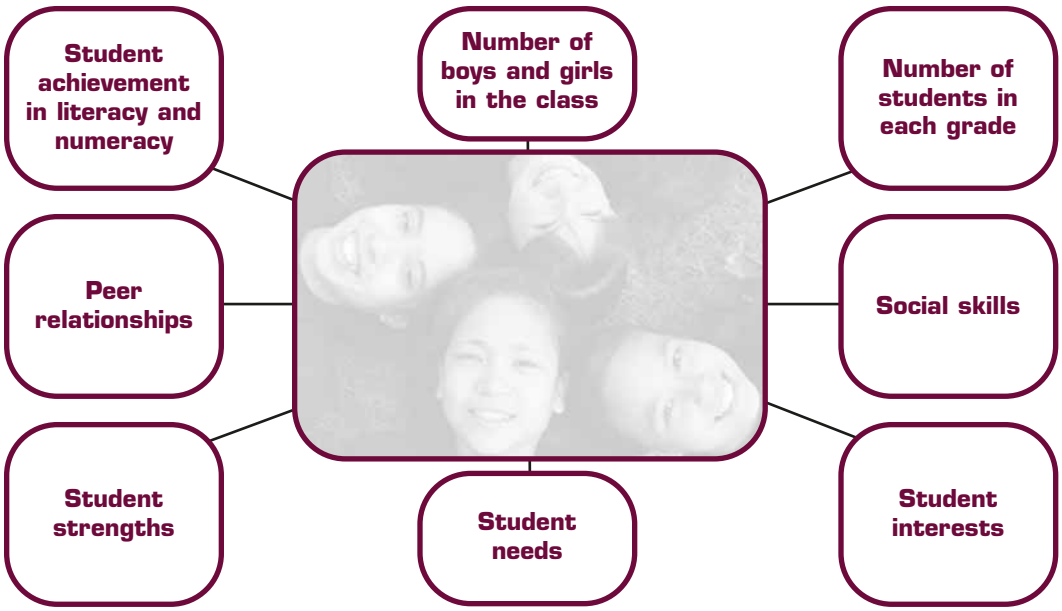
BUILDING CLASSES OF COMBINED GRADES

Given that the goal is to build a community of learners in every classroom, it is essential to ensure that the best interests of the students are central in all decisions about classroom organization. In order to ensure that the classes consisting of students from more than one grade are balanced in as many different ways as possible, principals and teachers need to take into consideration various factors, just as they do with single-grade classes. Some significant factors are the following:

> *"In successful schools, classrooms are organized to meet the learning needs of students. … Teachers create a culture of learning in the classroom that values each member of the learning community."*
> – *Literacy for Learning*, 2004, p. 96

- number of students in each grade
- number of boys and girls in the class
- social skills of the students (e.g., ability to cooperate or take the initiative)
- relationships with peers (e.g., ability to maintain friendships and to build new friendships)
- level of student achievement in literacy and numeracy
- students' strengths (e.g., degree of independence, ability in problem solving)
- students' needs (e.g., need for support in learning English, special education needs)
- students' interests

Factors to Consider in Organizing Classes



In assessing such factors, teachers can use the same assessment methods for students in classes of combined grades as they do for students in single-grade classes to identify the developmental phase of students.

Building balanced classes of students in combined grades is part of the process of equitable organization of *all* classes in the school. As they organize classes school-wide, principals and teachers should consider the social and emotional profiles, as well as the academic profiles, of the students. In doing this, it is useful to build a class profile to help classroom teachers to recognize students' strengths, needs, and interests.[4] Principals may be able to organize the classes in their school so that classes of combined grades have a smaller number of students in them than do single-grade classes.

ANSWERING PARENTS' QUESTIONS

Parents often have questions about the placement of their children in classes. The following are some frequently asked questions about classes of combined grades.

Why do you have classes of combined grades?

Most classes of combined grades are created to accommodate students in a school where it is not possible to create only single-grade classes. For example, if there are thirty Grade 2 students, thirty Grade 3 students, and three teachers, the only way to organize the children into smaller classes is to combine some students from both grades in one class. Some schools, however, choose to create classes of combined grades, so that their students have the opportunity to gain the academic and socio-emotional benefits associated with such classes.

What are the benefits of placement in a class of combined grades?

There are many socio-emotional benefits for students who are in classes with students of various ages. For example, in such classes, peer interactions have been shown to be very positive; students have opportunities for greater development of social skills and cooperation skills; and students often develop a feeling of comfort and security, a positive self-concept, and a sense of satisfaction with their achievements. There are also significant opportunities for development of leadership skills and for learning from peers. In studies measuring academic achievement, students in classes of combined grades were found to perform as well as students in single-grade classes.

Why was my child chosen to be in a class of combined grades?

When placing students in all classes, educators consider a variety of factors, including number of students, number of boys and girls, and students' interests, strengths, needs, learning styles, motivation, work habits, emotional development, and linguistic, cultural, and social backgrounds.

4. For details, see the expert panel report entitled *Education for All: The Report of the Expert Panel on Literacy and Numeracy Instruction for Students With Special Education Needs, Kindergarten to Grade 6* (Toronto: Ministry of Education, Ontario, 2005), chapter 4.

Will the teacher have as much time for each child in a class of combined grades?
The amount of time for an individual student is not determined by the organization of classrooms by grade. In all classrooms, teachers employ a number of instructional strategies to address the needs of all students. On a daily basis, teachers work with large groups, small groups, and individual students.

How do teachers prepare for teaching classes of combined grades?
Teachers develop the knowledge and skills to effectively manage any classroom, including knowledge of curriculum resources and flexibility in planning. Teachers also learn about which instructional strategies work well with the students in their class while they teach, whether it is a single-grade class or a class of combined grades. As well, the Ministry of Education and the local district school board provide many professional learning opportunities for teachers on planning and instruction.

"The older students really get to know their stuff through explaining it, younger classmates get peer role models, and everyone learns the importance of helping people."
– Trish Snyder, *Today's Parent*, October 2005

Will the child in the higher grade be sufficiently challenged?
Research has shown that there are no negative effects on academic achievement. Teachers design programs to challenge children at their appropriate academic level. In any given classroom, students have diverse needs and interests, and teachers spend a great deal of time planning a program so that it addresses this range. Along with the academic studies, students also learn to work with a cross-section of other students, reinforcing social and leadership skills. Research suggests that this is an advantage.

"Younger children actively use older children to develop skills and to acquire knowledge."

"Older children actively assert responsibility for younger ones and develop an increasingly sophisticated understanding of that responsibility."
– J. Feldman and P. Gray, 1999

Might the child in the lower grade be overwhelmed?
Teachers and principals are careful in selecting students who will be compatible in all classes. In any class, children show a range of development physically, emotionally, and academically. It is an advantage for younger children in a class of combined grades to have many people they can ask for help – both the teacher and older students. They may also benefit from being able to learn from older children who can model leadership and academic skills.

PLANNING INSTRUCTION

Long-Range Plans

The curriculum is the starting point for planning the content for both grades in the class. The purpose of long-range planning is to ensure that curriculum expectations are addressed in an appropriate sequence and that meaningful connections are made for students throughout the year. Since it is more of a challenge to align the various grade-specific topics covered in social studies and in science and technology in a class of combined grades, teachers should begin by laying out these topics for the whole school year.

The following are some suggestions for planning instruction over a school year:

- Align related topics and strands from the two grades. Focus on common "big ideas" and/or fundamental concepts and skills common to each grade.
- Decide on culminating performance tasks for each grade that will enable the students to demonstrate the expected learning. The same task may be used for both grades, with variations in content, product, or process to address the grade-specific expectations.
- Identify the writing/presentation forms, styles, organizational methods, and conventions required for the assessment tasks. Literacy instruction can be focused on different aspects of writing and presentation over the course of the year.
- Decide on reading materials that would fit best with the content and writing/presentation forms to enable students to develop their reading and writing skills. Consider which oral-language and media texts will be explored during each unit. Include other related literature.
- If possible, align mathematics, the arts, and health and physical education topics. Total alignment is not possible, and forcing topics together without taking into account the integrity of the subject content is not helpful. However, the more connections that can be made among different subject areas, the more it is likely that students will transfer skills from one area of learning to another.

The following are examples of parts of an overall plan focusing on social studies (page 11) and science and technology (page 12) for a Grade 4 and 5 class.

Social Studies

Months	Topics and Performance Tasks	Writing Focus: Forms/ Elements	Guided Reading	Reading Aloud	Arts Connections
September/ October	Medieval Times + Early Civilizations				
	Write a report and do a presentation on an aspect of medieval life or an early civilization	Report writing with a focus on: – selection of ideas – organization of content	Reports in texts at specific levels from various publishers Reports from the Internet	A variety of texts that support content and engage students (e.g., texts that support "big ideas" common to both grades or that contain grade-specific content)	Music and visual art of a medieval or an early civilization Presentation from the point of view of a character of the time (drama)

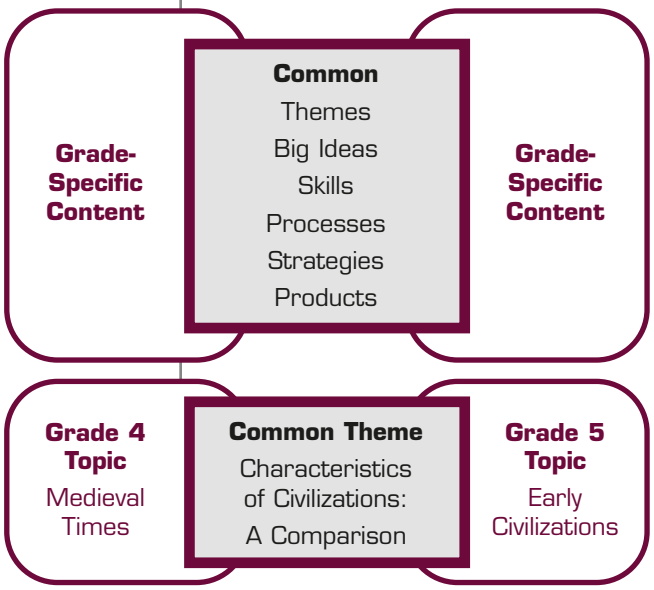
Science and Technology

Months	Topics and Performance Tasks	Writing Focus: Forms/ Elements	Guided Reading	Reading Aloud	Social Studies Connections
October/ November	Pulleys/Gears + Forces				
	Design, build, and test a mechanical system that uses pulleys and/or gears to perform a specific function, and write instructions for its set-up and operation	Procedure writing with a focus on: – selection of ideas – organization of content	Procedures in texts at specific levels from various publishers Procedures from the Internet	A variety of texts that support content and engage students (e.g., texts that support "big ideas" common to both grades or that contain grade-specific content)	Use of pulleys and gears in machinery and equipment in medieval times or in an early civilization

Unit Plans

Once topics have been laid out for the year, teachers should begin planning instructional units to integrate learning, keeping a culminating performance task in mind. The following are some suggestions for planning individual units:

- Focus instruction on "big ideas" and/or fundamental concepts and skills common to the two grades.
- Look for common threads between the different grade expectations, and identify themes and concepts that connect the two topics. Structure plans to focus on common themes, fundamental concepts or skills, and/or common processes, strategies, or products. (See the two diagrams on the left, the first showing possible common areas, the second showing an application to two grades of social studies.)

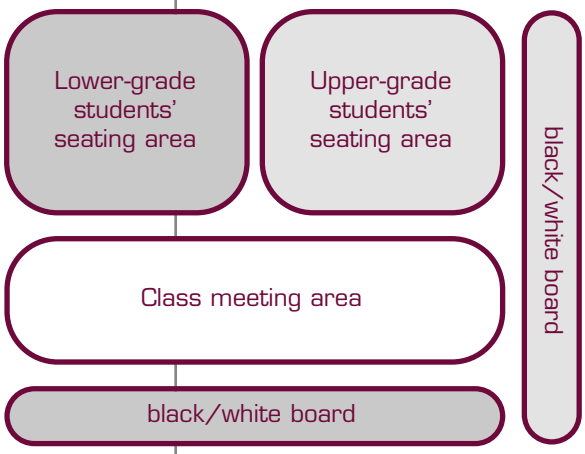


- Organize the unit around inquiry, which is a powerful learning tool. As students explore a topic, they seek out the learning experiences and resources that meet their needs. Common strategies and processes can be applied to different content.
- Use assessment and performance tasks for each grade in order to differentiate instruction as necessary.

- Design lessons that focus on developing appropriate skills and knowledge in the subject, as well as literacy skills. Vary products, processes, content, and text levels to suit the grade and the needs of students.
- Use the same resources, where possible, across the grades for students who have similar levels of skill development and who show a similar level of sophistication in their understanding of the expectations in the language curriculum.
- Plan common lessons. Then plan student activities related to the lessons that can help students to deepen knowledge and understanding, use reasoning and strategies, and apply concepts, skills, or strategies explicitly taught during the lesson. These activities can be done in cross-grade or grade-specific groups or by individual students. The groups should be flexible. The activities should take into consideration the grade-specific topic of inquiry, required skills, developmental needs of the students, level of difficulty of the texts, and students' interests. Lessons need to be flexible to allow for responsive teaching as students progress. Different groups can develop expertise in a specific area and report back to the class in order to contribute to the learning of the whole class.
- Plan for similar and developmentally appropriate activities for students in both grades to do in health and physical education and in the arts.

ESTABLISHING AN EFFECTIVE LEARNING ENVIRONMENT

Effective learning environments are intellectually challenging, developmentally appropriate for all students, and organized for particular purposes. Within such a learning environment, students learn through discussions, through posing questions for clarification and further inquiry, and through modelling and analysing ideas using multiple representations (e.g., manipulatives, drawings, symbols, words). In such social learning contexts, students develop and refine their thinking about ideas, strategies, and solutions, as well as themes and concepts in various subjects. Learning in this environment fosters the students' and the teacher's curiosity, perseverance, and confidence. Specific strategies for establishing the learning environment for a classroom with combined grades are outlined below.



- Use a variety of seating arrangements to support student interaction and learning at different times, such as same-grade group seating to enable same-grade interaction; a grade-specific meeting area near a black/white board at the side of the classroom for discussing grade-specific instructions or displaying grade-specific solutions and strategies; a seating area for whole-class discussion of diverse solutions and strategies at the main black/white board (see diagram).

- Organize the classroom space so that students can independently access learning materials that are organized and labelled in bins in designated areas.
- Provide students with routines for selecting and distributing learning materials, so that the teacher can focus on student learning rather than on classroom organization logistics. For example, organize the students in same-grade learning groups, and make each group responsible for one week for distributing and collecting journals, manipulatives, hand-outs, and assignments. Keep a running list of the responsibilities of the "group of the week" for each day, so that all members of the group know their responsibilities.
- Provide instructional routines so that students know what to expect when beginning specific activities. For example, provide a routine in which students record their thinking on chart paper or on the black/white board and then discuss their work with the teacher at a pre-arranged time. Such routines are necessary so that students can be sure to have discussion time when the teacher is not working with the other grade.

The following are suggested examples of supports[5] that can help students to independently access grade-specific and other materials.

Use of Space	Physical Resources	Routines
Easy access needs to be provided to materials and to different areas of the classroom. The classroom should include the following: • tables in locations with a view of the rest of the room • storage shelves with organized, labelled materials (e.g., reading materials, manipulatives for math) • large-group meeting area • conference area • small-group meeting area • individual spaces • comfortable reading corner	The following resources should be easily available to students: • conference table and chairs • chart/big book stand or easel • chart paper and markers • carpet for meeting area • places to hang charts • assorted writing paper and tools (e.g., paper with varying sizes of lines and empty spaces, pencils, erasers, staplers, hole punch, date stamp, tape, envelopes, calculators, graph and dot paper)	Explicitly model and reinforce procedures for such common routines as the following: • school/classroom entry and dismissal • storage of notes and/or planners carried to and from home • transitions and the signals for them (e.g., music, songs, chants, hand signals) • movement from one activity/location to another • problem-solving plans for common occurrences (e.g., bathroom routine; what to do if the teacher is busy with others) *continued*

5. These lists are adapted from lists provided in the ministry's pocket folder called *Differentiated Instruction: Continuing the Conversation*, published in 2006.

Use of Space	Physical Resources	Routines
• storage of materials that facilitate routines (e.g., sharp pencils, assortments of paper) in locations that are easily accessible to students • displays of books in many locations • an accessible word wall that allows words to be manipulated (e.g., words held with push pins) • desks that may be moved to suit student needs (e.g., arranged in groups) • space for volunteers to work • accommodations for students with special needs (e.g., wheelchairs, special seating)	• manipulatives (e.g., magnetic letters/numbers, letter/number cubes, letter tiles and blocks, coloured tiles, coloured rods, Mira, linking cubes, rulers, measuring tools, protractors) • reading "wands" and pointers • sticky notes • highlighters, highlighting tape, and/or waxed pipe cleaners (for circling and underlining charts) • word-wall cards and fasteners • bins for organizing and displaying books and math tools • tape recorders and blank tapes • personal listening devices and headphones • class set of small white boards, markers, and erasers (e.g., socks) • folders for student work • pocket charts • reading "phones" • retelling props (e.g., sequence cards, gloves, felt boards, story ladders, beach balls with prompts written on them) • wide range of text sources • portfolios or files for collecting student data	• materials management (e.g., finding sharp pencils and other writing tools) • reading with a partner or independently • book selection • finding reading locations in the room • procedures for handling work that is finished and work that is unfinished • options when work is completed • clean-up procedures • stages in writing- and reading-process workshops • guided-reading schedules • daily agenda

Text Resources	Anchor Charts	Visual Supports for Explicit Lessons
Text resources need to be varied, engaging, and suited to the needs and interests of students. They may include the following: • familiar songs, chants, big books, nursery rhymes, novels (selected with consideration of the school community) • new songs, chants, big books that can be used for shared-reading lessons for specific teaching points • texts from previous grade (e.g., poems and chants that had been posted in the classroom; class songbooks; student-made books in various languages) • texts that encourage personal connections (e.g., narratives about children of a similar age, dual-language books) • texts suitable for the range of levels reflected in the students' literacy profiles • balance of fiction and non-fiction • reference texts (e.g., atlases, dictionaries, world records, picture encyclopaedias, maps) • a variety of genres • non-fiction texts to support grade-specific science, social studies, and math inquiry • anthologies • magazines and other media • sources of rich mathematical problems	Anchor charts can be referred to often as they reinforce concepts that have been introduced through lessons. The most effective charts are those that are created with students and that are large enough to be read across the classroom. The following are some examples: • "looks like/sounds like" charts (T-charts) for partner reading, self-selected reading, effective listening • "looks like/sounds like/feels like" charts for work habits, problem solving, engaged learners, independent work • comprehension-strategy charts with sentence starters • sample graphic organizers and examples of what they look like when they are completed effectively • "mission statements" or "respect agreements" • classroom helper charts • class-routine reminders • problem-solving charts • reading-strategy reminders • alphabet lines • daily schedule • word lists of frequently used words or words from a particular category • writing forms and conventions • writing elements or traits • media techniques • rubrics or criteria for achievement	Routines, procedures, strategies, skills, and information are introduced through explicit lessons that model expectations for the students. These might include mini-lessons to address the following: • shared reading – students' roles • letters/sounds – introduce, review, and reinforce • writer's workshop – routines • book selection – choosing a "just right" book • roles and responsibilities of the class team, and agreements • group skills – taking turns, listening to others • the school/class behaviour code • partner reading – the 5 Ws • word-solving strategies – how to use the variety of strategies available • use of classroom materials (e.g., student notebooks, classroom library books, pencil sharpeners, staplers) • voice levels – appropriate levels for a variety of situations and places • signals for turn-taking (e.g., raising a hand) • classroom signals for transitions and the responses that are expected for each one *continued*

Text Resources	Anchor Charts	Visual Supports for Explicit Lessons
	• numbers and pattern charts • charts with illustrations and definitions of key math concepts • higher-level question prompts	• problem solving in common classroom situations (e.g., what to do when the teacher is working with another individual or group; how to handle someone who is interrupting your concentration) • higher-level questions • contextual problem-solving prompts

PLANNING LITERACY INSTRUCTION

USE OF LITERACY ASSESSMENT IN INSTRUCTION

> *"Professional judgement is valued and integral to quality classroom observation."*
> – Manitoba Education and Youth, 2003, p. 3.3

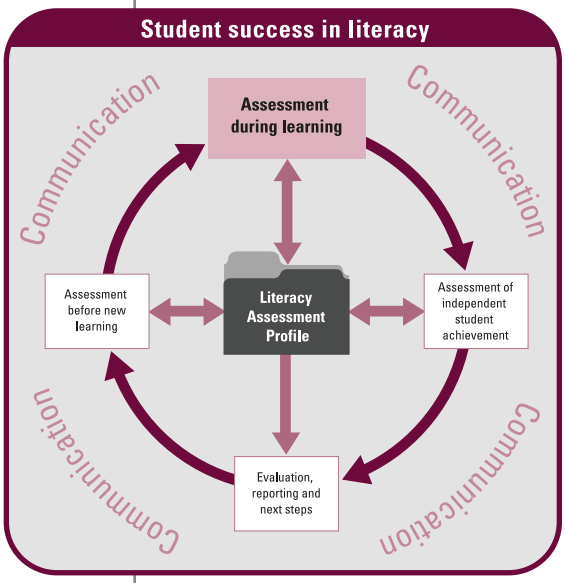
A variety of assessment strategies and tools should be in place to inform classroom instruction in both single-grade classes and classes of combined grades. In addition to grade-specific assessments, developmental continua – such as those provided in the ministry's guides to effective instruction in reading and writing for both primary and junior grades[6] – allow teachers to determine a student's phase(s) of development in reading, writing, and oral language. The information gained through these assessments provides teachers with the insights required to plan for focused instruction.

> *"**Assessment** is the ongoing, systematic gathering, recording, and analysis of information about a student's achievement, using a variety of strategies and tools.*
>
> ***Evaluation** involves making a judgement about the level of a student's achievement on the basis of assessment data, and assigning a level, grade, or mark. The judgement is based on the student's best and most consistent performance."*
> – *A Guide to Effective Instruction in Reading, Kindergarten to Grade 3,* 2003, p. 12.3

Teachers use assessments to inform their instruction before, during, and after teaching a unit. At the beginning of instruction, a teacher uses diagnostic assessments to provide information on the students' current performance levels. Teachers use this information to plan activities for guided-reading groups, to plan the focus of whole-class instruction, and to determine the correct reading level for independent reading resources for the students. As students progress, teachers provide them with opportunities to "say, write, and do" on a daily basis to enable them to demonstrate their learning. Hargreaves (2001) believes that classes of combined grades lend themselves well to the use of formative-assessment tools, which are used with individuals instead of a large, supposedly homogeneous age group. These formative-assessment tools allow teachers to see the progress their students are making as they acquire new skills. Diagnostic and formative assessments are done primarily for the purposes of determining a student's learning needs and providing feedback to the student. The assessments that teachers do after teaching are assessments

6. Ministry of Education, Ontario, *A Guide to Effective Instruction in Reading, Kindergarten to Grade 3, 2003*, oral language continuum, pp. 3.21–3.25; *A Guide to Effective Instruction in Writing, Kindergarten to Grade 3, 2005*, writing continuum, pp. 1.5–1.8; and *A Guide to Effective Literacy Instruction: Grades 4 to 6: Volume One, 2006*, reading continuum, pp. 67–73.

of what the student has learned, and they also help provide teachers with direction for further programming. An important part of the whole process is the teacher's professional judgement, which is a cornerstone of the assessment and evaluation of student achievement. As well, it is crucial in all assessments that the teacher give timely feedback to the student.



In addition to assessments by the teacher, students should also assess their own progress as they learn. This self-assessment is a fundamental component of the language curriculum. Self-assessment and goal setting provide an opportunity for students to be involved in and accountable for their own learning.

Suggested assessment tools and strategies for teachers include rubrics, portfolios, classroom-based observations, formal and informal conferences, records of reading behaviour, and performance tasks. A more complete list may be found on page 12.7 of the ministry publication *A Guide to Effective Instruction in Reading, Kindergarten to Grade 3, 2003*. Further information on literacy assessment may be found in chapter 7 of the expert panel report *Literacy for Learning: The Report of the Expert Panel on Literacy in Grades 4 to 6 in Ontario, 2004*, and in the ministry's *Guide to Effective Literacy Instruction, Grades 4 to 6: Volume Two, 2006*, which is entirely devoted to assessment.

PLANNING FOR DIFFERENTIATED INSTRUCTION

Once early assessments have been completed, the teacher of a class of combined grades – just like the teacher of a single-grade class – needs to plan ways of addressing various identified needs regardless of the students' age or grade. Differentiating instruction involves creating an equitable environment in which all students can be successful in achieving curriculum goals. In response to student needs, teachers of classes of combined grades differentiate instruction by selecting content, text levels, instructional approaches, and tasks that are appropriate for the student. An effective way to differentiate instruction for a whole class is to develop open-ended assignments with various points of entry and exit. In accordance with Vygotsky's "zone of proximal development" (1978), teachers begin with a student's current developmental phase(s). Through teacher modelling and demonstration of skills, and through shared and guided practice, students progress to perform at a higher level (see chart on page 20).

Zone of actual development	Zone of proximal development		New zone of actual development
STUDENT	**TEACHER**	**JOINT**	**STUDENT**
What the student can already do independently	Assistance from teacher, peer, or environment	Transition from receiving assistance to working independently	What the student can do independently or in peer-led groups
	Gradual release of responsibility to the student		
Independent	**Instructional Approaches** **Modelled**	**Shared** **Guided**	**Independent**

Adapted from *A Guide to Effective Literacy Instruction, Grades 4 to 6: Volume One, 2006*, p. 79.

INSTRUCTIONAL APPROACHES

Teachers regularly use the instructional strategy of scaffolding, in which they allow the students to build on their prior knowledge, provide support to the students while they learn a new concept, and then gradually shift the responsibility for applying the new concept to the students. Instructional approaches that are part of scaffolding – for example, approaches that involve modelled, shared, guided, and independent activities – are the foundation for instruction for all learners in all grades. Although teachers of classes of combined grades have the additional challenge of planning and providing small-group and whole-group instruction for more than one grade, the developmental continua outlined in *A Guide to Effective Literacy Instruction, Grades 4 to 6: Volume One, 2006* can be used to guide instruction, just as they are used to guide instruction of one grade. An approach to literacy instruction that incorporates modelled, shared, guided, and independent reading and writing opportunities is useful in meeting the continuum of learning needs in any classroom. The gradual release of responsibility, as shown in the chart above, provides for explicit teaching that is based on assessment that informs classroom instruction. Practical support for these approaches is also provided in the ministry's guides to effective instruction in reading and writing for Kindergarten to Grade 3.

THE LITERACY LEARNING BLOCK

The purpose of long-range and unit planning is to ensure that the curriculum expectations are addressed in the various units over the school year. The purpose of daily and weekly planning is to ensure that teachers can respond flexibly to the ongoing needs of students during the course of a unit.

The "literacy learning block" is the daily instructional context in which students receive explicit teaching of the curriculum expectations. It is a block of time provided to enable students "to develop their literacy skills, explore topics thoughtfully and thoroughly, engage in research and inquiry in all subject areas, and apply their learning in new contexts."[7] Teachers provide students, either in flexible groups or individually, with explicit instruction that is appropriate to their assessed needs and interests, using engaging materials, activities, and strategies. They select appropriate content, processes, products, and text levels. As teachers continually assess student learning, they provide appropriate feedback to the students, so that the students can monitor their own understanding. Teachers also adjust unit plans and the specific learning focus of a unit to respond to the assessed needs of the students throughout the unit. Differentiating instruction in such ways is crucial to meeting the needs of the variety of learners in a class of combined grades.

Use of Explicit Teaching

Teachers incorporate explicit teaching as part of their repertoire of strategies that have been found to be highly effective for responding to the needs of their students. Explicit teaching provides instruction and modelling that enable students to progress from needing complete teacher support towards working independently. The sequence of support offered is as follows:

1. Clearly state the learning goal to the students.
2. Explain to the students how they are to accomplish the task. Teachers can break the task down into three or four simple steps and describe the steps both orally and by using visual means.
3. Show students what they are to do.
4. Guide the students as they apply the new learning. It is important that teachers give students many opportunities to practise a new skill before they are expected to apply the new learning independently. It is also important to provide feedback on their progress.

Use of Flexible Groupings

Throughout the learning block, students receive instruction as a whole class, as well as individually and in small, flexible groups. The following are some suggested strategies for forming groups:

- Teachers may form small, homogeneous groupings for students who have similar learning needs, using assessment information as a basis (e.g., information in records of reading behaviour or on the stage of language acquisition in ESL/ELD).
- Heterogeneous groupings may be formed where students have different interests and/or different levels of achievement and skill development. These groupings may be formed to emphasize students' strengths, backgrounds, and interests (e.g., literature circles).

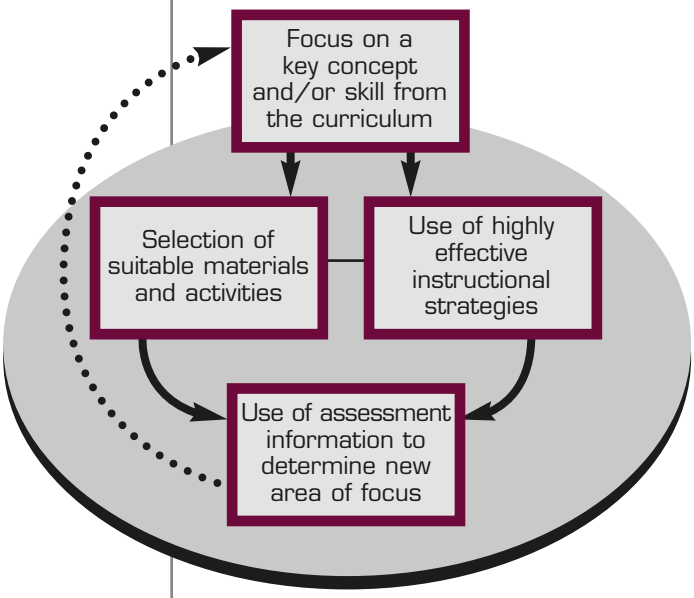
7. Expert Panel on Literacy in Grades 4 to 6 in Ontario, *Literacy for Learning: The Report of the Expert Panel on Literacy in Grades 4 to 6 in Ontario* (Toronto: Ministry of Education, Ontario, 2004), p. 29.

"Cooperative learning, which emphasizes the process as well as the product of group work, gives all students opportunities to deepen their understanding and to develop their problem-solving skills through purposeful talk, to work effectively with others (from a variety of cultural backgrounds), to develop friendships that otherwise may not happen, and to experience the satisfaction that comes from helping others."
– *Many Roots, Many Voices*, 2005, p. 22

- Groups may consist of students in more than one grade. For example, during literature circles, teachers may have Grade 2 students read informational text about animals while Grade 3 students read informational text about plants.
- Students may also be grouped with a partner for specific purposes (e.g., for peer coaching or tutoring).

Planning Daily Mini-lessons and Activities

Lessons can be delivered through instructional approaches that make use of modelled, shared, guided, and independent activities during the learning block. Teachers may wish to work with the whole group at the beginning and then with small groups or individuals during the mid-portion of the block. The lesson focus, student activities, and/or teaching strategies may be different for different grades or groups, depending on need or content. Ongoing informal assessments and observations of students, as well as feedback provided to students, inform the selection of concepts and skills for subsequent lessons and strategies or activities. The following diagram illustrates this approach.



Instructional Approach

Early in the year, mini-lessons can focus on establishing routines and procedures, as well as on content, while the teacher assesses the students' present level of learning. The mini-lessons then evolve into content lessons that respond to assessments. Although unit plans are laid out in advance for the school year, the learning-block content should be flexible and responsive to student needs. Teachers assess and provide ongoing feedback to students, and adjust their lesson plans to respond to student learning.

Selecting the focus, activities, and strategies for a mini-lesson

Teachers can ensure that the specific literacy needs of students are met by choosing an appropriate literacy focus each day for mini-lessons associated with the unit plans. The focus for each lesson is based on key concepts and skills in the Grade 1 to 8 language curriculum and on the teacher's assessment of different student needs in relation to the concepts and skills regardless of grade (see the following chart).

	Strand	Examples of Key Concepts and Skills
METACOGNITION AND INTERCONNECTED SKILLS	**Oral Communication**	• listening and critical literacy • speaking (formal and informal)
	Reading	• reading for meaning – comprehension strategies – critical literacy • understanding of form and style • reading with fluency
	Writing	• the writing process • forms, structures, and genres • writing traits and elements
	Media Literacy	• understanding of media texts (analysis and critical literacy) • media forms, conventions, and techniques • creating media texts

Teachers select literacy materials at appropriate levels to illustrate the mini-lesson focus. They then decide on specific activities for the lesson, which provide precise, responsive instruction to address student needs and interests. In addition, they select instructional strategies that have been shown to be highly effective as ways of supporting student learning, taking into account students' learning preferences, needs, and interests.

The chart on page 24 lists a few instructional strategies and learning activities that may be used for a lesson focused on developing the skill of "reading with fluency". In this example, instructional strategies are chosen as methods of supporting students in developing this skill, and activities are chosen to address various aspects of the skill. Instructional strategies listed here can be used with any of the sample activities, and vice versa.

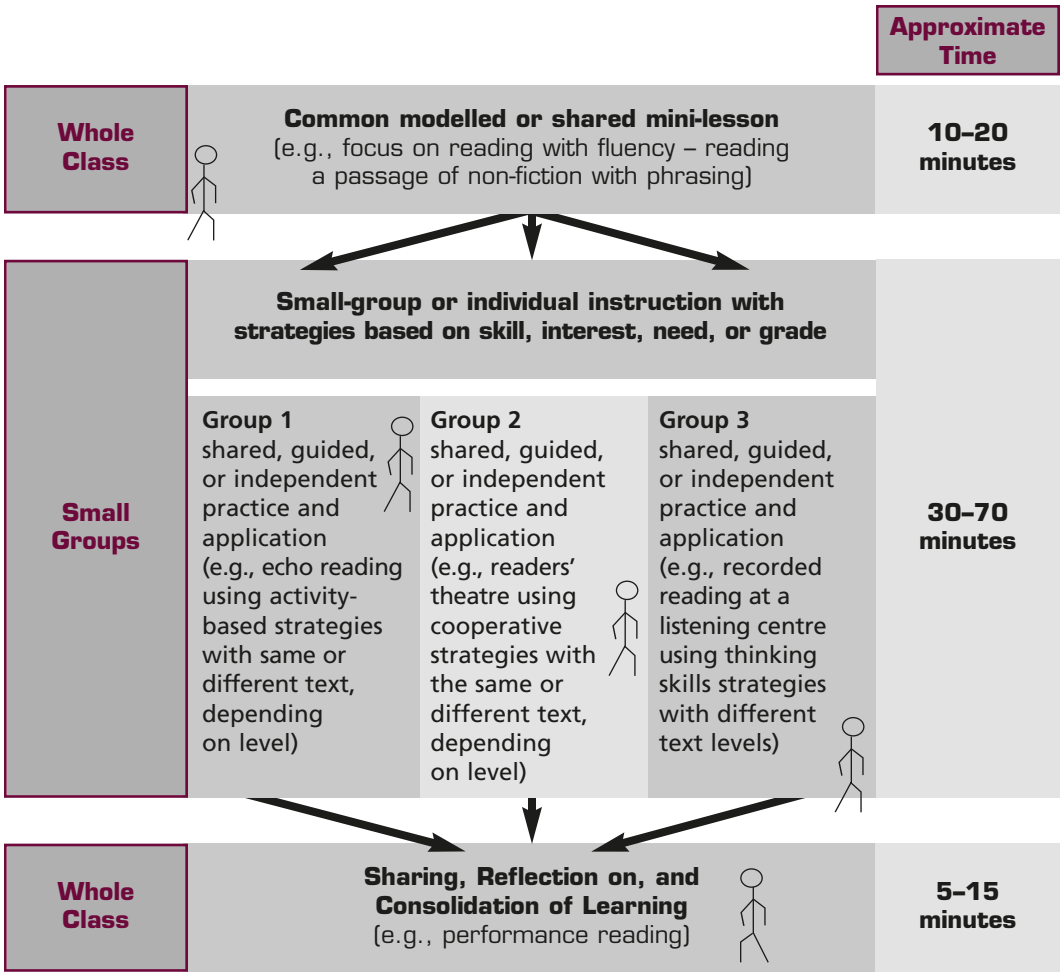
Many other ideas are available from the ministry's guides to effective reading, writing, and literacy instruction, as well as from the ministry's resource document *Think Literacy: Cross-Curricular Approaches, Grades 7–12, 2003* (which is adaptable for junior students), and from various commercial resources that are available. As well, the Ontario Curriculum Planner (www.ocup.org) outlines several effective strategies referred to in the chart on page 24.

Sample Focus – Reading With Fluency	
Instructional Strategies	**Sample Activities**
• activity-based strategies • arts-based strategies • cooperative strategies • direct instruction • independent learning • strategies for different learning styles • inquiry and research models • technology- and media-based applications • strategies to develop thinking skills	• repeated reading • radio reading • echo reading • buddy reading • readers' theatre • reading circles • word-wall entry • performance reading of speeches and poems • tape-recorded reading • reading while listening

Sample sequence of instruction in a mini-lesson

Mini-lessons can be taught using whole-class, small-group, and individual instruction. The following is a sample instructional sequence for one daily learning block:

1. ***Instruction of the whole class.*** The learning block can first be set up so that there is whole-class instruction in a mini-lesson about an aspect of learning that is critical for the class as a whole. This initial instruction is done through modelling, demonstration, and thinking aloud, and/or through shared-reading, writing, oral-language, or media experiences.
2. ***Instruction for small groups or individuals.*** Students then are divided into small guided-reading groups, or they can go to a learning centre to do independent activities. They are expected to practise and apply critical skills with teacher input and feedback. The teacher should vary group composition and teaching focus on the basis of student needs. He or she should focus on supporting and guiding the learning of one group, then circulate to monitor, observe, provide feedback and support, and assess learning in the other groups (see diagram on page 25).
3. ***Instruction of the whole class.*** Finally, the class is brought together again for the purpose of sharing, reflecting on, and consolidating learning gained from the learning block. In this way, curriculum is covered and support is given to all learners to accommodate their learning needs and interests, as well as the requirements of the expectations for their grade.



The teacher first directs the lesson with the large group, then circulates among the groups to guide and support students' learning, and finally facilitates sharing, reflection on, and consolidation of learning.

A CHECKLIST FOR MONITORING EFFECTIVENESS OF LITERACY INSTRUCTION

Once the flexible learning block is comfortably in place and the year progresses, it is helpful to use the following "Planning Checklist for Effective Literacy Instruction", which is taken from *A Guide to Effective Literacy Instruction, Grades 4 to 6: Volume One, 2006* (pages 107–108), to monitor the refinement of literacy instruction for classes of students in combined grades.

Planning Checklist for Effective Literacy Instruction

The following strategies should assist teachers when planning literacy instruction for all learners but especially those whose readiness is low in relation to the general skills and specific goals the teacher has identified.

Assessment for Learning:

- ❑ Have I assessed student readiness?
- ❑ Have I assessed student interests?
- ❑ Have I assessed student learner profiles, considering multiple intelligences and learning styles?
- ❑ Does my assessment inform my instruction?
- ❑ Is my assessment fair and equitable?

Content:

- ❑ Have I identified the main ideas or concepts that I want students to understand at the end of this lesson/unit?
- ❑ Are the Ontario curriculum expectations addressed?
- ❑ Have I planned for collaboration and co-teaching?
- ❑ Have I sought students' input into the planning process and considered their lives outside of the school context?
- ❑ Have I considered antiracist issues and gender issues?

Process:

- ❑ Have I considered readiness, interest, and learner profiles, including diverse life experiences?
- ❑ Have I planned for students to access their schema?
- ❑ Have I considered cross-curricular links?
- ❑ Have I included support staff?
- ❑ Have I built in opportunities for independent work?
- ❑ Have I scaffolded new learning?
- ❑ Have I planned for practice and feedback throughout the lesson/unit?
- ❑ Does my process allow for flexible grouping?
- ❑ Do my work spaces allow students to work in groups, pairs, or independently?

Planning Checklist for Effective Literacy Instruction – Continued

- ❑ Have I allowed for differentiation based on interest? Ability? Learner profile?
- ❑ Have I allowed enough time to explore materials, reflect, and share learnings?
- ❑ Are there a variety of instructional strategies, reading and writing activities, and hands-on investigations?
- ❑ Have I included graphic organizers?
- ❑ Are there sufficient interesting, useful, and varied resources to support this unit?
- ❑ Have I considered multiple intelligences when planning learner opportunities?
- ❑ Do my planned activities reflect the "lifelong learnings" – the essential concepts – I want my students to attain and retain?
- ❑ Have I posted reference points around the classroom?
- ❑ Are students comfortable and familiar with transition routines and group work?
- ❑ Have I established respect for the diverse needs and paths of discovery for all students in my class?
- ❑ Do I have a balance of teacher-guided, student-guided, compulsory, and differentiated activities?
- ❑ Have I allowed for independent projects?
- ❑ Have I planned on using a taxonomy of higher-order thinking for critical questioning and thinking?
- ❑ Have I created contracts that allow for goal setting and time management?

Products:

- ❑ Have I provided clear expectations of the culminating task?
- ❑ Does the culminating task reflect student readiness, interest, and learner profiles?
- ❑ Have I built in self-assessment checklists and feedback loops that students can access while creating the final product?
- ❑ Are products varied in means of expression, difficulty/complexity, and evaluation?
- ❑ Have I considered student choice?
- ❑ Have I considered possible extensions?
- ❑ Have I provided opportunities for student input?
- ❑ Have I considered the needs of all of my students?

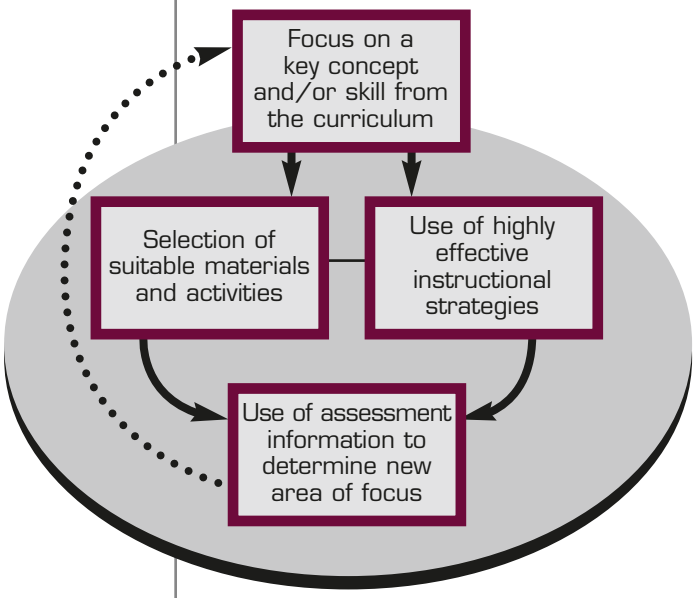
PLANNING MATHEMATICS INSTRUCTION

THE MATHEMATICS LEARNING BLOCK

The mathematics learning block is the daily instructional context where students are provided with focused instruction of grade-specific mathematics curriculum expectations. The primary and junior expert panel reports on mathematics[8] recommend that mathematics be given a one-hour block of uninterrupted time each day.

During this daily learning block, teachers focus instruction on key concepts and/or skills outlined in the Grade 1 to 8 mathematics curriculum and the teachers' assessment of students' prior knowledge and experience, interests, and learning needs. Teachers select learning materials that are appropriate for the lesson focus. They then decide on specific activities for precise, responsive instruction to build on students' knowledge and interests. In addition, instructional strategies that have been shown to be highly effective may be selected as ways of delivering those activities, taking into account student learning preferences, needs, and interests.

As teachers assess student learning, they provide appropriate feedback so that students can reflect on and take action to improve their own mathematical knowledge and skills. The results of assessments can help teachers reflect on the lesson and adjust the focus of subsequent lessons in order to better facilitate student learning and improve student achievement. The diagram on the left illustrates this approach.



Instructional Approach

8. Expert Panel on Early Math in Ontario, *Early Math Strategy: The Report of the Expert Panel on Early Math in Ontario* (Toronto: Ministry of Education, Ontario, 2003), and Expert Panel on Mathematics in Grades 4 to 6, *Teaching and Learning Mathematics: The Report of the Expert Panel on Mathematics in Grades 4 to 6 in Ontario* (Toronto: Ministry of Education, Ontario, 2004).

PLANNING A MATHEMATICS PROGRAM

Effective mathematics programs include problem-solving-based mathematical tasks. Lessons that include such tasks engage students at their level of mathematical readiness. Such lessons also provoke students to: develop conceptual understanding; generate, select, and use appropriate procedures, algorithms, and problem-solving strategies; and activate multiple representations of their mathematical thinking. Through such tasks, students engage in solving problems and examine their mathematical thinking as a way to learn mathematics.

Generally, mathematics lessons can be organized according to one of three instructional designs:

- exploration/investigation
- guided instruction
- modelled/direct instruction

The instructional lesson design is selected to support the type of mathematics that is to be learned, which may include:

- concepts
- procedures/algorithms
- strategies (e.g., mental math, problem solving)

A Problem-Solving Model

Understand the Problem (the exploratory stage)
➤ reread and restate the problem ➤ identify the information given and the information that needs to be determined ***Communication:*** talk about the problem to understand it better
Make a Plan
➤ relate the problem to similar problems solved in the past ➤ consider possible strategies ➤ select a strategy or a combination of strategies ***Communication:*** discuss ideas with others to clarify which strategy or strategies would work best
Carry Out the Plan
➤ execute the chosen strategy ➤ do the necessary calculations ➤ monitor success ➤ revise or apply different strategies as necessary ***Communication:*** ➤ draw pictures; use manipulatives to represent interim results ➤ use words and symbols to represent the steps in carrying out the plan or doing the calculations ➤ share results of computer or calculator operations
Look Back at the Solution
➤ check the reasonableness of the answer ➤ review the method used: Did it make sense? Is there a better way to approach the problem? ➤ consider extensions or variations ***Communication:*** describe how the solution was reached, using the most suitable format, and explain the solution

Taken from *The Ontario Curriculum, Mathematics: Grades 1 to 8, 2005*, revised, p. 13.

Lessons systematically include parts of the problem-solving process: Understand the Problem, Make a Plan, Carry Out the Plan, and Look Back at the Solution. (See the chart to the left.) As well, lessons are organized to activate and build on students' prior, intuitive, and informal knowledge of mathematics and to foster mathematical communication.

Some specific strategies for curriculum programming and planning for classes of combined grades include: becoming familiar with the adjacent mathematics curricula; developing a mathematics curriculum map; identifying similarities and differences in expectations across grades; developing a mathematics unit plan; choosing learning materials; and choosing lesson problems. These strategies are discussed on the following pages.

Becoming Familiar With the Adjacent Mathematics Curricula

Be familiar with the mathematics curriculum expectations for the grade *before* and the grade *after* the two combined grades. This familiarity helps ensure that the curriculum plan focuses on the continuity of mathematics learning. As well, such familiarity prevents gaps and repetition in the presentation of the curriculum expectations. For example, a teacher preparing a curriculum for a combined Grade 3 and 4 class in the area of Geometry and Spatial Sense, Location and Movement would gain a greater understanding of the students' learning continuum by considering the following chart of specific expectations from the curriculum for Grades 2, 3, 4, and 5.

Specific Expectations Learning Continuum			
By the end of Grade 2, students will: • describe the relative locations (e.g., beside, two steps to the right of) and the movements of objects on a map (e.g., "The path shows that he walked around the desk, down the aisle, and over to the window.").	By the end of Grade 3, students will: • describe movement from one location to another using a grid map (e.g., to get from the swings to the sandbox, move three squares to the right and two squares down).	By the end of Grade 4, students will: • identify and describe the general location of an object using a grid system (e.g., "The library is located at A3 on the map.").	By the end of Grade 5, students will: • locate an object using the cardinal directions (i.e., north, south, east, west) and a coordinate system (e.g., "If I walk 5 steps north and 3 steps east, I will arrive at the apple tree.").

Developing a Mathematics Curriculum Map

Organize a mathematics program for a class of combined grades so that simultaneous units of study are focused on the same strand. To start this process, develop a mathematics curriculum map that identifies the overall and specific mathematics curriculum expectations from each grade in order to highlight areas where connections can be made across grades and where grade-specific content must be addressed separately. In the following example, the connections between the curriculum expectations within and across grades are indicated with arrows.

Probability

By the end of Grade 4, students will:

- predict the frequency of an outcome in a simple probability experiment, explaining their reasoning; conduct the experiment; and compare the result with the prediction (***Sample problem:*** If you toss a pair of number cubes 20 times and calculate the sum for each toss, how many times would you expect to get 12? 7? 1? Explain your thinking. Then conduct the experiment and compare the results with your predictions.);
- determine, through investigation, how the number of repetitions of a probability experiment can affect the conclusions drawn (***Sample problem:*** Each student in the class tosses a coin 10 times and records how many times tails comes up. Combine the individual student results to determine a class result, and then compare the individual student results and the class result.).

Probability

By the end of Grade 5, students will:

- determine and represent all the possible outcomes in a simple probability experiment (e.g., when tossing a coin, the possible outcomes are heads and tails; when rolling a number cube, the possible outcomes are 1, 2, 3, 4, 5, and 6), using systematic lists and area models (e.g., a rectangle is divided into two equal areas to represent the outcomes of a coin toss experiment);
- represent, using a common fraction, the probability that an event will occur in simple games and probability experiments (e.g., "My spinner has four equal sections and one of those sections is coloured red. The probability that I will land on red is $\frac{1}{4}$.");
- pose and solve simple probability problems, and solve them by conducting probability experiments and selecting appropriate methods of recording the results (e.g., tally chart, line plot, bar graph).

Taken from *The Ontario Curriculum, Mathematics: Grades 1 to 8, 2005*, revised, pp. 74–75 and 84–85.

Identifying Similarities and Differences in Expectations Across Grades

Identify aspects of curriculum expectations that occur in both grades and that promote the learning and understanding of key concepts and big ideas in mathematics. Ensure that teaching, learning, and assessment focus on these curriculum expectations. It is also important to identify differences in order to ensure grade-specific programming.

In the sample chart on page 32, the overall expectations from the Patterning and Algebra strand are laid out side by side for ease of reference by the teacher. The overall expectations show that the concept of repeating, growing, and shrinking patterns and the concept of variables can be used as key concepts in a combined Grade 5 and 6 class. The key differences are that Grade 5 students are expected to focus on translation and on understanding variables in equations only, while Grade 6 students learn about rotations and about both equations and expressions.

Overall Expectations for Comparison	
By the end of Grade 5, students will: • determine, through investigation using a table of values, relationships in growing and shrinking patterns, and investigate repeating patterns involving translations; • demonstrate, through investigation, an understanding of the use of variables in equations.	By the end of Grade 6, students will: • describe and represent relationships in growing and shrinking patterns (where the terms are whole numbers), and investigate repeating patterns involving rotations; • use variables in simple algebraic expressions and equations to describe relationships.

Developing a Mathematics Unit Plan

Organize a mathematics program for a class of combined grades so that simultaneous units of study are focused on the same strand. Develop a unit plan for the class that identifies the learning goals (summarized to align with the grade-specific curriculum expectations) and lesson problems, to show the plan and structure of the instruction. For example, the teacher might use a staggered-lesson structure or might use the same warm-up and the same lesson problem with differentiated prompts. (These strategies are discussed later in this section.) An example of a partial Grade 5 and 6 curriculum unit plan is shown below. The example focuses on representing and comparing fractions with like and unlike denominators using square grids, number lines, manipulatives, and calculations. (See also Choosing Lesson Problems on page 35.)

Day	Grade 5 Learning Goal	Grade 5 Lesson Problem	Grade 6 Learning Goal	Grade 6 Lesson Problem
1	Review Grade 4 fraction curriculum expectations.	What fraction of lunch orders were hot dogs, hamburgers, pizza, and chicken salad?		What fraction of lunch orders were hot dogs, hamburgers, pizza, and chicken salad?
2	Represent the same fraction in different ways.	How can you use different numbers of tiles to model the same fraction?	Identify and model ratios to describe situations.	In what ways can square tiles be used to model each situation related to ratio?
3	Make models of fractions and name equivalent fractions.	What fraction of the orange punch is water, soda, and orange juice in the different recipes?	Determine equivalent ratios and use them to solve problems.	How much water, soda, and orange juice concentrate should be used to make orange punch for 40 people?

continued

Day	Grade 5 Learning Goal	Grade 5 Lesson Problem	Grade 6 Learning Goal	Grade 6 Lesson Problem
4	Compare the size of fractions.	Did each group get the same amount of the submarine sandwich?	Compare and order fractions on number lines.	Which group got the least and the greatest amounts of the submarine sandwich?
5	Use number lines to compare and order fractions.	Who has spent the shortest amount of time doing chores: Bob (6/10 of an hour), Sherise (4/5 of an hour), or Malcolm (40/60 of an hour)?	Compare fractions when the denominators are different.	Jane has walked 12/5 of the track and Ravi has walked 5/4 of the track. Who has walked the farthest?

Choosing Learning Materials

"Manipulatives are necessary tools for supporting the effective learning of mathematics by all students. These concrete learning tools invite students to explore and represent abstract mathematical ideas in varied, concrete, tactile, and visually rich ways. Moreover, using a variety of manipulatives helps deepen and extend students' understanding of mathematical concepts. … Manipulatives are also a valuable aid to teachers. By analysing students' concrete representations of mathematical concepts and listening carefully to their reasoning, teachers can gain useful insights into students' thinking and provide supports to help enhance their thinking." (*The Ontario Curriculum, Mathematics: Grades 1 to 8, 2005,* revised, p. 25)

For a list of key mathematics manipulatives, see *Early Math Strategy: The Report of the Expert Panel on Early Math in Ontario, 2003* and *Teaching and Learning Mathematics: The Report of the Expert Panel on Mathematics in Grades 4 to 6 in Ontario, 2004.*

The teacher's choice of manipulatives for a mathematics lesson for a class of combined grades needs to be appropriate to the lesson's mathematics learning goals (in accordance with the grade-specific expectations) and also needs to be logistically manageable for the teacher and students. In terms of student learning, the chosen manipulatives should enable students to: build on and extend mathematics conceptual learning from previous lessons and experiences; deepen their understanding of a concept; and challenge their mathematical understanding in an unfamiliar problem-solving context. For example:

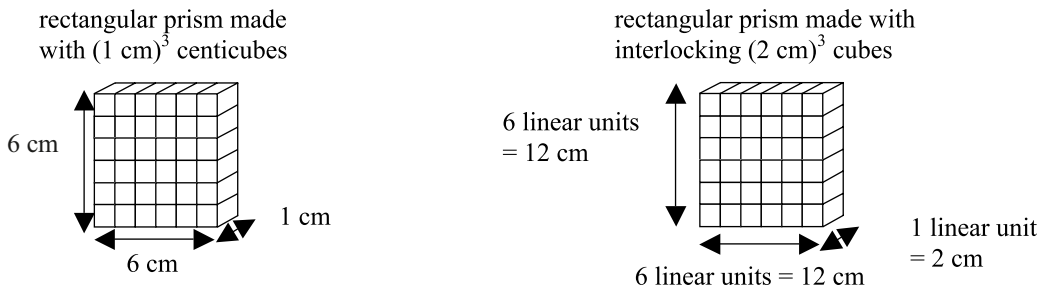
- Same learning materials, different purpose – The Four Square Units Problem uses the geoboard for both grades, but the learning goals are different. (See page 43.)
- Different learning materials, same purpose – The Butterfly Problem uses number lines, counters, hundreds charts to generate a range of solutions. (See page 40.)

In terms of logistics, there must be enough manipulatives for the class to work in pairs; each student's workspace must be large enough for the students to use the manipulatives and record the models built; and the manipulatives must be large enough for students to manipulate and mathematically precise enough to meet the goals of the lesson.

The following example uses similar specific expectations to create a problem that deals with the volume of a rectangular prism using manipulatives. Considerations relating to the manipulatives are outlined for the teacher on page 35.

Rectangular Prism Problem

What different rectangular prisms have a volume of 36 cubic units?



a. Grade 4 – How are the different rectangular prisms similar and different?

b. Grade 5 – What is the relationship between the height, the area of the base, and the volume of the rectangular prism?

This problem is based on the following similar specific expectations:

Specific Expectations Dealing With Rectangular Prisms	
By the end of Grade 4, students will: • estimate, measure using concrete materials, and record volume, and relate volume to the space taken up by an object (e.g., use centimetre cubes to demonstrate how much space a rectangular prism takes up) (*Sample problem:* Build a rectangular prism using connecting cubes. Describe the volume of the prism using the number of connecting cubes.).	By the end of Grade 5, students will: • determine, through investigation using stacked congruent rectangular layers of concrete materials, the relationship between the height, the area of the base, and the volume of a rectangular prism, and generalize to develop the formula (i.e., volume = area of base × height) (*Sample problem:* Create a variety of rectangular prisms using connecting cubes. For each rectangular prism, record the area of the base, the height, and the volume on a chart. Identify relationships.).

In this example, the teacher needs to consider the following:

- The size of cubes, $(1\ cm)^3$ or $(2\ cm)^3$, affects the students' construction and mathematical analysis of their rectangular prism models; that is, the larger cubes are easier to manipulate, but the $(1\ cm)^3$ cubes are more appropriate if students are discerning the relationship between the linear dimensions and the volume of the rectangular prism.
- Each pair of students needs 36 cubes, so for a class of 30 students, 36 × 15 pairs of students = 540 cubes.
- Cubes that interlock and stay intact facilitate sharing of models during class discussion. Cubes that do not interlock, but stack, are easier to manipulate but difficult to keep intact to show during class discussion.
- When students are using $(1\ cm)^3$ cubes, they should use 1 cm square grid paper to record top, side, and front views of their rectangular prism and construct a net of the rectangular prism. However, when students are recording a three-dimensional perspective of the rectangular prism, then isometric dot paper is more appropriate.

Choosing Lesson Problems

To create lesson problems for a class of combined grades, look at the core resource material (e.g., textbook program, curriculum unit resource materials) for both grades. Then adapt the problems so that they combine, extend, and/or integrate grade-specific learning goals. Effective lesson problems allow a range of student entry points and student responses. Before giving a problem to students it is important to consider some possible solutions to the problem and the key mathematics inherent in those solutions. It is important that the teacher develop an anticipatory schema of students' mathematical thinking for the lesson problem, so that the teacher is able to recognize the students' emerging mathematical knowledge in their solutions.

The following problem was chosen as a Grade 5 lesson problem and then adapted to extend the learning to a Grade 6 lesson problem. It focuses on students' understanding of area in terms of specific expectations for both grades, as shown below. The same problem context is used for both grades, but the prompts are differentiated to provoke grade-level responses.

L-Shape Problem

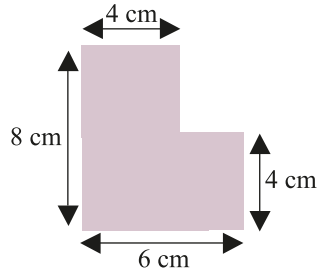
a. What is the area of this shape?

b. Show at least two different solutions.

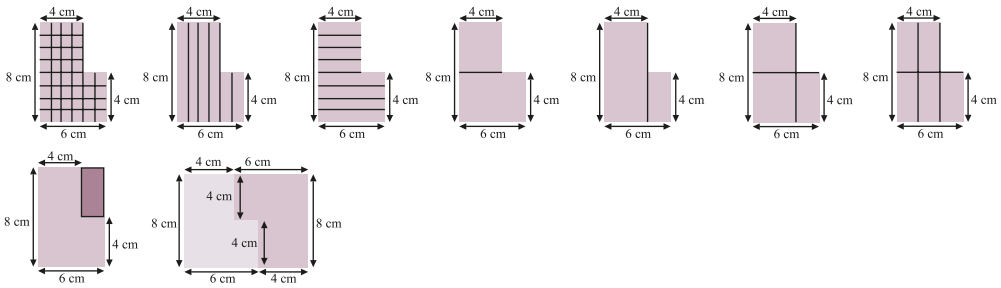
c. Explain the strategies used.

d. Grade 5 – Use only rectangles.

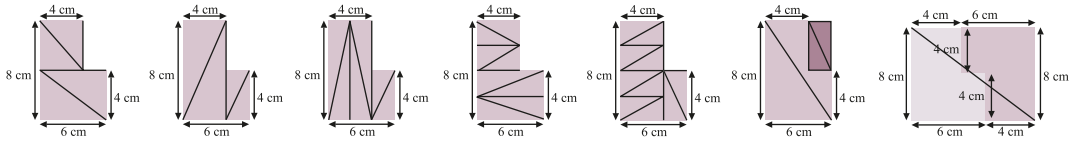
e. Grade 6 – Use only triangles.



Understanding the Range of Grade 5 Responses



Understanding the Range of Grade 6 Responses



This problem is based on the following expectations:

Specific Expectations Dealing With Area	
By the end of Grade 5, students will: • estimate and measure the perimeter and area of regular and irregular polygons, using a variety of tools and strategies; • determine, through investigation using a variety of tools and strategies, the relationships between the length and width of a rectangle and its area and perimeter, and generalize to develop the formulas.	By the end of Grade 6, students will: • construct a rectangle, a square, a triangle, and a parallelogram, using a variety of tools, given the area and/or perimeter; • determine through investigation, using a variety of tools and strategies, the relationship between the area of a rectangle and the areas of parallelograms and of triangles, by decomposing and composing; • solve problems involving the estimation and calculation of the areas of triangles and the areas of parallelograms.

MATHEMATICS CLASSROOM INSTRUCTION

Effective mathematics instruction engages all students in developing deep conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, clear and precise mathematical communication, and a positive and productive disposition towards mathematics. A mathematics program is only as effective as its implementation of problem-solving-based instructional strategies. Effective mathematics instruction is framed around a problem-solving process.

"A problem-solving approach encourages students to reason their way to a solution or a new understanding. As students engage in reasoning, teachers further encourage them to make conjectures and justify solutions, orally and in writing. The communication and reflection that occur during and after the process of problem solving help students not only to articulate and refine their thinking but also to see the problem they are solving from different perspectives. This opens the door to recognizing the range of strategies that can be used to arrive at a solution. By seeing how others solve a problem, students can begin to reflect on their own

	Throughout Grade 3, students will:
Problem Solving	• apply developing problem-solving strategies as they pose and solve problems and conduct investigations, to help deepen their mathematical understanding;
Reasoning and Proving	• apply developing reasoning skills (e.g., pattern recognition, classification) to make and investigate conjectures (e.g., through discussion with others);
Reflecting	• demonstrate that they are reflecting on and monitoring their thinking to help clarify their understanding as they complete an investigation or solve a problem (e.g., by explaining to others why they think their solution is correct);
Selecting Tools and Computational Strategies	• select and use a variety of concrete, visual, and electronic learning tools and appropriate computational strategies to investigate mathematical ideas and to solve problems;
Connecting	• make connections among simple mathematical concepts and procedures, and relate mathematical ideas to situations drawn from everyday contexts;
Representing	• create basic representations of simple mathematical ideas (e.g., using concrete materials; physical actions, such as hopping or clapping; pictures; numbers; diagrams; invented symbols), make connections among them, and apply them to solve problems;
Communicating	• communicate mathematical thinking orally, visually, and in writing, using everyday language, a developing mathematical vocabulary, and a variety of representations.

	Throughout Grade 6, students will:
Problem Solving	• develop, select, and apply problem-solving strategies as they pose and solve problems and conduct investigations, to help deepen their mathematical understanding;
Reasoning and Proving	• develop and apply reasoning skills (e.g., classification, recognition of relationships, use of counter-examples) to make and investigate conjectures and construct and defend arguments;
Reflecting	• demonstrate that they are reflecting on and monitoring their thinking to help clarify their understanding as they complete an investigation or solve a problem (e.g., by comparing and adjusting strategies used, by explaining why they think their results are reasonable, by recording their thinking in a math journal);
Selecting Tools and Computational Strategies	• select and use a variety of concrete, visual, and electronic learning tools and appropriate computational strategies to investigate mathematical ideas and to solve problems;
Connecting	• make connections among mathematical concepts and procedures, and relate mathematical ideas to situations or phenomena drawn from other contexts (e.g., other curriculum areas, daily life, sports);
Representing	• create a variety of representations of mathematical ideas (e.g., by using physical models, pictures, numbers, variables, diagrams, graphs, onscreen dynamic representations), make connections among them, and apply them to solve problems;
Communicating	• communicate mathematical thinking orally, visually, and in writing, using everyday language, a basic mathematical vocabulary, and a variety of representations, and observing basic mathematical conventions.

Taken from *The Ontario Curriculum, Mathematics: Grades 1 to 8, 2005*, revised, pp. 54, 87.

thinking (a process known as "metacognition") and the thinking of others, and to consciously adjust their own strategies in order to make their solutions as efficient and accurate as possible." The mathematical processes described above "can be seen as the processes through which students acquire and apply mathematical knowledge and skills. These processes are interconnected." (*The Ontario Curriculum, Mathematics: Grades 1 to 8*, *2005,* revised, p. 11)

More specifically, teaching and learning mathematics through problem solving focuses on students posing and/or understanding a mathematics problem and then developing, communicating, and analysing several solutions. It is important that the teacher have an anticipatory schema of possible student solutions, so that the teacher is prepared to recognize the significance of the mathematical knowledge and skills emerging from students' collaborative discussions and partial solutions.

The teacher can offer questions and comments to provoke students' mathematical thinking and actions, so that there is greater clarity and precision in their solutions. Once the teacher identifies the range of students' mathematical thinking as evidenced in the developing solutions, the teacher can consider ways to strategically coordinate students' communications and reflections on their mathematical thinking, actions, and solutions. Some strategies for coordinating such mathematical discussions include bansho, math congress (Fosnot and Dolk, 2001), and simply sorting and classifying some solutions using a same/different organizer.

Further, through this shared class discussion, the teacher needs to highlight the mathematics learning of the lesson, using the student solutions as examples. Such highlights could include circling key parts of the student solutions or annotating parts of the solutions with mathematical terms and symbols. Following the discussion of the lesson problem, other similar problems are provided to the students so that they can consolidate their learning through shared and independent practice.

Teaching and learning mathematics through problem solving is applicable and necessary for mathematics instruction in classes of combined grades.

Some specific strategies for mathematics instruction in classes of combined grades centre around the choice of the lesson problems, the problem prompts, and the anticipated range of students' mathematical responses. The examples on the following pages focus on four possible lesson *problem organizers* for combined grades, in terms of these three components: lesson problem, lesson problem prompts, and student responses. For example, a lesson organized as *Same-Same-Same* means same lesson problem, same lesson problem prompts, and same range of student responses expected.

The organization of lesson time is outlined in the following chart to indicate whether the mathematics lesson should start at the same time for both grades, be time-staggered towards the end of the lesson, or be time-staggered with lessons from another curriculum area, such as language. Some examples are provided in the chart.

Sample Overview of Mathematics Lessons		
Problem Organizers	**Organization of Time**	**Time Required**
Same-Same-Same	Same mathematics learning block	~ 1 hour
Same-Same-Different	Same start time, different time for consolidation (sharing and practice)	~ 75 minutes
Same-Different-Different	Same start time, different time for sharing and consolidating by staggering the end of the lesson with a lesson from another curricular area	~ 75 minutes
Different-Different-Different	Stagger mathematics learning block with other curricular lessons before and after the mathematics lesson	~ 1 hour

The Same-Same-Same Problem Organizer

Same lesson problem	**Same** problem prompts	**Same** range of student responses

Same lesson problem

↓

Same problem prompts

↓

Same range of student responses

This problem organizer, Same-Same-Same, enables students in both grades to develop a range of solutions to the same problem based on their prior mathematics knowledge and experiences. It is expected that, through sharing and discussing the range of solutions, all students will develop new mathematics knowledge and skills. It is important that the teacher strategically organize the sharing and discussion of the solutions to highlight key mathematical concepts, strategies, and mathematical terms and symbols. An example of such a lesson problem is shown on the following page, along with the overall and specific curriculum expectations for the relevant grades and an explanation of the mathematics knowledge that the problem would elicit.

Butterfly Problem

Three butterflies landed on a bush.

Then, 4 more butterflies landed.

Later, 8 more butterflies joined them on the bush.

How many butterflies are on the bush altogether?

a. Show at least 2 different solutions.

b. Use different tools and strategies.

This problem is based on the following expectations:

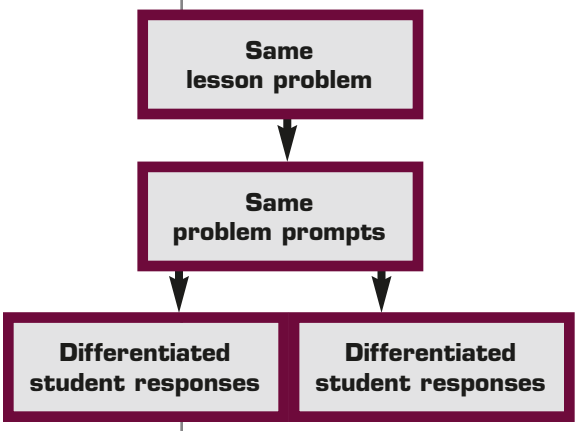
Expectations That Need the Same Range of Responses	
By the end of Grade 1, students will:	By the end of Grade 2, students will:
Overall Expectations	
• solve problems involving the addition and subtraction of single-digit whole numbers, using a variety of strategies.	• solve problems involving the addition and subtraction of one- and two-digit whole numbers, using a variety of strategies, and investigate multiplication and division.
Specific Expectations	
• represent, compare, and order whole numbers to 50, using a variety of tools (e.g., connecting cubes, ten frames, base ten materials, number lines, hundreds charts) and contexts (e.g., real-life experiences, number stories); • relate numbers to the anchors of 5 and 10 (e.g., 7 is 2 more than 5 and 3 less than 10); • compose and decompose numbers up to 20 in a variety of ways, using concrete materials (e.g., 7 can be decomposed using connecting cubes into 6 and 1, or 5 and 2, or 4 and 3).	• solve problems involving the addition and subtraction of whole numbers to 18, using a variety of mental strategies (e.g., "To add 6 + 8, I could double 6 and get 12 and then add 2 more to get 14."); • describe relationships between quantities by using whole-number addition and subtraction (e.g., "If you ate 7 grapes and I ate 12 grapes, I can say that I ate 5 more grapes than you did, or you ate 5 fewer grapes than I did.").

Students are expected to create more than one solution, using different mathematical models, strategies, numbers, and number operations for the same answer. By doing this, all students can deepen their understanding of number sense and operation and learn new strategies for composing and decomposing numbers. In addition, different tools, such as colour tiles, number lines, and a rekenrek are offered to provoke different solutions (e.g., counting from one, counting on from first addend, counting on from the larger addend, regrouping addends to anchors of 5 and 10, repeated addition, regrouping with addition and multiplication, doubling plus one more or one less). With so many possibilities, it is not surprising to see Grade 1 students showing emergent mathematical knowledge that is expected for Grade 2 students in their different solutions. The grade-specific curriculum expectations provide the teacher with some details about the mathematics that could be present in the students' solutions to this problem.

Given that the development of mathematical knowledge is a gradual and continuous process, this organizer could be used at the start of a unit of study to activate students' diverse mathematical thinking, or it could be used towards the end of a unit of study to consolidate students' use of particular mathematical models, strategies, and/or mathematical terms and symbols.

The Same-Same-Different Problem Organizer

Same lesson problem	**Same** problem prompts	**Differentiated** student responses



Sometimes it is possible to use the same lesson problem and the same lesson problem prompts for both of the grades and expect students to develop differentiated solutions in accordance with the grade-specific expectations. The teacher anticipates possible responses to the problem because the teacher has worked on the problem and recognizes the differentiated knowledge that each grade group will bring to solving the problem. In this type of lesson problem organizer, each grade group shares and discusses the solution separately so that the teacher's comments and questions can focus on students' understanding of the grade-specific curriculum expectations. After each group discussion, the teacher can provide each grade group with grade-specific practice problems that align directly with the curriculum expectations.

Classroom Carpet Problem

Read the message from the principal.

a. What is the problem to be solved?

b. Why is this problem a problem?

c. Show two different ways to solve this carpet problem.

d. How do you know we have listed all the possible solutions?

> Hello Grade 3 and 4 students,
> The carpet you have been asking for arrives tonight. Please clear a space in your room today that will fit this new carpet. The perimeter of the carpet is 12 m.
> – From your principal

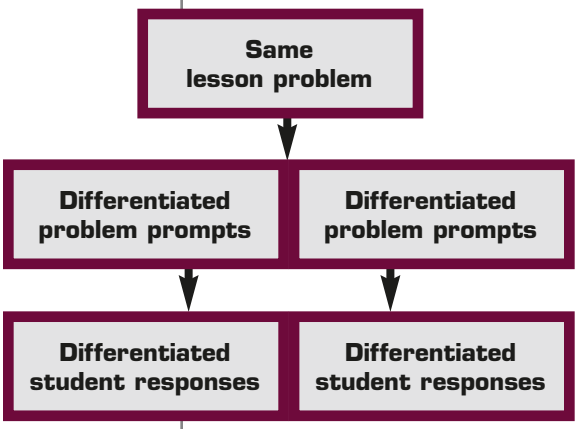
This problem is based on the following expectations:

Specific Expectations That Need Grade-Specific Responses	
By the end of Grade 3, students will: • estimate, measure, and record the perimeter of two-dimensional shapes, through investigation using standard units; • estimate, measure (i.e., using centimetre grid paper, arrays), and record area (e.g., if a row of 10 connecting cubes is approximately the width of a book, skip counting down the cover of the book with the row of cubes [i.e., counting 10, 20, 30, ...] is one way to determine the area of the book cover).	By the end of Grade 4, students will: • determine, through investigation, the relationship between the side lengths of a rectangle and its perimeter and area (*Sample problem:* Create a variety of rectangles on a geoboard. Record the length, width, area, and perimeter of each rectangle on a chart. Identify relationships.); • pose and solve meaningful problems that require the ability to distinguish perimeter and area (e.g., "I need to know about area when I cover a bulletin board with construction paper. I need to know about perimeter when I make the border.").

This lesson problem organizer, Same-Same-Different, uses the same lesson problem and lesson problem prompts to elicit differentiated grade-specific student responses in accordance with the curriculum expectations. This organizer can be used throughout a unit of study to focus on lessons that have similar overall expectations but different specific expectations for each grade. Staggered time for students to share grade-specific solutions is important so that the grade-specific learning goals for each grade are made explicit to the students, and so that students have the opportunity for shared and independent practice that focuses on the grade-specific curriculum expectations.

The Same-Different-Different Problem Organizer

Same lesson problem	**Differentiated** problem prompts	**Differentiated** student responses

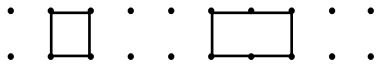


Another method of organizing mathematics instruction is to use the same lesson problem with differentiated problem prompts in order to ensure that student responses are differentiated in accordance with grade-specific curriculum expectations. To do this, the teacher usually creates variations on the lesson problem prompts or specific scaffold prompts that provoke the students to solve the problem using particular mathematical models, concepts, and/or strategies.

For example, the Four Square Units Problem begins with the same lesson problem prompts (a), (b), (c), and then the final prompt, (d), is differentiated in accordance with the grade-specific curriculum expectations. In this case, the sharing and discussion of the solutions is separated for each grade group, so that the teacher's comments and questions can focus on students' understanding of the grade-specific curriculum expectations. After each group discussion, the teacher can provide each group with grade-specific practice problems that align with the curriculum expectations.

Four Square Units Problem

Is it true that there are over 30 different polygons that are 4 square units?



a) one square unit b) two square units

a. Show as many polygons as possible that have an area of 4 square units.

b. Create your polygons on a geoboard.

c. Record the polygons you created on geoboard dot paper.

d. *See differentiated prompts to provoke differentiated responses in the following chart.*

Differentiated Grade-Specific Prompts			
Grade 3	**Grade 4**	**Grade 5**	**Grade 6**
Choose 2 of the polygons you created. Explain how you measured the area of each of them.	Choose 2 of the polygons you created. Describe 2 strategies you used to estimate and measure the area of each of them.	Examine the rectangles you created. What is the relationship between the rectangle's width and length and its area?	Examine the polygons you created that have rectangles and triangles as part of their shape. How is the area of a rectangle related to the area of a triangle?

This problem is based on the following expectations:

Expectations That Need Differentiated Prompts			
By the end of Grade 3, students will:	By the end of Grade 4, students will:	By the end of Grade 5, students will:	By the end of Grade 6, students will:
Overall Expectations			
• estimate, measure, and record length, perimeter, area, mass, capacity, time, and temperature, using standard units.	• estimate, measure, and record length, perimeter, area, mass, capacity, volume, and elapsed time, using a variety of strategies.	• estimate, measure, and record perimeter, area, temperature change, and elapsed time, using a variety of strategies.	• determine the relationships among units and measurable attributes, including the area of a parallelogram, the area of a triangle, and the volume of a triangular prism.
Specific Expectations			
	• pose and solve meaningful problems that require the ability to distinguish perimeter and area.	• estimate and measure the perimeter and area of regular and irregular polygons, using a variety of tools and strategies; • create, through investigation using a variety of tools (e.g., pattern blocks, geoboard, grid paper) and strategies, two-dimensional shapes with the same perimeter or the same area;	• determine, through investigation using a variety of tools and strategies, the relationship between the area of a rectangle and the areas of parallelograms and triangles, by decomposing and composing.

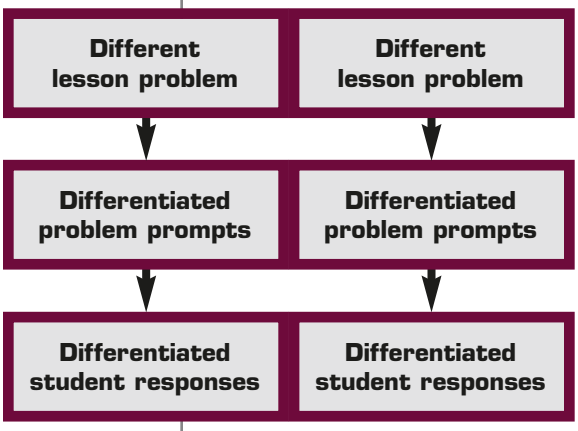
continued

Expectations That Need Differentiated Prompts			
		• determine, through investigation using a variety of tools and strategies, the relationships between the length and width of a rectangle and its area and perimeter, and generalize to develop the formulas.	

This lesson problem organizer, Same-Different-Different, uses the same lesson problem and different problem prompts to elicit differentiated grade-specific student responses in accordance with the curriculum expectations. This organizer can be used throughout a unit of study to focus on lessons that have similar overall curriculum expectations but different specific curriculum expectations for each grade level. Staggered time for students to share grade-specific solutions is important so that the grade-specific learning goals for each grade level are made explicit to the students, and so that students have the opportunity for shared and independent practice that focuses on the grade-specific curriculum expectations.

The Different-Different-Different Problem Organizer

Different lesson problem	**Differentiated** problem prompts	**Differentiated** student responses



At other times, instruction requires different lesson problems, different problem prompts, and thus different student responses. This type of instruction can be used with different curriculum expectations for each grade within the same strand. Staggering of instructional time is needed for a seamless transition between the three parts of the math lesson for each grade group.

Generally, a mathematics lesson using this format begins with the teacher working directly with only one grade group. At the same time, the students in the other grade

work as a group on the warm-up for the lesson (e.g., discuss solutions to the previous lesson, develop the solution to a warm-up problem) or independently on the work from the previous lesson block in another curricular area. The lesson is timed so that, when the teacher needs to be actively engaged with one grade group, the other grade group works productively and interdependently on another part of their lesson without the teacher's direct assistance. The sharing and discussion of the solutions is separated for each grade group, so that the teacher's comments and questions can focus on students' understanding of the grade-specific curriculum expectations. In addition, after each group discussion, the teacher can provide each group with grade-specific practice problems that align with the curriculum expectations.

Expectations That Need Differentiated Instruction	
By the end of Grade 1, students will:	By the end of Grade 2, students will:
Overall Expectations	
• compose and decompose common two-dimensional shapes and three-dimensional figures.	• compose and decompose two-dimensional shapes and three-dimensional figures.
Specific Expectations	
• identify and describe shapes within other shapes (e.g., shapes within a geometric design).	• identify and describe various polygons (i.e., triangles, quadrilaterals, pentagons, hexagons, heptagons, octagons) and sort and classify them by their geometric properties, using concrete materials and pictorial representations.

Differentiated Grade-Specific Problems	
Grade 1 Flower Problem	**Grade 2 Polygon Problem**
What different flowers can be created using pattern blocks? How do you know that they are different? a. Create a flower using pattern blocks. b. What shapes do you see in your flower picture?	What different polygons can be created using pattern blocks? How do you know that they are different? a. Compose different polygons (e.g., triangles, quadrilaterals, pentagons, hexagons, heptagons, octagons) that use more than 2 triangles each, using pattern blocks. b. Which pattern blocks did you use most often? Why?

This organizer can be used throughout a unit of study to focus on lessons that have different overall expectations and different specific expectations for each grade. Staggered time for students to share grade-specific solutions is important so that the learning goals for each grade are made explicit to the students, and so that students have the opportunity for practice that focuses on the grade-specific curriculum expectations.

MATHEMATICS ASSESSMENT

Assessment is the process of gathering information from a variety of sources that, taken together, accurately reflects how well a student is achieving the curriculum expectations. Students learn mathematics within an assessment process that includes demonstrating what they know and can do in different ways and receiving constructive and focused feedback from their peers and teacher. Effective mathematics assessment is ongoing and promotes continual growth in students' mathematics learning over time.

Assessment can be divided into three types: initial assessment, assessment *for* learning, and assessment *of* learning. Initial assessment is carried out at the start of a new unit of study to activate students' prior mathematics knowledge. Assessment *for* learning is descriptive feedback provided to students to guide their actions towards improvement. This type of assessment informs the teacher's daily program and instructional decisions and actions. Assessments *of* learning are collections and records of students' achievement of curriculum expectations.

In this section, examples of assessment tools for classes of combined grades are provided for all three types of assessment. As well, a sample assessment, evaluation, and reporting schedule is provided.

Initial Assessment

An initial assessment activates students' prior mathematics knowledge and experience through an open-ended mathematics task or problem within a small-group context. To ascertain the prior knowledge of individual students, focused questions or a similar problem can be provided for students to complete independently. Such an initial assessment makes explicit to both the teacher and the students the mathematical knowledge, skills, and experiences that the students have prior to the start of a mathematics unit of study. This type of assessment helps the teacher to determine the best sequence of learning goals and the pace of the unit. An initial assessment also provides useful feedback for the students so that they become aware of the mathematics they will use and build on during the unit.

Use an initial mathematics assessment tool to record student learning of key concepts or difficult units of study or as a daily tracking tool. Such a tool provides concrete evidence of students' mathematical thinking individually and in relation to the entire class. See page 50 for a sample tool.

An initial mathematics assessment tool includes key mathematical information such as the following.

- ***Students' Mathematical Thinking.*** While students are developing solutions to the lesson problem, record the mathematics they are showing in the "Students' Mathematical Thinking" space under "Observations and Interview Anecdotal Notes" (see the example on page 50). Record each mathematical concept, skill, or strategy observed under a separate number. On the left-hand side of the page, record the numbers that correspond to the mathematics each student showed.
- ***Errors and Misconceptions.*** Any mathematical errors and/or misconceptions that are evident in the student solutions can be recorded and then referenced to each student as described above.
- ***Next Steps.*** List any ideas that you have for planning the next lesson for the whole class or for planning small-group or individual discussions with students.

For an example of the use of an initial mathematics assessment tool, see the Lunch Order Problem below. This problem assesses Grade 5 and 6 students' prior knowledge of Grade 4 and 5 curriculum expectations related to fractions.

Lunch Order Problem

The Grade 8 students have just put on a hot lunch for the school. They want to know how to improve the menu for the next school lunch. They have heard rumours that the Grade 6 students preferred pizza over the other lunches. Their teacher suggests that they look at the list of lunches that were ordered to find out which was the most popular.

Grade 6 Classes	Hot Dogs	Hamburgers	Pizza	Total Orders
Ms. Matthews	9	6	15	30
Mr. Ng	15	10	5	30
Mrs. Christenson	6	3	21	30

a. What fraction of the lunch orders *for each class* were hot dogs, hamburgers, and pizza?

b. What fraction of the lunch orders *for all classes* were hot dogs, hamburgers, and pizza?

c. Explain how you know that students prefer or do not prefer pizza in comparison to the other lunches.

Specific Expectations That Need Differentiated Prompts	
By the end of Grade 4, students will: • represent fractions using concrete materials, words, and standard fractional notation, and explain the meaning of the denominator as the number of the fractional parts of a whole or a set, and the numerator as the number of fractional parts being considered; • compare and order fractions by considering the size and the number of fractional parts (e.g., 4/5 is greater than 3/5 because there are more parts in 4/5; 1/4 is greater than 1/5 because the size of the part is larger in 1/4).	By the end of Grade 5, students will: • represent, compare, and order fractional amounts with like denominators, including proper and improper fractions and mixed numbers, using a variety of tools and using standard fractional notation.

The student responses to this question provide the teacher with initial assessment data that shows the fraction knowledge that students are using and that the teacher can build on during subsequent lessons. As well, the aspects of fraction knowledge that students do not display will guide the teacher in creating lesson problems in subsequent lessons that provoke the learning of such knowledge. The teacher can record observations of students' mathematical thinking as they discuss their ideas with other students and can analyse the details of their modelled and written mathematical solutions.

Assessment for Learning

Assessment for learning includes teacher observations, interviews, and analysis of small-group and individual responses to lesson problems and practice problems during a unit. To record evidence of student learning using such assessment strategies, the teacher uses anecdotal notes, checklists, rubrics, and class assessment record lists over a period of time. See page 52 for a sample tool.

An assessment for learning tool includes key mathematical information such as the following.

- ***Students' Mathematical Thinking.*** While students are developing solutions to the lesson problem, record the mathematics they are showing in the "Students' Mathematical Thinking" space under "Observations and Interview Anecdotal Notes" (see the example on page 52). Record each mathematical concept, skill, or strategy observed under a separate number. On the left-hand side of the page, record the numbers that correspond to the mathematics each student showed.

Initial Mathematics Assessment

Math Unit Title: Comparing Fractions

Initial Assessment Task:

a. What fraction of lunch orders *for each class* were hot dogs, hamburgers, and pizza?
b. What fraction of the lunch orders *for all classes* were hot dogs, hamburgers, and pizza?
c. Explain how you know that students prefer or do not prefer pizza in comparison to the other lunches.

Assessment Criteria: (Curriculum Expectations)

Grade 4 – compare and order fractions by considering the size and the number of fractional parts
Grade 5 – represent, compare, and order fractional amounts with like denominators, including proper and improper fractions and mixed numbers, using a variety of tools and using standard fractional notation

Student Names	Student's Math Thinking	Errors and Misconceptions
Melissa	1, 2	1
Jerry	1, 3	1

Observations and Interview Anecdotal Notes

Students' Mathematical Thinking

1. Ms. Matthews' class: hot dogs are 9/30, hamburgers are 6/30, pizzas are 15/30; 15 pizzas are more than 9 hot dogs and more than 6.

2. All classes: 30/90 hotdogs, 19/90 hamburgers, 41/90 pizzas: 30 + 19 = 49 hot dogs and hamburgers, which is more than 41 pizzas, so pizza is not the preference.

3. All classes: 41 pizzas > 30 hotdogs and 41 pizzas > 19 hamburgers, so pizza is the preference.

4.

Errors and Misconceptions

1. In Ms. Matthew's class, there are 15 orders of hot dogs and hamburgers to 15 orders of pizza, so there is no absolute preference of pizza, but there is a relational preference of pizza to hot dogs and to hamburgers.

2.

Next Steps

1. Ask the students why comparing the parts of the class order to other parts is not the same as comparing parts of the class order to the whole class order.
2.

- ***Errors and Misconceptions.*** Any mathematical errors and/or misconceptions that are evident in the student solutions can be recorded and then referenced to each student as described above.
- ***Next Steps.*** List any ideas that you have for planning the next lesson for the whole class or for planning small-group or individual discussions with students.

The example on page 52 demonstrates how to record observations and interview notes about the mathematics evident in each student's solution, as well as how to make adjustments for the next lessons on the basis of the evidence of student learning during the lesson. The example gives a record of students' mathematical thinking during the combined Grade 1 and 2 mathematics lesson used on page 46 (reproduced below).

Expectations That Need Differentiated Instruction	
By the end of Grade 1, students will:	By the end of Grade 2, students will:
Overall Expectations	
• compose and decompose common two-dimensional shapes and three-dimensional figures.	• compose and decompose two-dimensional shapes and three-dimensional figures.
Specific Expectations	
• identify and describe shapes within other shapes (e.g., shapes within a geometric design).	• identify and describe various polygons (i.e., triangles, quadrilaterals, pentagons, hexagons, heptagons, octagons) and sort and classify them by their geometric properties, using concrete materials and pictorial representations.

Differentiated Grade-Specific Problems	
Grade 1 Flower Problem	**Grade 2 Polygon Problem**
What different flowers can be created using pattern blocks? How do you know that they are different? a. Create a flower using pattern blocks. b. What shapes do you see in your flower picture?	What different polygons can be created using pattern blocks? How do you know that they are different? a. Compose different polygons (e.g., triangles, quadrilaterals, pentagons, hexagons, heptagons, octagons) that use more than 2 triangles each, using pattern blocks. b. Which pattern blocks did you use most often? Why?

Sample Assessment for Learning

Assessment for Learning - Mathematics

Math Unit Title:

Lesson Problem:

What different flowers can be created using pattern blocks?
How do you know that they are different?

Assessment Criteria: (Curriculum Expectations)
Grade 1
Identify and describe shapes within other shapes (e.g., shapes within a geometric design).

Student Name	Student's Math Thinking	Errors and Misconceptions	Observations and Interview Anecdotal Notes
			Students' Mathematical Thinking: **1.** 3 rhombi inside 1 hexagon. **2.** 2 trapezoids inside 1 hexagon. **3.** 3 squares inside 1 rectangle. **4.** **5.**
			Errors and Misconceptions: **1.** A square is not a rectangle. **2.**

Next Steps
1. Use different student solutions to activate students' knowledge of how to identify and describe shapes by the number of sides.
2.

Assessment for Learning - Mathematics

Math Unit Title:

Lesson Problem:

What different polygons can be created using pattern blocks?
How do you know that they are different?

Assessment Criteria: (Curriculum Expectations)
Grade 2
Compose and decompose two-dimensional shapes and three-dimensional figures.

Student Name	Student's Math Thinking	Errors and Misconceptions	Observations and Interview Anecdotal Notes
			Students' Mathematical Thinking: **1.** 6 triangles to make 1 hexagon. **2.** 2 triangles and 2 rhombi inside 1 hexagon. **3.** **4.** **5.**
			Errors and Misconceptions: **1.** **2.**

Next Steps
1. Use different student solutions to activate students' knowledge of composing and decomposing shapes, such as hexagons and rectangles.
2.

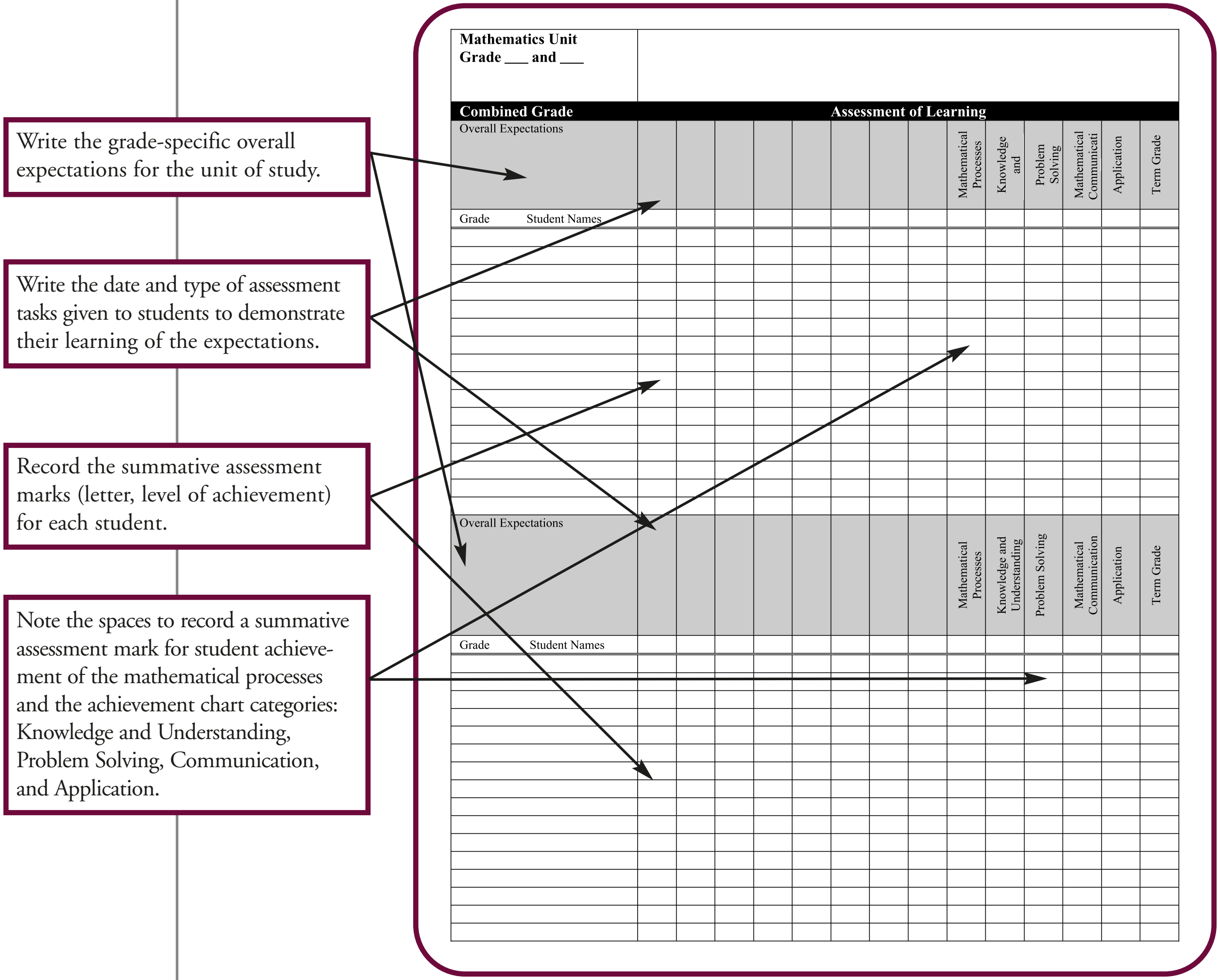
Use this assessment for learning tool to record student learning for key mathematical concepts, difficult units of study, or as a daily tracking tool, as it provides concrete evidence of students' mathematical thinking individually and in relation to the entire class.

Assessment of Learning

Most textbook programs and mathematics learning resource materials include tasks for assessment of learning, or summative assessment, such as mid-unit and end-of-unit tasks that show single-strand or cross-strand performance; culminating tasks or projects; or tests to be administered at the middle and end of the unit. It is important to ensure that the problems, tasks, and tests chosen focus on the same grade-specific curriculum expectations on which the teacher focused during the unit of study.

Generally student achievement is recorded in a class list or spreadsheet that shows the students' names and the dates and titles of the assessments. A sample summative assessment recording tool is provided below.

Sample Assessment of Learning



Mathematics Unit **Grade ___ and ___**														
Combined Grade	**Assessment of Learning**													
Overall Expectations									Mathematical Processes	Knowledge and	Problem Solving	Mathematical Communicati	Application	Term Grade
Grade Student Names														
Overall Expectations									Mathematical Processes	Knowledge and Understanding	Problem Solving	Mathematical Communication	Application	Term Grade
Grade Student Names														

Write the grade-specific overall expectations for the unit of study.

Write the date and type of assessment tasks given to students to demonstrate their learning of the expectations.

Record the summative assessment marks (letter, level of achievement) for each student.

Note the spaces to record a summative assessment mark for student achievement of the mathematical processes and the achievement chart categories: Knowledge and Understanding, Problem Solving, Communication, and Application.

Assessment, Evaluation, and Reporting Schedule

It is important to plan and track the dates and types of assessment collected during each unit of study to ensure that sufficient assessment of learning data is collected. That way, the students can receive ongoing feedback about their mathematics learning and the teacher can adjust subsequent lessons to reinforce newly learned concepts, address student misconceptions and errors, or fast-track particular mathematics concepts and strategies of which students already have a solid understanding.

The sample assessment, evaluation, and reporting schedule shown below tracks how often various types of summative assessment data are collected within the framework of term evaluation and reporting.

Provide a mathematics unit of study title and a brief description of the overall expectations that will be addressed during each month.

Record the dates and types of assessment (e.g., performance task, culminating task, paper-pencil test) for each grade.

Record the report card due dates, in terms of marks cut-off dates, submission of report cards to administrators, and handing out of report cards to students and/or parents.

Mathematics Assessment, Evaluation, and Reporting Schedule

2006–2007	Mathematics Unit Title	Grade	Grade
September			
October			
November			
1st Term Report	Due Date		
December			
January			
February			
2nd Term Report	Due Date		
March			
April			
May			
June			
3rd Term Report	Due Date		

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