Frequently Asked Questions

Approaches to Instruction and Assessment

"The primary purpose of assessment and evaluation is to improve student learning."
Ontario Curriculum - Mathematics, Grades 1-8, and Growing Success

"When we make thinking visible, we get not only a window into what students understand, but also how they are understanding it."
Ritchhart, Church & Morrison, 2011

1. What instructional approaches best support a comprehensive mathematics program?

In designing a comprehensive and balanced mathematics program, it is important to consider a problem-based learning environment which allows the teacher to focus on the development of conceptual and procedural understanding, skill development, and problem-solving. This environment fosters a culture of inquiry and uses engaging and intriguing rich tasks to support a comprehensive mathematics program.

The Ontario Mathematics Curriculum, grades 1-8 (2005) states "problem solving forms the basis of effective mathematics programs and should be the mainstay of mathematical instruction."

Within the context of a balanced mathematics program, the three part lesson framework is a mindset which allows for the thinking and doing of mathematics and provides opportunities for students to consolidate and reflect on their learning. The use of rich tasks within this framework is crucial, although their use alone is not sufficient. The learning environment and the implementation of the task, including listening and responding to students through effective questioning, are what make the task rich. Piggott (2007) states, "much of what makes a rich task 'rich' is the environment in which it is presented, which includes the support and questioning that is used by the teacher and the roles that learners are encouraged to adopt." To learn more about student inquiry, click here.

"Asking clarifying and extending questions that prompt clarification, that gather and generate different ideas and approaches and challenge the validity of ideas discussed prompt all students to think about and make connections between their mathematical thinking and the class mathematical discussion."
Ministry of Education, 2010

A balance must be found between independent and collaborative work, and guided and direct instruction through targeted, purposeful and intentional planning based on student learner profiles. *Learning for All* (2013) provides information on the learner profile in chapter 4. Students should have the opportunity to work in a variety of collaborative groupings, and be given multiple opportunities to discuss and demonstrate their math understanding. Bruce (2007) states, "math is…a social endeavor…where thinking, talking, agreeing, and disagreeing are encouraged." Groups may change, as Krpan (2013) states, "based on the topics explored and the students' individual needs."

> *"The role of the teacher during whole-class discussion is to develop and build on the personal and collective sense-making of students rather than to simply sanction particular approaches as being correct or demonstrate procedures for solving predictable tasks."*
>
> Stein, Engle, Smith & Hughes, 2008

2. What assessment approaches best support a comprehensive mathematics program?

When we assess our students within a comprehensive mathematics program, we are gathering information about their learning that informs our teaching. Assessment information should be triangulated in the form of observations, conversations and products. The Ministry of Education (2010) states, "we obtain assessment information through a variety of means, which may include formal and informal observations, discussions, learning conversations, questioning, conferences, homework, tasks done in groups, demonstrations, projects, portfolios, developmental continua, performances, peer and self-assessments, self-reflections, essays, and tests…Teachers will ensure that students' demonstration of their achievement is assessed in a balanced manner with respect to the four categories of the achievement chart."

Observations can be a focused opportunity for observing student thinking and understanding in the math classroom. We might observe, for example, that a student has trouble selecting a problem-solving strategy when dealing with a proportional reasoning problem, and plan a targeted and precise guided lesson to move their mathematical thinking along. Or, we might notice that a student is struggling with multiplication, because they are still developing their basic fact fluency. Davies (2007) states, "some learning can only be observed…the record of observations becomes evidence."

Student-teacher conversations are another opportunity to gather very specific assessment evidence about student learning. Through mathematical discourse, students show how they understand the mathematics by explaining their thinking, discussing their strategies, and illuminating any struggles they are having. Conversations allow us to give very targeted descriptive feedback to propel the learner forward. As Brookhart (2008) states, "good feedback contains information that a student can use in a timely and specific way." Feedback gives both teacher and learner their next steps.

Assessment of learning is gathered at or near the end of a period of learning. These strategically determined periods of learning may have focused on a concept, unit, or strand and could include rich tasks, demonstrations, projects, tests or exams *(Growing Success,* 2010*).*

Using a combination of observations, conversations and products gives us a rich set of data that we can use to assess and evaluate student learning. The Ministry of Education (2007) states: "a student's

achievement of the overall expectations is evaluated on the basis of his or her achievement of related specific expectations (including the process expectations)."

> *"The aim is to inform teacher or student judgments about the key decisions; 'Should I relearn…Practice again…Move forward…To What?'"*
>
> Hattie, 2012

3. How does inquiry-based learning support effective mathematics instruction and assessment?

Inquiry is a fluid and recursive approach to teaching and learning that is student-centred, and based on student needs. Students and teachers are co-learners through the inquiry process. An inquiry math classroom is one where students are actively wondering, posing questions, making connections to their own lives, planning ways to show their learning, and reflecting on what they have learned. In our math classrooms, students might be generating their own solutions to problems, discussing their solutions, and reflecting on their next steps.

An inquiry classroom supports effective assessment as teachers are constantly gathering data through observations and conversations, in an open and responsive environment that provides ongoing opportunities for feedback.

Click here to access the Monograph on Inquiry-based Learning.

> *"Inquiry-based learning is an approach to teaching and learning that places students' questions, ideas and observations at the centre of the learning experience. Educators play an active role throughout the process by establishing a culture where ideas are respectfully challenged, tested, redefined and viewed as improvable, moving children from a position of wondering to a position of enacted understanding and further questioning. (Scardamalia, 2002)"*
>
> Ministry of Education, 2013

4. How can we align assessment and instruction to support student learning?

Assessment and instruction to support student learning are aligned through the three-part lesson framework. The three-part lesson framework is a mindset to enable student thinking and learning through the use of *big ideas*. *Big ideas* are statements that link mathematical knowledge and skills into a coherent whole. The three-part lesson is a vehicle in which student thinking is made visible, and provides teachers multiple opportunities to assess student thinking (Fig. 1). A focus on the *big ideas* assists teachers with interpreting the curriculum as they plan differentiated lessons, based on a learning goal that is aligned to a *big idea*, and assessments to support the needs of all learners. *Big ideas* also help teachers and students to connect various mathematical concepts between strands and grades and make student thinking visible through the mathematical processes. Through the use of effective questions the teacher is able to draw out the key learnings of the lesson, to ensure students have a conceptual understanding.

When consolidating the student thinking, teachers may use high-yield communication strategies such as gallery walk, math congress and bansho. During this time, teachers check for conceptual understanding and that the learning goal has been met, and to inform their instructional next steps. Teaching for conceptual understanding through the use of rich tasks gives students the opportunity to reflect on their thinking, develop their thinking, and consolidate their thinking. Students have opportunity to consolidate and reflect on their learning by reflecting on similarities and differences between various student solutions, and to communicate their learnings as well as their struggles.

Click here to access the Monograph describing gallery walk, math congress and Bansho.

Fig.1 Assessment and Instruction Through the Three Part Lesson Framework

	Students are:	Teachers are:
When Activating Student Thinking	Engaging Organizing Questioning Reflecting Connecting	Inviting Encouraging Open Assessing Organizing Introducing Questioning
When Developing Student Thinking	Discussing Applying Reflecting Creating Listening Discovering Reasoning Questioning Exploring Connecting	Selecting strategies Listening Observing Assessing Scaffolding Questioning
When Consolidating Student Thinking	Discussing Sharing Listening Reflecting Questioning Connecting	Assessing Checking for conceptual understanding Pulling out the math Questioning

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