

Guide for Administrators and Other Facilitators of Teachers' Learning for Mathematics Instruction

with indicators of mathematics classrooms moving forward regarding mathematics and literacy learning

Recent research has identified the role of teacher as the critical element in the development of learners' mathematical understanding.

Ball, 2003; Ball & Bass, 2002; Ball & Evan, 2004; Boaler, 2002

Research points to the need for teachers to change their teaching habits to match recommended practices. The kinds of changes teachers are being asked to undertake require a substantive re-orientation of their basic beliefs about the world in general and mathematics education in particular. Such a re-orientation can only occur (if at all) over time and requires ongoing and iterative cycles of professional engagement.

C. Suurtamm, CIIM Symposium, 2008

"Leadership is second only to teaching in its impact on student outcomes. Principals and vice-principals play an essential role as school leaders to achieve this impact."

Purpose to Practice: Putting Ontario's Leadership Framework into Action - A Guide for School and System Leaders

This guide provides a framework to inform implementation of effective mathematics classroom practices. The six broad organizers – Equity, Curriculum, Learning, Assessment and Evaluation, Learning Tools and Teaching – are essential dimensions of a high quality program, and align with those in the *Ontario Curriculum, Mathematics, Revised 2005/06/07* documents, and in the *Principles and Standards*, developed by the National Council of Teachers of Mathematics (NCTM), 2000.

A working document that will continue to evolve in consultation with researchers and to be aligned with evolving literacy indicators

As 'agents of change,' administrators and leaders can use this guide:

- as a framework for classroom observation, identifying and discussing the areas to observe beforehand with the teacher;
- to assist teachers in developing an individual action plan for growth, identifying 1-3 goals for a term, semester, or year;
- to develop an agenda for action with a department, division or school.

Indicators of Moving Literacy and Learning Forward in Math Class

Equity

- A shift from high expectations in mathematics for some learners to explicit communication of high expectations for all learners and provision of strong, scaffolded support, as needed
 - A shift from students working in isolation to establishing classroom structures and social skills that enable students to engage in cooperative learning, and productive interaction and talk
 - The classroom becomes increasingly inclusive by: reflecting cultural knowledge and practices; supporting anti-discrimination education; appealing to both genders; valuing knowledge, experiences and literacies all learners bring to school
 - A shift from insistence on English as the sole language to acceptance of strategic use of first languages for learning
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Curriculum

- A shift from lessons as a series of activities to an instructional trajectory informed by curriculum expectations
 - A shift from literacy, social, and learning skills as add-ons to lessons to including these skills as integral goals with curriculum learning goals for lessons
 - Increasingly thoughtful selection and use of literacy and learning strategies based on matching underlying structure and principles to concepts and skills
 - Increasingly explicit support of metacognitive skill development
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Learning

- A shift from rote learning and recall to developing conceptual understanding and making connections
 - Students increasingly engage in classroom discourse and social interaction to reorganize knowledge, make sense, and make connections
 - A shift from rigid reliance on one strategy and one modality for problem solving to flexibility in approach
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Assessment and Evaluation

- The teacher increasingly gauges learning and literacy needs throughout a lesson, and uses this data during consolidation and subsequent planning
 - The teacher increasingly provides precise and timely feedback, particularly oral feedback, on progress and targeted support before learning is evaluated
 - Students increasingly know learning goals and criteria for assessment and have opportunities to reflect on their progress
 - Increasing use of a range of assessment and evaluation tools and strategies
 - A shift from individual to collaborative teacher planning, development, and scoring of assessments
 - A shift from displaying only commercial products to displaying student work that illustrates a range of performances on a variety of tasks
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Learning Tools

- Increasing use of tools and technologies by all to learn, explore, and communicate understanding
 - Increasing focus on problem solving and higher-order thinking by re-allocating time away from skills rendered less necessary by new technological tools
 - Increasing respect for and engagement with technological knowledge and skills, and digital backgrounds students bring to school
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Teaching

- The teacher increasingly draws flexibly on knowledge and depth of understanding in classroom interactions
- Increasing understanding of adolescent literacy development and challenges
- Increasingly thoughtful use of literacy strategies – being explicit and systematic, understanding conditions for effective strategy instruction, modelling, and application
- A shift from fixed seating arrangements to flexible groupings based on different goals and needs
- A shift from rapid fire low-level questions to questions that engage all students in higher-order thinking
- Increasing use of a lesson structure to connect new learning with prior learning and sufficient consolidation

Indicators of Moving Literacy and Learning Forward in Math Class

Curriculum

- A shift in focus from only standard algorithms to also include mental math and alternative algorithms
 - Students increasingly take responsibility for learning of others and self. Math sense becomes the criterion for learning. **
 - Increasing attention to both cognitive and affective domains – interaction, risk taking, perseverance
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Learning Tools

- A shift in attitudes about using tools in making sense of mathematics and in demonstrating understanding from just struggling students to all learners, and to the extent indicated in the revised Ontario curriculum for mathematics
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Teaching and Learning

- Increasing demonstration of positive attitudes about, and comfort with, mathematics
- A shift from a singular approach to one that encourages a variety of solutions and methodologies
- A shift from teacher as questioner to students and teacher as questioners **
- Students increasingly explain and articulate their mathematical thinking **
- A shift from teacher as source of all the math ideas to students' ideas also influencing direction of lesson **
- Increasing knowledge about the challenges students are likely to encounter in learning mathematics
- A shift from teaching and practising skills before application to development of conceptual understanding through rich tasks and the Mathematical Processes before practice:

**The Math-Talk Learning Community Package containing samples of evidence along action trajectories is available at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/MathTalk.pdf>

Problem Solving

- Planning an approach
- Collecting data connected to the problem
- Selecting and applying a problem-solving strategy

Samples of student actions, instructional strategies, sample questions, and feedback are available at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/files/tips4rm/TIPS4RMProcesses.pdf>

Reasoning and Proving

- Hypothesizing and making conjectures
- Making inferences, conclusions, and justifications

Reflecting

- Considering data collected
- Reflecting on new skills, concepts, and questions to see how they connect to prior knowledge

Selecting Tools and Computational Strategies

- Knowing when and how to apply mental math skills
- Knowing when and how to estimate
- Using technology to explore, gather, display, manipulate, and present data
- Using tools to develop understanding of new concepts, for communicating, or for performing tasks
- Selecting and using different computational strategies, depending on the numbers

Connecting

- Making connections between new and prior knowledge
- Applying mathematics knowledge and skills to contexts outside mathematics
- Making connections among various representations of the same thing
- Applying strategies and references from other contexts

Representing

- Selecting, forming, and using multiple appropriate representations and defending choices
- Understanding that various representations can be used to appropriately represent the same thing
- Understanding that there may be different variations of the same representation
- Understanding the role of constants and variables

Communicating

- Using correct mathematical language and vocabulary
- Communicating thinking clearly, logically, and in detail
- Communicating thinking orally, visually, kinaesthetically, and in writing
- Using various representations, e.g., words with diagrams, charts or graphs with verbal descriptions

The indicators in this resource are aligned with and support:

1. Teacher Performance Appraisal Domains and Competencies

Commitment to Pupils and Pupil Learning

CP1 Teachers demonstrate commitment to the well-being and development of all pupils.

CP2 Teachers are dedicated in their efforts to teach and support pupil learning and achievement.

CP3 Teachers teach all pupils equitably and with respect.

CP4 Teachers provide an environment for learning that encourages pupils to be problem solvers, decisions makers, lifelong learners, and contributing members of a changing society.

Professional Knowledge

PK1 Teachers know their subject matter, the Ontario curriculum, and education-related legislation.

PK2 Teachers know a variety of effective teaching and assessment practices.

PK3 Teachers know a variety of effective classroom management strategies.

PK4 Teachers know how pupils learn and factors that influence pupil learning and achievement.

Professional Practice

PP1 Teachers use their professional knowledge and understanding of pupils, curriculum, legislation, teaching practices, and classroom management strategies to promote the learning and achievement of their pupils.

PP2 Teachers communicate effectively with pupils, parents, and colleagues.

PP3 Teachers conduct ongoing assessment of pupils' progress, evaluate their achievement, and report results to pupils and parents regularly.

PP4 Teachers adapt and refine their teaching practices through continuous learning and reflection, using a variety of sources and resources.

PP5 Teachers use appropriate technology in their teaching practice and related professional responsibilities.

Leadership in Learning Communities

LL1 Teachers collaborate with other teachers and school colleagues to create and sustain learning communities in their classrooms and in their schools.

LL2 Teachers work with other professionals, parents, and researchers of the community to enhance pupil learning, pupil achievement, and school programs.

Ongoing Professional Learning

PL1 Teachers engage in ongoing professional learning and apply it to improve their teaching practices.

Ministry of Education, *Performance Appraisal of Experienced Teachers: Technical Requirements Manual*, 2007. p. 22

2. 10 Dimensions of Reform Mathematics as Outlined in the PRIME Administrator's Resource

Dimension 1: Program Scope - how the mandated curriculum is being implemented

Dimension 2: Meeting Individual Needs - variety and appropriateness of instructional approaches

Dimension 3: Student Learning Environment - how the learning will take place, which students need extra attention, where to place the furniture, how to structure the lesson and what conversations will take place

Dimension 4: Student Activities and Tasks - balance of types of activities and rich tasks

Dimension 5: Construction of Knowledge - teacher's beliefs about how students learn mathematics

Dimension 6: Teacher's Role - facilitator of learning, and communicator

Dimension 7: Mathematical Tools - about the use of mathematics tools for the teaching of mathematics

Dimension 8: Student Interaction - building a community of learners

Dimension 9: Student Assessment - the purpose, transparency and variety of assessments used

Dimension 10: Teacher's Conception of Mathematics - fixed mathematical rules and algorithms or a dynamic rich set of integrated and interdependent topics

3. Criteria in the Student Success Board Action Planning Template for Mathematical Literacy

Focusing on important mathematics

Teaching for conceptual understanding (in-depth learning, attention to developmental continua)

Teaching through the Mathematical Processes

Effective use of manipulatives and technologies

Establishing classroom math-talk learning Communities

Application of differentiated instruction

Assessment for learning

Consistency and alignment of assessments of learning