The Literacy and Numeracy Secretariat
Webcast Professional Learning Series

Viewer's Guide

The Three-Part Lesson in Mathematics

Co-planning, Co-teaching and Supporting Student Learning

Multi-media resource for professional learning

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Funded by the Literacy and Numeracy Secretariat, Ontario Ministry of Education.

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Overview

> "...although *mathematics is big*, children's minds are bigger."
>
> Ontario Ministry of Education, 2007, p. 11

In this resource, we follow a Grade 6 three-part lesson on fractions – co-planned, co-taught and observed by a team of teachers and support staff. Each phase of design, planning, instruction and reflection is captured in video segments which tell the story of a professional learning journey that spans pedagogy and learning the math content. The video also tells the story of an inquiry in mathematical concepts and ideas that, in the words of one teacher, "created students who think like mathematicians!"

In preparing for the lesson, the team works collaboratively to design an appropriate and challenging problem that allows for student choice and can be solved in a variety of ways. As they co-plan the lesson, they consult Ontario curriculum expectations and the *Guides to Effective Instruction in Mathematics* and delve into what research and experience reveal as effective practice. The teachers "do the math" prior to the lesson. By solving the problem themselves, they are better able to anticipate potential student solutions and to deepen their collective and personal understanding of the mathematics.

In Part 1 – the "Before" or "Getting Started" phase of the lesson – students cognitively prepare for the mathematics in the lesson by engaging in several brief tasks. They use a think-pair-share strategy as they consider and respond to the activation problem.

In Part 2 – the "During" phase – students continue to work in partners as they solve the lesson problem. They reflect and ask questions of each other to clarify their understanding throughout the lesson. The co-teachers ask questions that prompt students to explain and justify their thinking.

Next, in preparation for the third and final phase of the lesson, the teachers collectively examine student solutions emerging from the lesson. They consider mathematical details and ideas that are evident across the range of student communication and look for connections between solutions. They decide which solutions will be shared with the class in the final part of the lesson.

Key characteristics of effective professional learning:

- teacher-directed and research-supported inquiry where educators, facilitators and researchers work collaboratively to engage in areas of mutual interest
- classroom-embedded learning where the primary site of inquiry and professional learning is within the classroom context (also requires an opening of the classroom to "guests" and collaborators)
- cyclical, iterative and sustained inquiry
- use of asset-oriented models of learning where all participants consider themselves learners
- activity that focuses on students, student thinking, and student demonstrations of understanding

C.D. Bruce, 2010

In Part 3 – "the After" phase – teachers and students reflect on and talk about the various ways in which students have solved the problem and represented their thinking. Students share their thinking and respond to questions from the teacher and from other students. The teachers strategically highlight the selected work, noting mathematical concepts, ideas and vocabulary as they are reflected in the student solutions.

Student voice is recognized and valued during the three-part lesson, as students articulate and reflect on their understanding. They learn to listen intently and build on and/or challenge the ideas of their peers. Students engage in accountable talk during the teaching-learning process to clarify and justify their thinking and collaboratively solve problems.

When engaged in co-planning and co-teaching, educators mobilize their own knowledge at the same time as they contribute to the collective knowledge of the group – "the classroom becomes the primary and legitimate site of teacher professional learning" (Bruce, 2010).

WEBCAST SEGMENTS

A Problem-Solving Approach

Students View Themselves as Mathematicians [3:48]

The Grade 6 teacher whose class is featured in this resource discusses the three-part lesson in light of its positive impact on students and how this framework for problem solving has contributed to students' viewing themselves as mathematicians. We hear how a problem-solving approach can lead to changes in the way teachers and students engage in the mathematics.

- ***How might a problem-solving approach impact on, or shift, the role of the student and the role of the teacher in a mathematics classroom?***

Building Self-Efficacy [2:05]

We recognize that self-efficacy is important to learning and personal growth. How do we cultivate and nurture it in the mathematics classroom? The Grade 4/5 teacher who serves as co-teacher in the three-part lesson describes her own journey and her fears of mathematics as a student. She speaks openly, sharing her experiences and feelings with students. The Grade 6 teacher highlights the importance of a safe, risk-free environment that ensures that all students feel they are active participants in the learning. Challenge and support are balanced to build student efficacy.

- ***Share your own experiences and challenges in learning and teaching mathematics.***

You may wish to refer to the following Shared Perspectives segment:

Deborah Loewenberg Ball - "What Do Teachers Need to Know about Doing Mathematics?"

> "One of the biggest challenges for teachers is trying to teach mathematics in ways they did not experience as students."
>
> Literacy and Numeracy Secretariat, 2010b

Student Collaboration and Talk [2:48]

This segment focuses on the importance of student-to-student talk in the mathematics classroom. The Grade 6 teacher shares ideas about the value of group and partner work, and emphasizes that students need opportunities to share their thinking. Students underscore how talk and group work help them to "understand in a different way." The teacher goes on to highlight additional accountable talk strategies that promote student thinking and student-to-student interaction: wait time, turn and talk and gallery walk.

- ***What strategies have you found to be successful in promoting accountable math-talk?***
- ***What strategies described by the teacher might you want to investigate further?***

You may wish to refer to the following Shared Perspectives segments:

Lucy West - "Culture of Classroom Discourse", "Student Voice" and "Barriers to Talk"

Marian Small - "Asking Prompting Questions During Instruction"

> "Teachers play an important role in assisting students to engage in high quality math talk."
> C.D. Bruce, 2007

Student Thinking about Mathematics [3:30]

What does a problem-solving classroom look and sound like? How does a culture of inquiry promote student thinking and metacognition? Educators, as well as some students, provide a perspective on these questions.

- ***In light of your students' prior experiences in mathematics, what challenges do you anticipate or have you experienced when teaching using a problem-solving approach?***
- ***What ideas do you have to help overcome these challenges? What ideas do others have?***

You may wish to refer to the following Shared Perspectives segments:

Lucy West – "Culture of Classroom Discourse," "Student Voice" and "Barriers to Talk"

Marian Small – "Asking Prompting Questions During Instruction"

Co-planning

Co-planning engages educators in meaningful and dynamic professional learning centred on mathematical concepts, ideas and strategies. Not only do teachers plan for student learning, but in the process of doing so they also foster their own understandings and knowledge about the mathematics they are going to teach.

The educators featured in this resource describe a planning process that includes the aspects found on the organizer below. This organizer may assist teachers to capture their thinking or note questions as the segment proceeds.

Planning Process	
Begin with the Ontario Curriculum.	Use "big ideas" in mathematics to cluster expectations.
Select or design an appropriate and challenging problem.	
Plan for the math by doing the math.	Anticipate possible student solutions to the problem.

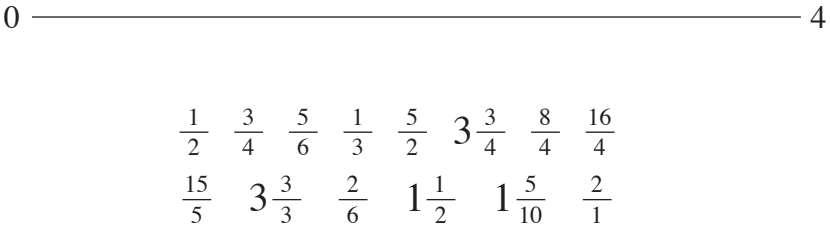
During the co-planning process, viewers are asked to stop and solve the problem that will be the focus of the three-part lesson presented in this resource. Solving the problem is a critical step in laying the groundwork for active participant engagement with the mathematical ideas found in the lesson. Working through a problem and solving it in more than one way, in advance of the lesson, helps educators to begin to deconstruct their own mathematical knowledge and understandings.

- ***What are the benefits to teachers and students of teachers doing the math prior to the lesson?***

The Problem

Work in partners to solve the problem.

Order the following fractions on the 0–4 number line:



Participants compare and examine their solutions, looking for mathematical details and relationships.

"In what ways does this problem unpack key understandings about fractions? In what ways does the problem address the continuum of learning that might exist in a Grade 6 classroom?"

You may wish to refer to the following Shared Perspectives segments:

Deborah Loewenberg Ball – "What Do Teachers Need to Know about Doing Mathematics?"

Marian Small – "Responding to a Range of Student Thinking" and "Asking Prompting Questions During Instruction"

Steven Katz – "Networked Learning Communities"

Co-teaching

Powerful Professional Learning [1:42]

Co-teaching is a strategy that roots professional learning in the work of the classroom. It may involve as few as two educators at a school or be structured to include more, as in a networked setting. Positive interdependence is the core of both co-planning and co-teaching. The segment highlights strategies that can help leverage professional learning in mathematics.

- ***What conditions must be in place to facilitate powerful professional learning?***

Co-teaching Is Co-learning [1:23]

This is one teacher's personal contemplation of how co-teaching has increased her confidence, both as a teacher and a mathematician.

- ***What reflections resonate with you and relate to your own practice?***

A Network Approach to Co-teaching [2:46]

This segment includes a description of what co-teaching in a larger group can look like. Roles such as "co-teacher" and "observer" are outlined.

- ***What essential elements need to be considered in order to set up a network co-teaching session for success?***

Co-teaching as a Whole-School Strategy [2:04]

A number of voices, including the administrator's, describe how co-teaching can impact positively on the culture of a school.

- ***If the learning is in the doing, how might we begin to create or extend opportunities for co-teaching? As a staff? As a network? What might some of the challenges be? How might we address these?***
- ***In what ways might co-planning a lesson enhance positive interdependence in the co-teaching of that lesson? What other benefits might there be?***

Supporting Student Learning

Note: *Solving the problem* ***in more than one way in advance of the lesson*** *is a critical step in laying the groundwork for active participant engagement with the mathematical ideas found in the lesson. Please refer to the section on "Co-planning" (above) for the lesson problem.*

Part 1 – Before [7:15]

The first part of the three-part lesson is brief, collaborative and provides a window into students' prior knowledge and understandings. The purpose is to cognitively prepare students for the mathematics, big ideas and learning goals that they will encounter in the second and third parts of the lesson.

- ***What are the characteristics of an effective activation task?***
- ***How do the "getting started" tasks connect to the lesson problem that will be solved by students in Part 2 (and previously solved by viewers in preparation for this portion of the resource)? Discuss the mathematics and big ideas common to both.***
- ***What are your observations about collaborative work and student learning and thinking?***

Part 2 – During [11:04]

Following a brief review of Part 1, we watch Part 2 unfold. The co-teachers:

- introduce the problem (selected for its connection to the key mathematical ideas)
- ask students to restate the problem by posing two questions: *What is the problem asking us? What information do we need to solve the problem?*
- facilitate student work by organizing the classroom learning environment
- pose questions, facilitate conversations, extend student thinking
- gather information about what the students know and what misconceptions exist

As you view this segment, you may wish to complete the following statements …

Characteristics of effective problems are …
In this part of the lesson, the role of the teacher is …
Some ways to extend student thinking are …
I am wondering about ….

Share your thinking about the above statements.

You may wish to refer to the following Shared Perspectives segment:
Marian Small – "Asking Prompting Questions During Instruction"

Reflecting on Student Solutions [11:57]

The educators pause for reflection between Parts 2 and 3 of the lesson, and collaboratively consider what mathematical details are evident in the student communication. Not only does this strategy prepare the educators for the "After" portion of the lesson, the dialogue serves as a powerful form of inquiry that further develops their own understandings about the mathematics evident in the student work. As the educators deliberate on the written pieces of work, observations and conversations with students are viewed as vital components that assist in assessing what students know and what misconceptions they may have.

- ***What tips and ideas for selecting and organizing students' solutions for Part 3 of the lesson do you find helpful? About which aspects do you have more questions?***
- ***What criteria did the teachers use when selecting the pieces of work that will be shared in Part 3 of the lesson?***

Part 3 – After [11:00]

Having determined and selected pieces of student work to be shared, teachers return to the classroom for Part 3 of the lesson.

Consolidation: Selected student work, posted one piece at a time, serves as a visual to focus student explanations and promote dialogue and questioning. Questions from other students and the teacher help make the mathematics explicit.

Highlights/Summary: As students discuss the solutions, the teacher highlights and annotates student thinking in order to make it even more evident and clear. The summary chart is co-constructed with students and captures generalizations as well as the finer attributes of the learning. It will assist the teacher to reflect on and/or determine the nature of the independent practice as well as guiding future lessons and lesson goals.

- ***Reflect on this part of the lesson in light of John Mason's statement (below). What insights does this provide for your own teaching and learning?***

> "The goal of instruction is to support each student as a mathematician, not fix the math."
>
> J. Mason, 1996

You may wish to refer to the following Shared Perspectives segments:

Deborah Loewenberg Ball – "What Do Teachers Need to Know about Doing Mathematics?"

Steven Katz – "Networked Learning Communities"

Lucy West – "Student Voice"

Shared Perspectives

Deborah Loewenberg Ball – "What Do Teachers Need to Know about Doing Mathematics?" [6:07]

How does working to understand student solutions help educators themselves to understand mathematics content more deeply?

Lucy West – "Culture of Classroom Discourse" [2:32]

In your experience, what is the dynamic of most classroom discourse? Does classroom discourse differ depending on the subject? What are the implications?

Lucy West – "Student Voice" [3:26]

In your experience, whose voice usually has weight in a mathematics classroom?

Comment on the following statement:
"Is it possible that the quality of adult discussion is mirrored in the quality of classroom discussion?"

Lucy West – "Barriers to Talk" [1:55]

Pre- viewing:

If someone asked you to define "Mathematics," what would you say?

Marian Small – "Responding to a Range of Student Thinking" [3:28]

What role does ambiguity play in a mathematics classroom?

Marian Small – "Asking Prompting Questions During Instruction" [3:46]

Is there a mathematics problem you have used that effectively "initiated" student conversation? Why do think that was so?

What might teachers do to ready themselves if their goal is to pose the type of questions that further student conversation and deepen student thinking during instruction?

Steven Katz – "Networked Learning Communities" [3:52]

What do critical challenge and joint work look like in a collaborative learning community engaged in a mathematical inquiry?

Resources and Related Reading

Bruce, C. D. (2010). *Research on mathematics education*. Research summary. www.aero-ontario.org/docs/Bruce_AERO_Fall2010_Handout.pdf

Bruce, C. D. (2007). *Student interaction in the math classroom: Stealing ideas or building understanding. What Works? Research into Practice*, #1. (On this DVD.)

Bruce, C. D., & Ross, J. A. (2010). *External review of collaborative inquiry and learning in mathematics*. Final report submitted to the Ontario Ministry of Education. Peterborough, ON: Trent University

Literacy and Numeracy Secretariat (2011). *Bansho (board writing). Capacity Building Series*, #17. (On this DVD.)

Literacy and Numeracy Secretariat (2010a).*Collaborative teacher inquiry, Capacity Building Series*, #16. (On this DVD.)

Literacy and Numeracy Secretariat (2010b).*Communication in the mathematics classroom: Congress, gallery walk and bansho. Capacity Building Series*, #13. (On this DVD.)

Literacy and Numeracy Secretariat (2008). *Differentiating mathematics instruction. Capacity Building Series*, #7. (On this DVD.)

MacMath, S., Wallace, J., & Chi, X. (2009). *Problem-based learning in mathematics: A tool for developing students' conceptual knowledge. What Works? Research into Practice, Research*, #22. (On this DVD).

Mason J., & Johnston-Wilder, S. (2004). *Fundamental constructs in mathematics education*. New York: Routledge Falmer.

Ontario Ministry of Education. (2007). *A guide to effective instruction in mathematics, Kindergarten to Grade 3 – Data management and probability.* Toronto: Queen's Printer for Ontario.

Ontario Ministry of Education. (2006). *A guide to effective instruction in mathematics, Kindergarten to Grade 6 – Volume 2, Problem solving and communication.* Toronto: Queen's Printer for Ontario.

Technical Instructions

How to Access the Print and Video Resources

To access the Print and Video Resources folder in Windows, insert the DVD into the DVD drive of your computer and:

1. Click on the Start menu.
2. Select My Computer.
3. Right-click the mouse on the DVD icon titled COPLANNING_DVD to open a drop-down options list.
4. From the drop-down list, select and click on the Open option.
5. Double-click on the folder titled Print and Video Resources to access the files. Ignore the folders titled Audio_TS and Video_TS.
6. Select the resources you wish to use directly from this folder, OR Copy onto the Desktop and open files from the Desktop.

Alternatively, when the DVD is inserted and the options box opens:

1. Select the option Open Folder to View Files.
2. Click on the Print and Video Resources folder.
3. Select the files you wish to use directly from this folder, OR

Copy the files onto the Desktop and open them from the Desktop.

To access the Print and Video Resources folder in Mac OS X, insert the DVD into the DVD drive of your computer and:

1. Exit from the DVD player (which typically opens automatically when a DVD is inserted in the drive).
2. Double-click on the DVD icon titled COPLANNING_DVD
3. Select the files you wish to use directly from this folder, OR
4. Copy the files onto the Desktop and open them from the Desktop.

How to Save the Video Files to Your Computer

The video files can all be copied and saved to your computer using either of the following methods for copying and pasting files.

Method 1

1. Right-click on the file and choose the Copy option.
2. Right-click within any computer folder into which you would like to save the file, and choose the Paste option.

Method 2

1. Left-click the mouse on the file you want to save, so that the file is highlighted.
2. Simultaneously press the Ctrl and C keys (or, for Macintosh users, the Command and C keys) to copy the file.
3. Left-click within any computer folder in which you would like to save the file, and simultaneously press the Ctrl and V keys (or, for Macintosh users, the Command and V keys) to paste the file there.

   For Macintosh users, the Command key is the one with the following symbol: ⌘

NOTE: If you want to insert video files into a PowerPoint presentation, you must save these video files in the same folder that contains your PowerPoint file. If you save a PowerPoint presentation to another location (e.g., a memory stick, CD-ROM, etc.), you must also save the video files in the same location in order for the video to play. So, if you transfer the presentation to another computer, you must also transfer the video files with it, or else the video will not link to the PowerPoint presentation.

How to Insert Video Clips (WMV files) into a PowerPoint Presentation

On this DVD, you will find WMV versions of all segments of the webcast. To insert a clip into a PowerPoint presentation, follow the directions below:

1. Open your PowerPoint program.
2. Create a new PowerPoint presentation OR open an existing PowerPoint presentation, and within it, open the slide on which you would like to add the video.
3. Insert the webcast DVD into the DVD drive of your computer.
4. If a new window opens asking how you would like to view the files on the disk, choose the option Open Folder to View Files; OR

   If a new window does not open, open the My Computer window from the Start menu. In the My Computer window, double-click on the icon that is shaped like a disk, which will likely be labelled D: or E:.
5. Save the video segment that you want to insert in a PowerPoint into the same folder that contains your PowerPoint presentation.

   NOTE: Video files that have been saved to your computer can be cropped and edited into smaller segments using Movie Maker (free on PCs) or iMovie (free on Macintosh).
6. Open the PowerPoint slide on which you would like to insert the video, and click on the Insert menu in the PowerPoint menu bar.
7. From the Insert menu, select Movies and Sounds, and click on the Movie from File option.
8. A window opens, prompting you to select the video file that you would like to add. Find and select the video file that you saved in step 5.
9. Once you have chosen the video file you need, another window opens and asks whether you want your movie to play either automatically when you enter the slide, or only when it is clicked. Choose your preference. (You will notice that the starting image of your movie is not displayed on the slide.)

Printed on recycled paper
ISBN 978-1-4435-6722-0