Webcasts for Educators
Student Achievement Division

Viewer's Guide

Engaging Students in Mathematics

Multi-media resource for professional learning

reach every student

Ontario

On this DVD you will find a Print and Video Resources folder which contains WMV files for PowerPoint presentations, this Viewer's Guide (PDF), and monographs *Communication in the Mathematics Classroom, Asking Effective Questions* and *Bansho (Board Writing)*.

To order:
Webcasts for Educators – Engaging Students in Mathematics

Contact ServiceOntario
416-326-5300 or 1-800-668-9938
http://www.publications.serviceontario.ca/ecom

The webcast segments and related resources are also accessible online at www.curriculum.org/secretariat/engagingmath/

Table of Contents

> It is an essential fact that children learn mathematics primarily through... doing, talking, reflecting, discussing, observing, investigating, listening, and reasoning.
>
> Copley, 2000

Overview

This resource explores a mathematics lesson taught within a three-part lesson framework. Throughout, the teacher assesses, prompts and allows for differentiation in how students learn and, in this way, involves the entire class in solving the lesson problem and extending the thinking of each student about the big ideas of mathematics.

In the "Getting Started" section of the video, you will see how the teacher activates students' prior knowledge. This is followed by "Working On It," where you will observe students engaged in solving the lesson problem, designed by the teacher to contribute to improved learning for the entire class. In "Consolidation," you will notice how the teacher facilitates the sharing of solutions by students and then captures some of the key learnings.

The teacher provides opportunities for her students to develop leadership and communication skills. She fosters the development of habits of mind such as thinking critically, being open to the ideas of others and persisting in the face of challenges. She encourages students to be metacognitive in their approach – to think about their thinking and what works for them as learners – and in this way helps to build their confidence as independent learners, not just in mathematics but in all subject matters and areas of curriculum.

The classroom featured in this resource has a diverse population of students, many of whom face socio-economic challenges at home. They reflect the demographics of their school, Joyce Public School, which in the last 10 years has moved toward its goal of all students achieving a high level of academic success. School leadership is shared by the principal and teachers. The learning community includes parents and extends beyond the building, connecting with partners in education locally, nationally and internationally. The school's focus on using oral language and technology to engage students in mathematics is evident in the lesson.

> A big idea is an idea that connects numerous mathematical understandings into a coherent whole.
>
> Small, 2009

From Viewing to Action

What questions do you want to explore further about the three-part lesson? You may wish to use the following organizer to frame your thinking:

Organizer #1 — The Three-Part Lesson

Before viewing I know ...	*After viewing I understand ...*	*I am still wondering about ...*

**NOTE: Organizer #1 is available in Word and in PDF in the Print Resources folder on the DVD.*

As you view this resource, think about your own understanding of the teaching of mathematics and how the content impacts on your thinking. You may wish to record your observations and ideas on the following organizer:

Organizer #2 — Engaging Students in Mathematics

Segment	*What I noticed ...*	*Connections to my practice …*

**NOTE: Organizer #2 is available in Word and in PDF in the Print Resources folder on the DVD.*

The lesson task in this video provokes thinking and demonstrates tools and strategies linked to proportional reasoning. The big ideas of proportional reasoning are as follows:

- Proportional reasoning involves recognizing multiplicative comparisons between ratios.
- Proportional reasoning relationships can be expressed using fractions, ratios and percentages.
- Students begin to develop the ability to reason proportionally through informal activities.

(Guide to Effective Instruction: Number Sense and Numeration – Grades 4 to 6, 2006)

As you view this resource, record the evidence you notice that indicates this teacher is teaching to the big ideas of proportional reasoning.

What might be the learning goals for Grades 5 and 6 related to their mathematical proficiency and conceptual understanding of proportional reasoning?

What might be the learning trajectory? (A learning trajectory is based on an asset model of classroom-based observations of student learning.)

VIDEO SEGMENTS

Getting Started

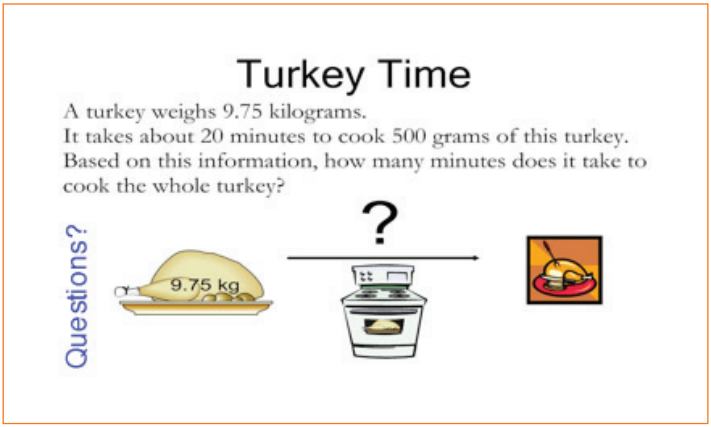
Activating Prior Knowledge *(3:38)*

Students activate their prior knowledge and prepare for the lesson problem of the day. They practise their critical thinking and collaborative skills as they work together to build new understandings.

- *Considering the main purpose of this part of the lesson, what would did the teacher consider when planning?*
- *What needs to happen if some of the students do not have the understanding to continue?*
- *What must the teacher be assessing during this part of the lesson?*
- *Consider the contrast in the thinking of some students – "Both cost $10, so the price is the same." – with the thinking of other students: "The price is the same, but 1200 grams is less than 1300 grams, so you are getting less for the same price, so it is costing more."*
- *How does the second way of thinking show proportional reasoning? How might you take advantage of this teachable moment?*

Introducing the Lesson Problem *(1:46)*

Students work collaboratively and in small groups to solve the lesson problem. They think about their strategies and look for the most efficient way to proceed. The teacher assesses for learning and selectively chooses times to provide immediate feedback.



- *Anticipate student solutions to the problem above.*
- *What will you look for as you watch this segment?*
- *What additional questions do you have after viewing this segment?*

Working On It

Students work collaboratively to solve the lesson problem. They listen and question each other respectfully as they clarify and record their thinking either on paper or on their laptops.

Solving the Problem

- *Conversions (0:38)*
- *Using Unit Rate (1:00)*
- *Constructing Equivalent Rates (0:46)*
- *Using Friendly Numbers (2:56)*

The Lesson Problem is an open problem in that there are different strategies, tools and approaches that can be used to solve it. It is "open-routed" or "open-in-the-middle" rather than "open-ended".

Discuss the above statement. What does open-routed or open-in-the-middle mean to the teaching and learning stance?

Before watching students at work, anticipate possible solutions and errors they might make. What questions might challenge their thinking?

As you view the student work, you may wish to record your thoughts on the following organizer:

Organizer #3 — Observations of Student Work

I observed …	*I thought …*	*Possible next steps*
Conversions		
Unit Rate		
Constructing Equivalent Rates		
Using Friendly Numbers		

NOTE: Organizer #3 is available in Word and in PDF in the Print Resources folder on the DVD.

What do you keep in mind as you examine student work?

What is revealed in the student work shared in this resource? Consider:

- *What aspects of each solution relate to the lesson goals?*
- *What mathematical tools and concepts are evident in each of the solutions?*
- *What math processes are evident?*
- *What math content is evident?*

- *What probing questions might support students in generalizing the mathematics?*
- *What aspects of accountable talk and assessment for learning did you notice?*
- *How is the teacher facilitating discussions among students while they work?*

Below are examples of prompts and questions that teachers and students may pose in order to probe and provoke mathematical thinking:

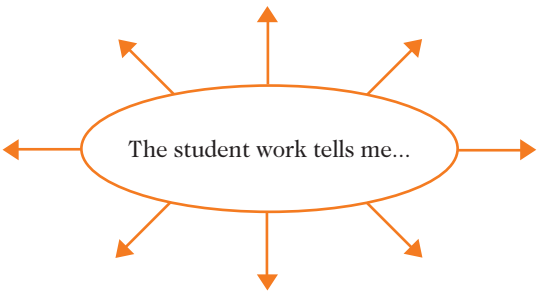
- *How do you/we know?*
- *What could you/we add to your/our solution to make it clearer for the reader?*
- *Would this work every time? Can you/we think of any examples that don't work?*

(Adapted from the LNS Capacity Building Series monograph Asking Effective Questions, July 2011)

What other questions might be used? Why?

You may wish to record your thinking on the organizer below:

Organizer #4 — Examining Student Work



NOTE: Organiser #4 is available in Word and in PDF in the Print Resources folder on the DVD.

Consolidation

In this part of the lesson, the teacher strategically facilitates several students sharing their work with the whole class. Students have the opportunity to use their laptops to demonstrate their work and solutions during a class gallery walk.

> Five teaching practices for improving the quality of discourse in mathematics classrooms:
>
> 1. "talk moves" that engage students/facilitate discussion
> 2. the art of questioning
> 3. using student thinking to propel discussions
> 4. setting up supportive environments
> 5. orchestrating the discourse
>
> Chapin, O'Connor & Canavan Anderson, 2009

Using Feedback *(4:19)*

In the math community, a gallery walk builds communication skills, collaborative skills, flexible thinking and being open to other people's point of view. It extends students' content knowledge as they struggle to understand and provide feedback to their peers. It actively engages students in their own learning and begins to support consolidation of the mathematics.

- *The gallery walk is a strategy that is beneficial to both students and teachers. What conditions need to be in place for students to maximize the learning during a gallery walk?*
- *What opportunities exist for ongoing assessment during a gallery walk?*
- *How might you infuse the expectation that students self-assess during the gallery walk?*
- *What habits of mind are students developing through this learning experience?*
- *Students demonstrated an understanding of the importance of giving and receiving appropriate feedback. What transferable skills did they develop during this gallery walk?*
- *What strategies have you found to be effective for sharing feedback?*

Sharing

Students share their work with their peers. The presenters use appropriate math vocabulary to articulate their ideas. Those listening ask questions for clarification. The conversation is primarily student-to-student, with the teacher intervening to prompt deeper thinking or to capitalize on a just-in-time teaching opportunity.

- *Group 1 (4:03)*
- *Group 2 (6:42)*
- *Group 3 (5:54)*

> Every time I am tempted to tell students something, I try to ask a question instead.
> Reinhart, 2000

As the second group presents, watch for the connections between the first and second group's solutions. While the first group uses pictures of turkeys to find out that there are 19.5 groups of 500 grams and the total turkey mass is 9,750 grams, the second group uses a double number line.

- *What did you notice about the teacher's questioning techniques?*
- *What did you notice about the students' questioning techniques?*
- *How do you think students developed their questioning skills?*
- *Why did the teacher refer students' questions to the students sharing their solution?*

Highlights, Summary and Independent Practice *(4:17)*

> Research is beginning to identify important characteristics of highly effective teachers (Ma 1999; Stigler 2004; Weiss, Heck, and Shimkus, 2004). For example, effective teachers ask appropriate and timely questions, they are able to facilitate high-level classroom conversations focused on important content, and they are able to assess students' thinking and understanding during instruction.
>
> Charles, 2005

To move further towards consolidation of the learning, the teacher first highlights and summarizes the key mathematical concepts, algorithms and/or strategies related to the lesson learning goals. These will be referred to in later lessons and will help form the success criteria related to the learning goals for this unit of learning. The teacher will then assign independent practice.

- *How did the teacher stimulate thinking during this part of the lesson?*
- *When describing this phase of the three-part lesson, what would you say is the main purpose of highlighting, summarizing and independent practice?*
- *What would you have highlighted in addition to the strategies that the teacher in the video highlighted? What strategies did you notice this teacher used in order to assess student understanding during this part of the lesson?*
- *How might you assess student understanding? What might you do to support students who are not attaining the intended learning goals?*
- *What strategies might you use to remember your observations and thinking during the lesson?*

Teacher Debrief

This teacher is a co-learner with her students, constantly reflecting on her practice and its impact on student learning. She nurtures independent thinking and provides opportunities for students to work collaboratively, take a critical stance and clearly communicate their learning.

· *Collaboration (2:17)*
· *Flexible Grouping (1:37)*
· *Strategies and Tools (0:47)*
· *Questioning and Math Talk (2:59)*
· *Planning (2:00)*

This teacher has high expectations for all students and genuinely believes that all students can learn. She teaches and models leadership skills, collaboration, effective listening and giving feedback. Students examine success criteria for the tasks and participate fully in self-assessment. They build metacognition and learn how to use technology as a tool. The teacher asks probing questions to encourage deep thinking as students construct their mathematical understandings.

- *Comment on the parts of this teacher's reflections that connect to the above quote.*
- *This teacher is intentional in her planning and reflective in her practice. Which part of her reflections resonated with you in relation to your own practice?*
- *How might you begin to implement some of the ideas you heard in this part of the resource?*
- *What questions do you have that you would like to explore further?*
- *Comment on this teacher's use of technology to create an inclusive learning environment.*
- *This teacher participated in a school-wide focus on oral language, technology and professional learning to improve student achievement. What evidence do you see of the impact of this focus on her practice and on student learning?*

> The classroom becomes a workshop as learners investigate together. It becomes a mini-society – a community of learners engaged in mathematical activity, discourse and reflection.
>
> Fosnot, 2005

Resources and Related Reading

Chapin, S.H., O'Connor, C., & Canavan Anderson, N. (2009). *Classroom discussions: Using math talk to help students learn*. Sausalito, CA: Math Solutions.

Charles, R.I. (2005). Big ideas and understandings as the foundation for elementary and middle school mathematics. *Journal of Mathematics Education Leadership*, *7*(3).

Copley, J.V. (2000). *The young child and mathematics*. Washington, DC: National Association for the Education of Young Children.

Fosnot, C.T. & Dolk, M. (2002). *Young mathematicians at work: Constructing fractions, decimals and percents*. Portsmouth, NH: Heinemann.

Fosnot, C.T. (2005). Constructivism revisited: Implications and reflections. *The Constructivist, 16*(1).

Ontario Ministry of Education's Capacity Building Series
http://www.edu.gov.on.ca/eng/literacynumeracy/inspire/research/capacityBuilding.html

Asking Effective Questions (July 2011)
Bansho (Board Writing) (February 2011)
Communication in the Mathematics Classroom (September 2010)

Reinhart, S.C. (2000). Never say anything a kid can say! *Mathematics Teaching in the Middle School*, *5*(8).

Small, M. (2009). *Making math meaningful to Canadian students, K–8*. Toronto: Nelson Education.

Small, M. (2009). *Big ideas from Dr. Small: Creating a comfort zone for teaching mathematics*. Toronto: Nelson Education.

Van de Walle, J.A. & Folk, S. (2008). *Elementary and middle school mathematics : Teaching developmentally, 2nd Canadian Edition*. Toronto: Pearson Canada.

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 ENGAGING_STUDENTS_IN_MATH to open a drop-down options list. (Both DVDs contain the same resources.)
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 ENGAGING_STUDENTS_IN_MATH. (Both DVDs contain the same resources.)
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 978-1-4435-7340-5