

# An Annotated Learning Journey within a Primary Classroom

## Setting the Context: Grade 2

**Ontario Catholic School Graduate Expectations:** CGE 2b, 3c, 4b, 5a, 7b  
**Gospel Values/Virtues:** Excellence, Hope, Community, Love  
**Learning Skills and Work Habits:** Collaboration, Initiative, Self-Regulation, Independent work  
**Curricular Learning Goals:**  
 I can compose and decompose two-digit numbers using addition and subtraction.  
 I can use strategies to investigate multiplication and division.

**Revealing the educator's thinking:**  
 "My grade partner and I wanted our students to see that the strategies they were using to add numbers to 20 could be used to add numbers up to and beyond 100. This concept is the beginning of several of the big ideas of proportional reasoning:

- If units are related, you can use that relationship to predict how many of one unit if you know how many of the other;
- Any number can be compared to any other number multiplicatively,
- Two numbers can be far apart from an additive point of view, but not from a multiplicative point of view." (Marian Small, EOSDN, 2014)

"We wanted the class to co-construct an anchor chart of strategies they each use so the students can add to their own personal tool belt of strategies to help when problem-solving."  
 "We wanted to assess who was effectively adding and subtracting numbers; what strategies each student used and if he/she could explain his/her thinking."

**The educator wonders...**  
 "How might this experience strengthen each child's own self-efficacy toward mathematical thinking and establish a strong Catholic learning community?  
 What are the learning goals?  
 What kind of a learning task will reach each student's needs?  
 How might this task allow students to uncover many big ideas from the curriculum?  
 How might this task be designed to be engaging for all students?  
 How much time would be devoted to this learning experience?"

**Planning with the end in mind:**  
 The educator and her grade partner collaboratively planned a learning experience that would extend, challenge and push the thinking of each student while respecting the dignity and the learning journey of each child.  
 Mathematically each student will be exploring specific skills while making meaningful connections to the big ideas of proportional reasoning.  
 The educators have intentionally planned to gather evidence of learning aligned to the learning goals in order to be responsive to the needs of each student.

**Revealing the educator's intentional decisions to allow for student-centred collaborative inquiry:**

- Students choose the size of paper and where in the room they will work.
- Students write in pen or marker. Crossed out work becomes a record of thinking for both the student and the educator.
- Buckets of manipulatives are placed around the room. Students know they are welcome to use whatever they feel is needed to solve the problem.
- Students are given control and ownership of the problem and expected to struggle.
- Students who ask for help or require assistance are challenged with probing questions that will move their thinking forward.

**Assessment for, as and of Learning:**  
 The educator is continuously assessing while the students are engaged in their inquiry. There is a moral imperative to allow purposeful talk and observation of student interaction to guide instruction for each student on an individual level. This proactive differentiated instruction is effective when the educator fully recognizes the specific needs of each student. Challenging a student to extend his/her thinking is just as important as reducing the size of the number for the student who finds 30 to be a large number.

## The Learning Experience:

**Choose two whole numbers less than 100. One should be a large quantity and the other a small quantity. Explain how many of the smaller number it would take to make the bigger one. How do you know? Reveal your thinking.**  
 This learning experience should take three 75-minute blocks.

**The Instructional Task:**  
 This open-ended task was chosen to respect the learning journey of each student. Students were challenged to pick their own pair of numbers, pick the appropriate strategies and empowered to solve the problem. The element of choice is an essential element of differentiated instruction allowing the dignity of the learner to be respected as it values the child's learning journey.

Students are encouraged to collaborate, share ideas and give advice to each other. This promotes a culture of community, respecting each other's thinking and fostering mathematical discussion.

Deep observation and listening to the students' conversations will give invaluable assessment for learning evidence for the educator in order to support professional judgement and provide information for instructional decision-making.

## Activation:

**"How might we identify the strategies we use to add and subtract numbers?"**  
 The class co-constructs a list of strategies, naming and giving examples of each strategy. Strategies include: counting on, anchors of five, making ten, using friendly numbers, doubling, doubles plus or minus one, skip counting.

**"What constitutes a big number?" "What constitutes a small number?"**  
 Through discussion and by considering examples students came to understand that a quantity is relative to the object or circumstance addressed.

"Fifty is a big number if you are talking about cars. You can't have 50 cars. If you were to only have \$50 and you wanted to buy a house then you don't have enough. It depends on what you are talking about."

**How does the activation phase support the learning?**  
 The activation phase provokes thinking and leads into the learning experience. In this problem, the educator is listening for any misconceptions. This is important assessment for learning information which will allow her/him to support students as they choose the pairs of numbers appropriate for their level of challenge.

Allowing students to hear each other's thinking generates ideas, validates a student's thinking and creates a safe, respectful environment for a student to question a peer or herself/himself. This is important for all students but necessary for students who may struggle. Everyone should feel eager and ready to tackle the problem after the activation. This allows the child's innate wonder and awe in discovery to manifest itself.

## Working on it:

**Scenario 1:** The educator knows who will need a restating of the problem and calls these students into a guided group.

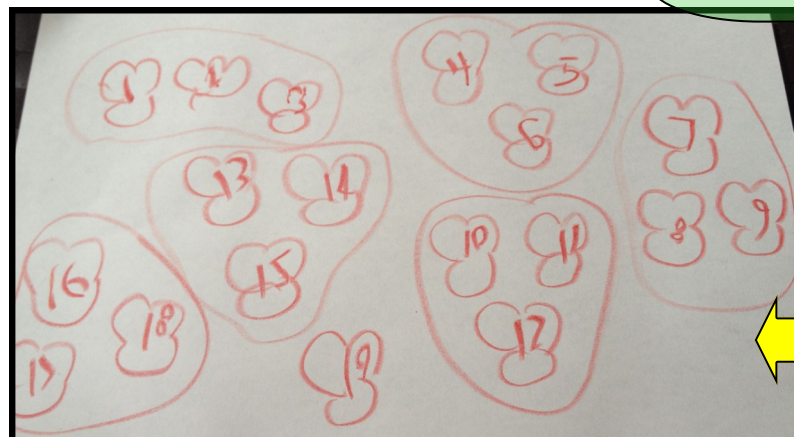
**Scenario 2:** One student solves the problem quickly using the numbers 100 and 1. He justifies his response by relating his ideas to money (i.e. 100 cents equals \$1) He needs a challenge. After discussion with the educator about the criteria, he chooses 1000 and 20.

**Scenario 3:** As the educator is observing students, she notices one student who is playing with something in her desk and not attempting the problem. Using probing questions, it is clear that this student does not know where to start. The educator knows that this student has difficulty representing numbers beyond 20. When asked what she thought a big number was, she responded, "Nineteen, because 19 watermelons is a lot." She chose 3 as her smaller number. It appeared she still didn't know where to start so the educator asked, "How many groups of 3 would make 19?" The student retrieved 19 teddy bear manipulatives and knew how to proceed. By the end of the class, she had a great question to ask the class during consolidation, "What happens to the one left over?"

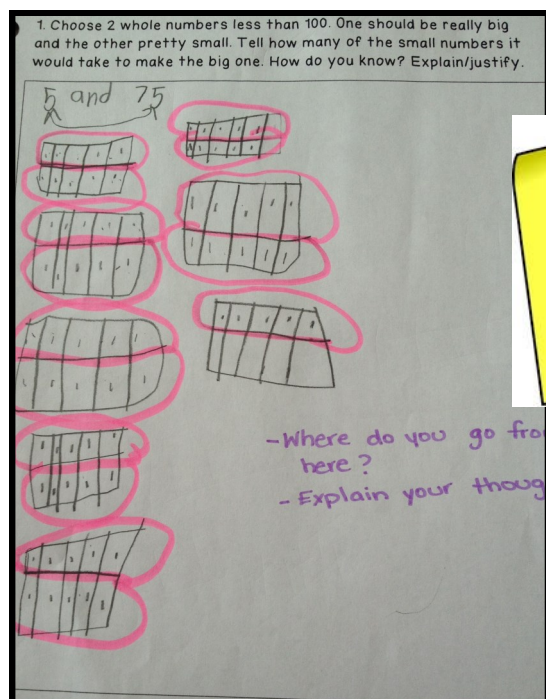
**Scenario 4:** Two students who both picked the numbers 75 and 5 were having a great debate since they both had different answers yet were able to defend their work. The students asked the educator to intervene. The educator asked each student to explain their thinking. The first student counted all the 5 frames he had drawn on his paper—a count of 21. The second student did the same and came up with 15 frames. How could they both have the same number of dots and both have a different number of groups? It was decided to ask the class to help during the consolidation.

## A Glimpse of Student Thinking:

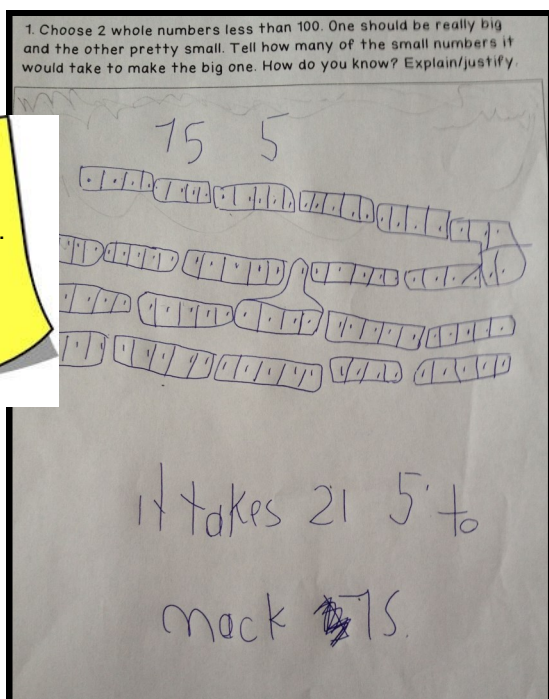
To honour the thinking of each student, it is imperative that they be given multiple opportunities to demonstrate their learning in a variety of ways in order to show growth over time. Observations, conversations and written products, aligned to learning goals and success criteria, are gathered and documented by educators and students.



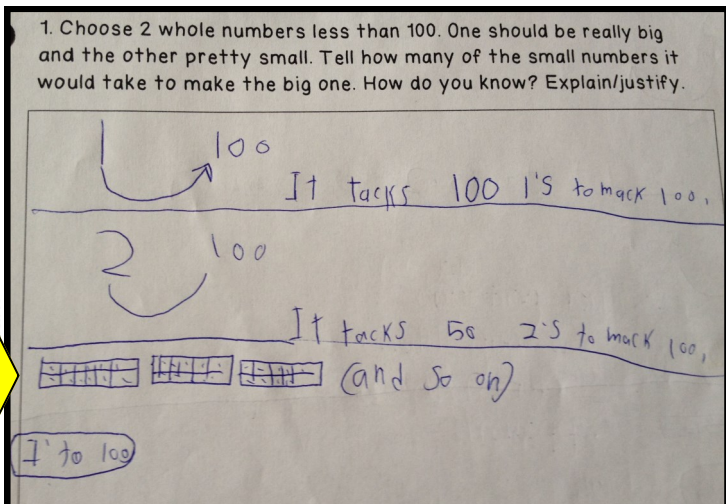
Student A chooses the numbers 3 and 19. She draws a diagram to explain her thinking.



Two students choose 5 and 75. Each is sure his response is accurate.



it takes 21 5's to  
make 75.



A student explores different combinations of numbers.

## Consolidation:

The first student explained that she picked the numbers 3 and 19 and made 3 groups of 6 making a total of 18. She had one left over and wondered what she should do? The students thought about it, talked about it, and agreed it didn't change the solution to the problem. "If you had 7 groups of 3 then, that is too many!"

Next the two friends who were debating came up to show their work. The class was asked "What are your thoughts? How is this possible?" Someone noticed, "That five frame only has 4." Another student piggybacked on her thinking pointing out a few more that were not in fact five frames but 4 frames. When the two students went back and looked over the work again, they realized he did have 21 frames, however, some of the frames were 4 frames and not 5 frames. When he went back and revisited his work, he came up with 15 groups of 5 to make 75. The big idea of checking work carefully and listening carefully to support each others' work was reinforced.

Other student work included: counting by 10s in order to find out how many 10s it takes to make 50; using the 100s chart to see how many times 13 would go into 99; using the number 2 and 40 and drawing a number line jumping by 2s. A student who did not write anything down explained how he picked the numbers 4 and 88. He was able to tell the class that he knew if he looked at the numbers individually,  $4 + 4 = 8$  or  $4 \times 2$  and continued the pattern that it would take 22 fours to make 88.

Consolidating and celebrating the learning of each student remains the cornerstone of this phase of instruction. If a culture of respect and dignity has been maintained throughout the process, each student - no matter their own skill level - can learn from the other.

The educator carefully and intentionally plans the consolidation in order to scaffold the learning. Errors are seen as opportunities for growth and celebrated, rather than downplayed, ignored or seen as failures.

The consolidation phase is a time for students to construct understanding, but it is a **critical** time for educators to gather evidence (i.e. Assessment for learning). The educator makes instructional decisions to personalize the next steps for each student as well as plans multiple opportunities for practice moving towards assessment of learning to come.

## Reflection:

**Student Reflections:** One student noticed that using tallies was not working well because it took a lot of work. To make the work more efficient, she made one image (i.e. a square) represent the quantity 5. She remarked, "It's like cheating, because I am not doing all the work. But I wanted to get it done."

One student noticed that he chose 5 and 100 while another student chose 10 and 100. It took the first student 20 times to make 100; it took the second student 10 groups to make 100. He noticed that 5 is half of 10 and because it is smaller, it takes more.

During consolidation, students noticed, "The bigger the big number and the smaller the small number the more times it takes to make up the big number. If you chose 2 and 98 like my friend did, it took 49 groups of the 2s. But if you took 10 and 100 it took only 10."

When consolidating, the feeling of hope and reassurance is provided for all students. "We are co-learning together!"

Asking students to reflect on their learning (i.e. assessment as learning) provides students with an opportunity to think about their thinking. The educator intentionally designed this learning experience so students could make connections about the big ideas of mathematics. Students made connections to the effectiveness of strategies by revisiting the co-constructed anchor chart to review, extend and add to it. Students made connections to the big ideas of proportional reasoning.

She will also direct them to think critically about the conditions needed for working collaboratively with others, listening respectfully and being accepting of others in their learning journeys.

## Next Steps:

**For the whole class:** "I noticed that many of my students used 5 or 10 frames, however, for bigger numbers this may not be the most effective strategy. I need to think about how other strategies will be modelled. I wonder what questioning I will use to help students make explicit connections between repeated addition and multiplication, and then connections with division. I am wondering what other tasks will help reinforce these concepts?"

**For individual students:** "This open-ended task supported the needs of all students in my class. The initial limit of 100 was changed for some because it was too high or too low. Every child was able to enter into this task! That was my goal."

**For the educator:** "I will continue to document the learning. When students have had time to practice and incorporate feedback, I will discuss the progress with my grade partner. Together we will design a task to serve as assessment of learning."

The educator reflects back on the learning experience, taking responsibility for each child under her supervision. Both assessment and instructional next steps for the whole class and for individual students are determined. Personal next steps for the educator and collaborative partners are discussed.

The educators understand that students will develop their understanding at different times, therefore assessment of learning may also vary.

## An Annotated Learning Journey within a Primary Classroom

### Contextual Information

#### Anchoring on the Big Ideas:

**Proportional reasoning:** A number tells how many or how much. Usually we use numbers to give us the sense of the size of something.

Numbers are compared in many ways. Sometimes they are compared to each other; other times, they are compared to benchmark numbers.

#### Connecting the Mathematical Processes to Curricular Goals:

**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:** developing reasoning skills (e.g., pattern recognition, classification) to make and investigate conjectures;

**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;

**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 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.

#### Developing Ontario Catholic School Graduate Expectations:

An Effective Communicator who:

CGE2a Listens actively and critically to understand and learn in light of gospel values.

CGE2b Reads, understands and uses written materials effectively.

A Reflective and Creative Thinker who:

CGE3c Thinks reflectively and creatively to evaluate situations and solve problems.

A Self-Directed, Responsible, Lifelong Learner who:

CGE4a Demonstrates a confident and positive sense of self and respect for the dignity and welfare of others.

CGE4b Demonstrates flexibility and adaptability.

CGE4c Takes initiative and demonstrates Christian leadership.

CGE4f Applies effective communication, decision-making, problem-solving, time and resource management skills.

A Collaborative Contributor who:

CGE5a Works effectively as an interdependent team member.

CGE5e Respects the rights, responsibilities and contributions of self and others.

A Responsible Citizen who:

CGE7b Accepts accountability for one's own actions.

## Learning Tasks in Mathematics

*"It is not realistic for a teacher to try to create 30 different instructional paths for 30 students ...Because this is the perceived alternative to one-size-fits-all teaching, instruction in mathematics is often not differentiated."*

Marian Small. (2012). *Good Questions: Great Ways to Differentiate Mathematics Instruction*. p. 6.

#### \*Valuing the Diversity of Student Thinking:

"Students in any classroom differ in many ways. When teachers develop instructional plans that acknowledge their differences, students can learn in ways that are suitable for and meaningful to them."

#### \*Focusing Instruction on Key Concepts:

"Overall curriculum expectations are likely to provide a starting point for what the key concepts are, but probably do not help [an educator] easily plan to differentiate instruction. One approach is to cluster specific curriculum expectations and use them as learning goals over a series of lessons. It is by clustering specific expectations, in conjunction with looking at the curriculum for other grade levels, that the key concepts become evident."

#### \*\*Open and Parallel Tasks:

"A question is **open** when it is framed in such a way that a variety of responses or approaches are possible. Almost any student can participate fully and gain from the discussion in the classroom learning community. By using the open question, students gain confidence; they can answer the teacher's question right from the start."

"**Parallel** tasks are sets of tasks, usually two or three, that are designed to meet the needs of students at different developmental levels, but that get at the same big idea and are close enough in context that they can be discussed simultaneously... Parallel tasks contribute to the creation of the classroom as a learning community in which all students are able to contribute to discussion of the topic being studied."

#### The Thinking Process of Differentiation:

- "Identify the key concepts for teaching and think through how they relate to overall and specific curriculum expectations.
- Find out where each of your students is on a developmental continuum or an instructional trajectory/landscape, related to those key concepts. Use different assessment strategies (e.g. observation, interview, performance assessment, work sample analysis) to gather evidence of your students' mathematical knowledge, thinking and experiences.
- Set learning and consolidation tasks in students' zone of proximal development. Use either open learning tasks (i.e. open-ended or open-routed) to provoke students to demonstrate their mathematics knowledge, skills and strategies. Use parallel consolidation tasks designed to suit the mathematical learning needs of different groups of students.
- Add elements of choice to your instructional plan, making sure that you use your instructional time wisely, enabling student learning to focus on important mathematical concepts and processes within students' zones of proximal development.
- Avoid the trap of believing that the teacher's job is to make each situation so clear and unambiguous that all students respond in the same way. A teacher who seeks to differentiate, in fact, wants sufficient ambiguity to enable lots of appropriate difference in responding."

\*Ontario Ministry of Education. (Sept. 2008). *Differentiating Mathematics Instruction*. pg. 1, 7-8.

\*\*Marian Small. (2012). *Good Questions: Great Ways to Differentiate Mathematics Instruction*. p. 6,10.

## Asking Effective Questions

### \*Asking Effective Questions

#### Provoking student thinking/deepening conceptual understanding in the mathematics classroom

“Researchers support a problem-solving approach in the mathematics classroom because it engages students in inquiry, prompting them to build on and improve their current knowledge as they “construct” explanations that help them solve the task at hand. “In a constructivist classroom,” Marian Small writes, “students are recognized as the ones who are actively creating their own knowledge”. The teacher’s skillful questioning plays a vital role in this context, helping students to identify thinking processes, to see the connections between ideas and to build new understanding as they work their way to a solution that makes sense to them.”

#### \*Eight Tips for Asking Effective Questions:

1. **Anticipate Student Thinking:** [Educators should] engage in solving the lesson problem in a variety of ways. This enables the [educator] to anticipate and plan the possible questions they may ask to stimulate thinking and deepen student understanding.
2. **Link to Learning Goals:** Ask questions that connect back to the overall expectations. During the consolidation phase, students are then better able to make generalizations and apply their learning.
3. **Pose Open Questions:** An open question is one that encourages a variety of approaches and responses.
4. **Pose Questions that Actually Need to be Answered:** [Pose a question that allows students to engage in their own reasoning.]
5. **Incorporate Verbs that Elicit Higher levels of Bloom’s Taxonomy:** Verbs such as connect, elaborate, evaluate and justify, prompt students to communicate their thinking and understanding, to deepen their understanding and to extend their learning.
6. **Pose Questions that Open Up the Conversations to Include Others:** The way in which questions are phrased will open up the problem to the big ideas under study. The teacher asks questions that will lead to group or class discussions about how the solution relates to prior and new learning.
7. **Keep Questions Neutral:** Qualifiers such as easy or hard can shut down learning in students. Facial expressions, gestures and tone of voice can send signals, which could stop students from thinking things through.
8. **Provide Wait Time:** When teachers allow for a wait time of three seconds or more after a question, there is generally a greater quantity and quality of student responses.

\*Ontario Ministry of Education. (July 2011). *Asking Effective Questions*. pg. 1-3.

#### Good questions don’t replace careful listening ...

“Circulating as students work in pairs or groups, teachers often arrive in the middle of an activity. Too often they immediately ask children to explain what they are doing. Doing so may not only be distracting but may also cause teachers to miss wonderful moments for assessment. Listening carefully first is usually more helpful, both to find out how students are thinking and to observe how they are interacting.

(Storeygard, Hamm, & Fosnot, 2010)

## Gathering Evidence of Learning

“Evidence of student achievement for evaluation is collected over time from three different sources — observations, conversations and student products... Using multiple sources of evidence increases the reliability and validity of the evaluation of student learning.”

Ontario Ministry of Education. (2010). *Growing Success: Assessment, Evaluation and Reporting in Ontario Schools*. p. 39.

#### \*Observation: A Powerful Lens on Learning:

“Primary and junior students demonstrate their mathematical knowledge and understanding through what they do, say, and show. Observation, therefore, is the most efficient and effective way for teachers to assess students’ mathematical abilities and is an integral part of all assessment strategies. Teachers must be attentive observers of their students as they seek evidence of how well students are learning concepts and skills. Observation is more than just looking. It involves:

- watching the way students approach learning tasks;
- listening to students’ ideas and trying to understand their reasoning;
- discussing problems so that students reveal their way of thinking;
- asking questions that probe students’ thinking;
- examining the products that students create.”

“The understanding of concepts in mathematics is critical to students’ present and future success in mathematics. It is important, therefore, that teachers focus their observation on behaviours and demonstrations that indicate the extent to which students understand fundamental concepts. Having a clear focus when observing students helps teachers watch and listen for evidence of learning, and guides them in providing feedback to students on their learning and on areas for improvement.”

#### Conferences or Conversations:

“Conferences (informal conversations) provide an opportunity for students to “talk math” while they are engaged in learning tasks. The teacher might initiate a conference with an individual or a group of students in order to probe their understanding more thoroughly, to help students clarify ideas, to challenge students’ thinking if misconceptions are evident, or to direct attention to mathematical ideas that students are ready to explore. Questions that reveal students’ thinking:

- ask students to show what they know and are able to do;
- prompt them to clarify their explanations and defend their thinking;
- challenge their curiosity;
- ask them to make connections by comparing ideas; and
- allow them to reflect on their thinking.

#### \*\*Developing Pedagogical Documentation:

“Educators are broadening their view of what type of evidence should be collected and how it can support learning.”

“The triangulation of evidence, especially observations and conversations, plays a critical role for planning with students in mind. Evidence relating to the student experience in classrooms is the catalyst as well for changes in educators’ actions, practice and understanding. Student experience becomes the subject of professional learning – engaging teachers in observation, analysis and responsive interaction with students. Students feel their ideas are valued, helping them to build confidence and a “growth mindset” about their own learning over time (Dweck, 2006).”

\*Ontario Ministry of Education. *A Guide to Effective Instruction in Mathematics: Kindergarten to Grade 6 - Volume 4: Assessment and Home Connections*. pg. 16-17.

\*\*Ontario Ministry of Education. (September, 2013). *Student Voice: Transforming Relationships*. pg. 6.