# Vector

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# Special Issue on Elementary Mathematics

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Articles can be submitted by email to the editors listed above. Authors should also include a short biographical statement of 40 words or less.

Articles should be in a common word processing format such as Apple Works, Microsoft Works, Microsoft Word (Mac or Windows), etc.All diagrams should be in TIFF, GIF, JPEG, BMP, or PICT formats. Photographs should be of high quality to facilitate scanning.

The editors reserve the right to edit for clarity, brevity, and grammar.

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**ON THE COVER:** Joan Sawicki was looking for an art project for her K's, for the school wide art extravaganza. She showed her students examples of the work of various artists and asked them which artist they liked. Overwhelmingly they chose Kandinsky, which is great because it brings a lot of math into it. Students chose all the colours for the backgrounds and the circles.

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# Vector: Special Elementary

Welcome to the second edition of the BCAMT Elementary Vector! We are excited and pleased to offer this special issue as the BCAMT continues to promote and support excellence in mathematics teaching.

With the upcoming transformation of the mathematics curriculum, students and teachers will be looking more closely at the competencies that enable us to acquire the mathematical content. https://curriculum.gov.bc.ca/curriculum/Mathematics Learning and teaching through problem solving are now forefront and more explicit.

This issue includes articles, ideas and experiences shared by teachers (in the classrooms or district support roles). The submissions range from grades K – 7 and help teachers connect the math curriculum to the core competencies as outlined in the Transformation Curriculum and Assessment document. Topics include differentiated instruction, assessment, enhancing aboriginal learning, proportional reasoning, technology, financial literacy and developing personal strategies.

We greatly appreciate the time and effort given by the authors that enable us to share their experiences in and passion for helping students developing numeracy.

As you read this edition, our hope is that you will be inspired to share your experiences and learning journeys in future issues. By becoming a member you would also be able to access past editions of Vector and professional resources.

While only one paper copy is provided to each school, please encourage your colleagues to view an e-Vector on the BCAMT website: www.bcamt.ca

Numeracy is a key component in developing the "educated citizen". We hope that this edition will provide ideas and support as you continue this journey of the transformation of mathematics curriculum.

Sandra Ball

Selina Millar

# PRESIDENT'S MESSAGE

## Hi Everyone,

Teaching K-7 students is a complex task with many obstacles to navigate. Teachers inevitably experience difficulties but fortunately there are great rewards to motivate us. The thrill of observing children work through challenges, be curious, and be excited about learning is incredibly heartening.

There are a large variety of learning environments within elementary schools and teachers are constantly having to adapt. Consequently, teachers need a solid pedagogical framework upon which to plan their thoughts and adjust lessons as they become familiar with their students. Developing this framework and making these adjustments is much easier if you have opportunities to collaborate with colleagues and access excellent resources. With that in mind, I hope the BCAMT can help you explore your thoughts around math education.

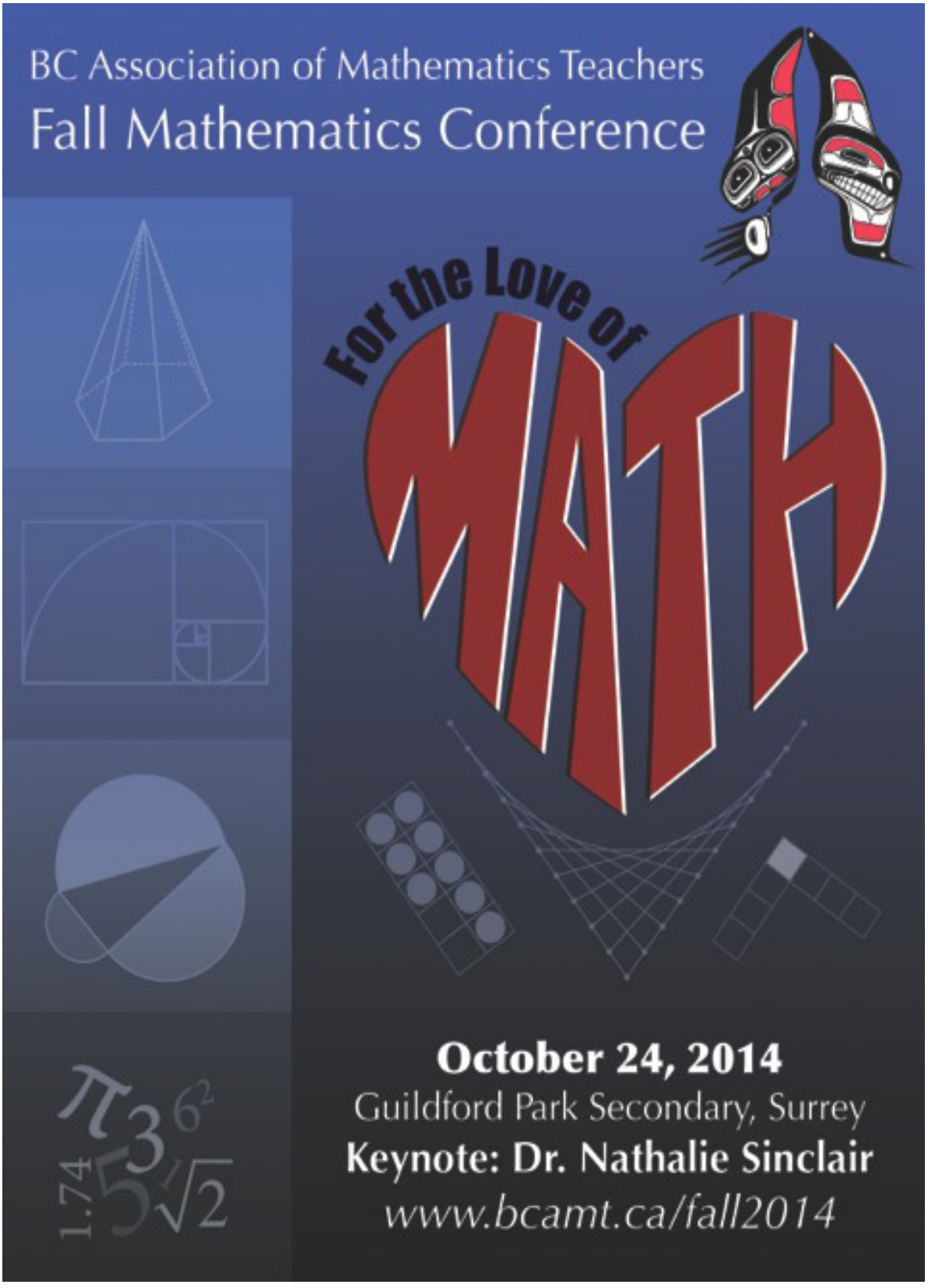
As you contemplate various ways to teach mathematics, you might want to consider the following question from Dr. Peter Liljedahl (SFU): Do you see math as a noun or as a verb? This question immediately makes you stop and try to make sense of it. The more you think about it, the more you realize it has many layers that cause you to reflect upon your beliefs. For now, I will give you my simple interpretation of the first layer: Do you see math as a list of things you need to learn or do you see math as thinking and doing?

As you read the articles in this journal, look at various resources, or consider the math curriculum, it is worthwhile to recall Peter's question. Moreover, discussing this question with colleagues can lead to some wonderful conversations on what 'should' happen in a math classroom. As for me, I generally lean strongly towards 'math is a verb'. This in turn leads me to wonder 'what does thinking mathematically and doing mathematics actually mean?' I hope the articles in this journal provide you with some insight and perhaps I will see you at future BCAMT conferences or workshops to explore things further.

In the meantime, I will leave you with this mantra to consider: 'I have experienced mathematics, therefore I think'.

**Ron Coleborn**
BCAMT President


I DON'T GET IT!!!
Hey, can you come over for the play date?
I can't right now dude. Math homework!
Helping my DAD with it!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Fall Mathematics Conference
For the Love of
MATH
October 24, 2014
Guildford Park Secondary, Surrey
Keynote: Dr. Nathalie Sinclair
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# Building Number Sense by Breaking Apart Numbers

by Carollee Norris

Carollee Norris is passionate about mathematics! She supported math K-12 in BC's SD#60 until her recent retirement, and she has taught SFU's elementary math methods course on multiple occasions. She is a former member of the BCAMT executive and has presented at numerous conferences provincially and internationally. You can read her math blog at focusonmath.wordpress.com

As teachers of mathematics, we all hope that our students will develop good number sense. In order for that to happen, we need to plan lessons/activities containing mathematical experiences that will give students the opportunity to build on their present understanding about numbers.

Although there are many definitions of number sense that have been put forth over the years, my favourite is still one I came across many years ago. Hilde Howden, in her article for Arithmetic Teacher, wrote this:

> "Number sense can be described as a good intuition about numbers and their relationships. It develops gradually as a result of exploring numbers, visualizing them in a variety of contexts, and relating them in ways that are not limited by traditional algorithms."
> (H.Howden, Arithmetic Teacher, Feb., 1989, p.11)

One component of number sense that Howden mentions is number relationships. Numbers are related to other numbers in many ways. For young students who are mainly dealing with numbers 1 to 10, we often build on relationships such as one (two) more/one (two) less; anchor numbers of 5 and 10; visual relationships, involving arrangements of numbers such as are found on dice, dominoes, playing cards, ten frames, etc.; and whole-part-part relationships (referred to as WPP) which involves breaking a number apart into two or more smaller numbers).

Primary educators tend to spend time with students building these relationships for the numbers1-10 first, then for numbers 1-20. But beyond grade 2 or so, I believe number relationships are not deemed to be as important. However, it is empowering for students when they understand that the same relationships they worked with in their early years of school can be extended all across the place value system and to other groups of numbers. Thus the one more/one less can be

applied to thousands place and to thousandths place. It can also be applied to fractions (e.g., 5/8 is 1/8 more than 4/8, and it is 1/8 less than 6/8). The idea of anchor numbers also works at many levels. Just as 7 is 2 more than 5 and 3 away from 10, so also we see that 0.7 is 0.2 away from 0.5 and 0.3 away from 1.0. There are many ways to visualize larger (or smaller) numbers using tools such as base-10 blocks, 100 dot arrays, 100 grids, percent circles, fraction circles, etc.). Lastly, every number can be broken apart to show a whole-part-part relationship. We do this with multi-digit numbers in ways that show place value, but we can also do it apart from place value (e.g. 27 comes apart as 25 and 2). Every number can be broken apart (e.g., 7/8 comes apart as 3/8 and 4/8).

It is this latter category of number relationships that I want to focus on here. With all due respect to other math educators who refer to this relationship as part-part-whole, I very deliberately state the relationship as whole-part-part, the emphasis being on the decomposition of the whole. Van de Walle first got me thinking about the importance of this particular relationship: "To conceptualize a number as being made up of two or more parts is the most important relationship that can be developed about numbers." Van de Walle, J. and Folk, S. (2005). Elementary and Middle School Mathematics: Teaching Developmentally (Can. Edition). Pearson: Toronto. (Italics from CN.)

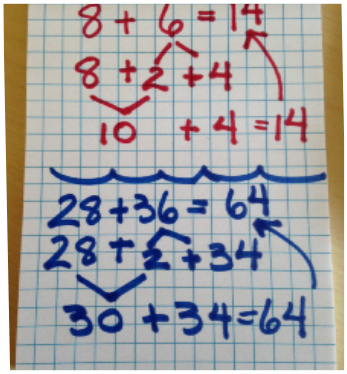


photo 1

It is easy to see how WPP relationships can be used as strategies when learning basic facts. For example, when adding any number 3 or more to 8, the number can be broken apart in two pieces: 2 and the remaining amount. The 2 is easily added to the 8, making the total 10 plus the remaining amount. This same strategy is helpful for adding numbers beyond basic facts as well, with any number which ends in an 8 (see photo 1 for example).

When learning multiplication basic facts, breaking apart numbers comes in handy again, mainly involving the distributive property. Thus, if when a student does not remember 8 x 6, the problem can be seen as 8 (5 + 1). Since the 5 facts are likely more familiar, the student can take 8 groups of 5 and then add to that 8 groups of 1. (See photo 2)

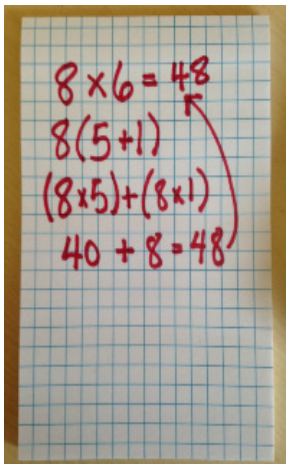


photo 2

Using the WPP relationship with larger numbers is also useful. Consider this subtraction problem:

5000
-2387

Normally students would use the regrouping method that we are all familiar with. However, a much easier method (one which uses and builds students' number sense) can be done by breaking apart 5000 into the components 4999 and 1. (See photo 3.)

Even if the start number is not as "nice" a number as 5000, this strategy still works. In the subtraction problem,

$$\begin{array}{r} 5023 \\ -2387 \\ \hline \end{array}$$

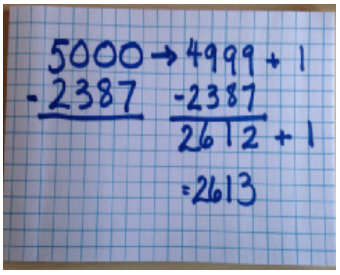



photo 3

one need only break apart from the first number 1 more than 22, thus making it 4999 + 23 and the strategy works nicely. (see photo 4)

Breaking a number into smaller components can be useful when working with fractions as well. I sat once with a boy who had just finished a fraction unit in his class. He was very frustrated because he realized he did not understand much of anything regarding them. To him they were just confusing numbers. He said, "I am supposed to be able to add fractions, and I can't!" I wrote the following question on a piece of paper:

$$1/2 + \ 5/8 =$$

I then asked him to tell me what he knew about the numbers. Reluctantly he confessed he understood what a half was, and he was able to articulate that the 5/8 meant that something had 8 parts and he had 5 of them. I asked how that information might be useful in adding the two different bits together. He sat for a few moments, the said, "Wait! I know that 4/8 is the same as 1/2. If I put the two halves together I have a whole. That leaves only the extra 1/8 so the answer has to be 1 1/8!" (See photo 5) Certainly this is not the "conventional" way of adding fractions, but it was a strategy that worked in this case and it gave the boy a boost of confidence that he knew more about fractions than he thought he did.

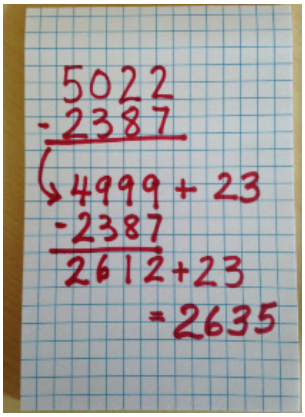



photo 4

So often we just ask students to go through the algorithms for operations and we never ask them to stop and think about using their number sense in the situation.

If, as Van de Walle postulated, knowing that numbers can be broken apart into smaller numbers is important, how do we help students develop an

awareness of this? What can we do to reinforce this important number relationship? The answer, I believe, is rather simple: we regularly practice pulling numbers apart!

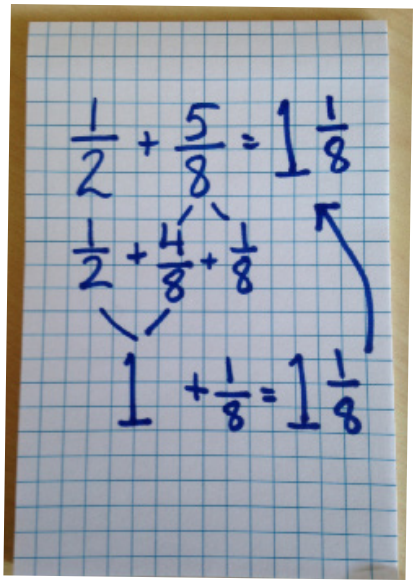
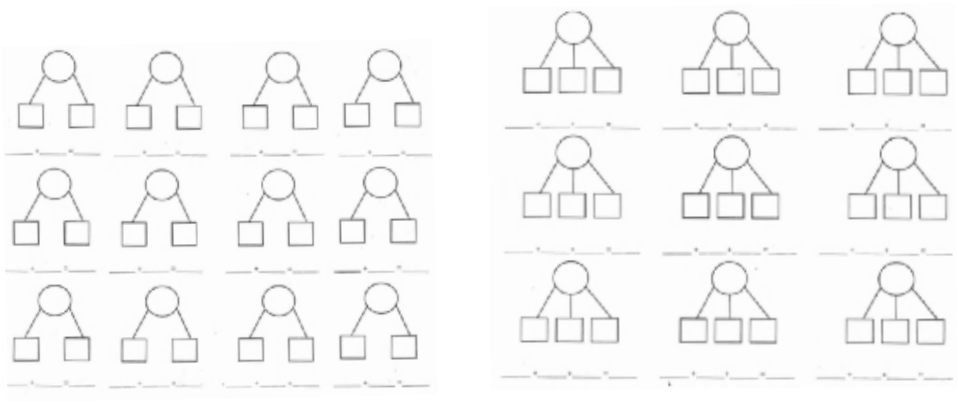


photo 5

Last year I was working with two elementary teachers in my district who taught at one particular elementary school. They were working to improve their math instruction and we had several afternoons, spaced three weeks apart, set aside to meet together. At our first meeting we were discussing number sense, specifically number relationships, and Van de Walle's statement. We considered how it might apply to their grade 2 and grade 3 classes. One of the teachers sat there and sketched a page for practicing breaking numbers apart, giving the opportunity for students to break apart a number into two smaller numbers, into three smaller numbers, and into four smaller numbers. (Note that it is the SAME number being pulled apart over and over on the page, not a new number each time. It was important for students to realize that each number has many different ways to break it apart). The teacher decided that practicing the skill was clearly what was missing and it was her intention to have her students do a page of practice every day.

Three weeks later when we met again she came into the room bubbling over with excitement. "I can hardly believe what three weeks of regular practice of pulling apart numbers has done for my students!" she exclaimed. "Now when the students are practicing basic facts, working on problems, or thinking about numbers in any way, they are asking themselves if there is a way to break the numbers apart to make it easier!"

Eventually the sketched sheet was turned into these pages (download full-sized versions of the sheets at focusonmath.wordpress.com.)



I encourage you to consider having your students practice breaking numbers apart, whether whole numbers, decimals, or fractions. The underlying principle is the same for all numbers, and in the process students will increase their sense of number. Any skill gets better with practice!

# Building Foundations of Proportional Reasoning in the Elementary Grades

by Marian Small

Marian Small speaks across Canada and the U.S. showing how we can teach math more effectively helping a broader spectrum of leaders to succeed. She believes that it's about the questions we ask and about the expectations we hold.
She has written over 80 publications, generally as the sole or senior author, for K-12 students and teachers. She works with a variety of organizations including the National Council of Teachers of Mathematics and the digital company Mathletics.
Marian Small is the former Dean of Education at the University of New Brunswick.

Thinking proportionally is known to be an important ability in the upper elementary grades as well as beyond, but proportional thinking actually starts much earlier. For example, when a young child associates 1 person with 2 eyes and therefore 2 people with 4 eyes, that child is thinking proportionally. We can better prepare our students to deal with more complex proportions in later grades by posing the right questions/ tasks throughout the elementary grades, even in the early years.

**What is proportional reasoning?**

Essentially one is thinking proportionally when considering one amount as a number of units of another. For example, when thinking proportionally, one views the number 10 as two fives or as two and a half fours or as five twos or as half of 20, rather than as one more than nine (even though, of course, ten is one more than nine). Proportional reasoning is fundamentally about multiplicative comparisons (Kaput and Maxwell-West, 1994, Ontario Ministry of Education, 2012).

One might think that means students must be able to multiply to be able to make multiplicative comparisons and so attention to proportional thinking is only relevant from Grade 3 onward. But, in fact, unitizing can and does happen earlier on. Helping students think in units in the primary years, whether working in measurement, number, or data or probability, better

prepares those students to think multiplicatively later on.

**What might proportional thinking look like in Grades K – 1?**

**Problem:**
About how many baby steps make a giant step?

Rationale:

It is important for students to realize that when the value describing a measurement is large, there are two possible reasons- either the object measured is large OR a small unit is used. And, from the other perspective, if the value is small, either the object measured is small OR a large unit is used.

Because students have latitude in deciding what baby steps and giant steps look like, both of the reasons for larger value (or smaller value) measurements are likely to arise. In addition, it could be made clear that knowing a particular giant step to baby step ratio does not lock down the actual size of either of those measures.

*Some questions to pose:*

• Why might different students have correctly provided different answers?

• Suppose someone's answer is a lot more than someone else's. Why might that happen?

• Suppose someone's answer is a less than other people's. Why might that happen?

• If someone told you exactly how many of her baby steps made her giant step, would you know the size of her giant step? her baby step?

**Problem:**
• Take 20 counters.

• Make three piles. Make sure one pile has double the number of (twice as many) counters as one of the other piles.

• What are some possibilities for the sizes of the three piles?

Rationale:

The purpose of this problem is to provide practice with composing and decomposing numbers. At the same time, though, an opportunity is provided to start thinking of a number as double another (or 2 units of another), a start in proportional thinking. (If necessary, explain that double means all of an amount and then all of it again.)

*Some questions to pose:*

• Could one of the piles have 18 counters? Why not?

• What is the biggest possible pile size? Why?

• Could two of the piles have the same size? When or how?

• What are all the possible combinations of three sizes? Why aren't there more?

**Problem:**
• Predict how many of these hexagon blocks it will take to cover this rectangle without actually covering it. Explain how you predicted.

Rationale:

The purpose of this problem is to encourage students to realize that one can estimate the measure of something by measuring part of it and relating the part to the whole. This particular problem uses this notion in an area context, but it could be any measure, whether length, area, volume, … In setting up the learning situation, it would be reasonable to use yellow pattern block hexagons covering part of a large sheet of paper or book, covering about 1/4 or 1/3 (or 1/2) of the whole. The values in the problems below might need to be

changed to match the actual situation.

*Some questions to pose:*

• Do you think it will take more than 8 blocks? Why?

• Do you think it will take more than 10 blocks? Why?

• What number do you predict and what is your reason for that prediction?

• Do you think it is usually possible to estimate a measurement by measuring only part of that thing?

**What might proportional thinking look like in Grades 2 – 3?**

**Problem:**

• A two-digit number has twice as many one blocks as ten rods when you model it with base ten blocks.

• What number could it be?

Rationale:

The purpose of this problem is to encourage students to make sense of place value with two-digit numbers, differentiating the tens from the ones. It also reinforces that even though numbers are written with digits up to 9, they can be represented with more than 9 ones or 9 tens. At the same time, because of how the problem is posed, there is an opportunity to focus on why the number of ones must be even and what it means to have twice as many of something.

*Some questions to pose:*

• Could the number have been more than 50? How?

• Could the number have been more than 100? How?

• Are there any number in the 60s? Why or why not? Are there others in the 60s?

• Could 1 have been someone's number? Why or why not?

• How many possible numbers are there between 10 and 100? What are they?

**Problem:**

• You add two numbers.

• The answer is twice as much as if you subtract them.

• What might the numbers be?

Rationale:

The purpose of this problem is to practise adding and subtracting, but at the same time, look for patterns and generalizations. Because of the use of the phrase "twice", proportional thinking is evoked.

*Some questions to pose*:

• Why didn't 2 and 4 work?

• Did anyone use 2 with another number?

• Could one of the numbers have been 10? What would the other number have been?

• Why are there two possible ways for one of the numbers to be 9?

• How might this picture help get you more answers?

Number 1: 

Number 2: 

**Problem:**

You build an array with twice as many rows as columns.

How many counters (less than 100) might you have used?

Rationale:

The purpose of this problem is to encourage students to practise multiplicative thinking. Because of the condition posed, however, they might consider why the number of counters has to be even (in fact, it is double a square number.) and consider the limits to the size of the array. They also will start noticing how products get farther and farther apart as both factors increase by 1.

*Some questions to pose:*

• Did anyone use 10 counters? Why not?

• What is the fewest number of counters you could have used? the most number (under 100)?

• Why do you think you came up with more answers with small numbers of counters than with larger numbers of counters?

**What might proportional thinking look like in Grades 4 – 5?**

**Problem:**

• 4 boys shared some candies.

• 2 girls shared the same number of candies.

• Suppose you knew how many candies each girl got.

• How would you figure out (or could you figure out) how much each boy got?

Rationale:

The purpose of this problem is look at the relationship between dividing by 4 and dividing by 2. Students should see that sharing 4 ways results in an amount half of sharing two ways without needing to actually calculate the results. It also reinforces that if more units are needed to show the same amount, the unit size must be smaller, i.e. 4 units of cookie packs = 2 units of a different size cookie pack means that the second size pack is more than the first.

*Some questions to pose:*

• Who got more - a girl or a boy? Why?

• Why didn't you need to know how much the girl got to answer the question?

• Suppose you knew what a boy got. How would you figure out what a girl got?

• Suppose 4 girls shared the same number as 6 boys. Then could you figure out what a boy would get if you knew what a girl got?

**Problem:**

• You will build a model with pattern blocks.

• You have to use TWICE as many red blocks as yellow ones.

• You have to use THREE times as many greens as reds.

• What could the design look like? What fraction of the area is green? What fraction of the blocks is green?

Rationale:

The purpose of this problem is to recognize how fractions can describe either parts of sets or parts of wholes and to recognize the relationship between the areas of the different pattern blocks. At the same time, because of the use of the phrases two times and three times, students will also see that triple a double is equivalent to multiplying by 6.

*Some questions to pose:*

• Could you have had an odd number of red blocks? Why or why not?

• Could you have had 10 green blocks? Why or why not?

• Why did the relationships of 2 x and 3x make the problem easy?

• Why was the fraction of green for the area less than the fraction of green for the blocks?

Problem:

A fraction is equivalent to 3/5 but the numerator and denominator are 24 apart. What is that fraction?

Rationale:

The purpose of this problem is to recognize that when working with fractions, it is not the additive (subtractive) difference between the numerator and denominator that best describes its size; it is the multiplicative relationship between the two. In fact, any fraction is equivalent to 3/5 only if the numerator is 3/5 of the denominator or the denominator is 5/3 of the numerator. How far apart the numerator and denominator are is irrelevant.

*Some questions to pose:*

• How do you know that 6/10 is equivalent to 3/5? Why doesn't it matter that 6 and 10 are 4 apart, but 3 and 5 are only 2 apart?

• If you multiply the numerator and denominator of 3/5 by 4, do you get an equivalent fraction? Why? How far apart are that numerator and denominator?

• Could the numerator and denominator of a fraction equivalent to 3/5 be 5 apart? Why or why not?

• How did you figure out the answer to the problem?

**What might proportional thinking look like in Grades 6 – 7?**

**Problem:**
The perimeter of a rectangle is 2 ½ times its length. What must be true about the length and width?

Rationale:
The purpose of this problem is to recognize that perimeter/length relationships for a rectangle automatically define length/width and perimeter/width relationships. The use of 2 ½ instead of, for example, 3 requires students to think a little harder. They might, for example, choose an even number of linking cubes to be a length, create 2 ½ of those lengths and realize that since one of those lengths is used for the top of the rectangle and one for the bottom, the remaining half-length must be split in half to make the widths; thus, each width is 1/4 of the length of the rectangle. Alternately, they might simply look for generalizations by using numbers. Students will be exploring the rectangle perimeter formula more deeply to think about what it means and will be realizing that statements of proportionality do not define quantities but just relationships.

*Some questions to pose:*
• How do you know that the perimeter of a rectangle has to be more than double the length?
• How do you know that the width can't be as big as half the length?
• Can you be sure what the length and width are or only about their relationship?
• Do you think a length/perimeter relationship will always force a particular length/width relationship? Why or why not?

**Problem:**

One number is 35% of another.
List lots of possibilities for the pair of numbers.
What relationships do you notice?

Rationale:
The purpose of this problem is to look at a number of potential relationships: that the first number is slightly more than 1/3 of the second, that the second number is slightly less than triple the first, that if you multiply both numbers by any amount, the 35% relationship remains true, and that, again, we can have either large or small numbers since information is provided about a relationship only.

*Some questions to pose:*
• How could you predict that the second number is more than double the first?
• How could you estimate what fraction of the second number the first number is?
• How could you estimate what to multiply the first number by to get the second?
• Why are there both large and small number answers?

**Problem:**

About how old are you if you are a million minutes old?

Rationale:
The purpose of this problem is to provide an opportunity for students to make sense of big numbers and, in particular, to realize that a very large number of very small units might still not be that much. Because the focus is on unit size, this evokes proportional reasoning. Students realize that knowing the relationship between 1 minute and 1 year is enough information to convert any number of minutes to years. As well, students have a chance to explore why units of very different sizes are generally used- to make better sense of descriptions when the number of certain units would be very big.

*Some questions to pose:*
• Since 1 000 000 is such a big number, should we predict that the age would have to be pretty old? Why or why not?
• How did you go about deciding the age? What description did you use and what calculations did you use?

• Could you have used a different unit than years? Why didn't you?
• If you had been a million hours old instead, would that have changed your answer a lot or just a little?

These problems are just a sampling of the enormous opportunities we have to get students to think proportionally in the elementary grades.

**References**

Kaput, J. J., & Maxwell-West, M. (1994). Missing-value proportional reasoning problems: Factors affecting informal reasoning patterns. In G. Harel & J. Confrey (Eds.), The development of multiplicative reasoning in the learning of mathematics (pp. 235–87). Albany, NY: State University of New York Press.

Ontario Ministry of Education. (2012) Paying attention to proportional reasoning. Available at http://www.edu.gov.on.ca/eng/teachers/studentsuccess/ProportionReason.pdf

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# Scaling New Heights

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# What is the Purpose of Calendar?

## by Carole Fullerton

Carole Fullerton is a private consultant who works throughout BC and the territories promoting mathematical reasoning K-12. If you'd like to involve her in work at your school, please contact her at mindfull.consulting@gmail.com

**Calendar – Past and Present**

Daily calendar is a staple in many early primary classrooms. Through it, we expose students to patterns and counting, as well as to concepts of place value. At least that is the intent. An overwhelming number of primary teachers with whom I've worked acknowledge that calendar time feels rote and unsatisfying – both for them and for their students. Many question the pedagogical value of the event, but wonder what might replace it. After all, aren't we "supposed" to do calendar in primary?

**Moving Forward**

What we have learned about the brain, what we know about the ways in which children acquire mathematical concepts, and what research and our curriculum tell us is developmentally appropriate practice has lead us to re-examine this traditional daily calendar approach. My colleague Sandra Ball (Surrey SD36) and I had long felt that calendar needed an overhaul and set to re-imagining what this might look like for our youngest learners. The result was a resource designed to promote more interactive daily mathematics experiences.

In this free on-line resource, we present a more active, participatory version of "calendar" – a daily opportunity for students to truly engage with meaningful math concepts, to play with materials, to process, think, and problem-solve. The tasks, questions and problems we have included are intended to inspire thoughtful math investigations into number, shape, measurement and pattern. We call these experiences "**Daily Math Investigations**".

**Re-imagining: Daily Math Investigations**

Daily Math investigations are an opportunity for students to think and play with mathematical ideas. Teachers present tasks and pose questions that are intended to promote curiosity about numeracy concepts. In opening up the kinds of questions we ask, we include more students in the learning

of math, and help to address the range of learners in our classrooms. A combination of **entry tasks** and **rich routines** allow for balance between whole group, small group and independent learning, providing a chance for students to explore the math at their level.

In designing entry tasks and rich routines, we considered the following:

**Timing**
• How long is too long?
• How much time is just right?

We know that young learners have a limited attention span. For the learning to happen, our whole group carpet time must be short, and spent wisely.

**Activity level of the students**
• Who's doing the talking?
• Who's doing the math?

Little children need to move, to touch, and to talk in order to learn. The richness of the math is lost when it is presented orally only. Introducing materials into carpet time, providing opportunities for students to think-pair-share, and recognizing and celebrating students' "aha moments" are essential.

**Grouping**
• Whole group?
• Small group?
• Independent?

Daily Math Investigations do not need to be done all together, all the time. Consider opportunities for students to work in small groups, pairs or even alone around a particular question or task.

**Content**
• What important math idea(s) will be explored?
• How does it address the range of learning needs?

Within the curriculum, there are several skills and concepts that require time to master. It makes sense to present these ideas over time and with intention in thought-provoking ways through a Daily Math Investigation! As they develop as thinkers throughout the year, students will engage with the important concepts again and again seeing it through a different, more evolved lens.

**Connectedness**
• What connections are being highlighted?
• What math-to-math, math-to-self, math-to-world connections can be made?

Students learn best – and remember more – when the learning they are doing is connected. Supporting students to think about how the mathematical idea you're exploring is like another they already know is an important foundational aspect of learning. Connecting to their own experience is likewise critical - embedding the math in something relevant to your students is highly motivating!

**Engagement**
• How will I know if my students are learning?
• What kinds of questions keep students thinking?

In the past, students' experience of calendar was at best, minimally engaging. Being the "VIP" happened far too seldom for real learning to happen! As we evolve in our practice, it's important to consider the degree of engagement at this rich learning time. The engaging part of the task must be the math - the complexity of the question, the curiosity it inspires and the conversations that emerge.

**Assessment**
•What can I learn about my students?
•What can I watch and listen for?

Daily Math Investigations are ideal opportunities for teachers to observe, listen and reflect on what their young learners know and can do. As they wrestle with important math, students' thinking is exposed through their actions and words. Take advantage!

## Thinking through tasks – Ideas for Daily Math Investigations

**Entry Tasks**

**Entry Tasks - What are they?**
Entry tasks are exactly that - tasks that are prepared and waiting for students as they enter the classroom at the beginning of the day. Knowing that our students' minds tend to be the most fresh in the morning, presenting these problems and mathematical curiosities to students as they arrive makes sense. Likewise, they will allow teachers to welcome and talk to their students as they transition into the learning space.

Entry tasks are invitational in nature. They are intended to inspire wonder and to encourage questioning. Students love these interesting questions and eagerly anticipate these morning tasks. These explorations can be very motivating - even for reluctant learners.

Consider the following:

**Tangram puzzles**


Use a complete set of 7 tangram pieces and the puzzles found in the resource (or other commercially available ones). Have students match pieces to the outlines. Encourage them to complete the puzzles in more than one way! Give students the language of flipping and turning to describe the translations they are using.

Consider reading "Grandfather Tang's Story" as an introduction to these puzzles.

**Hundred Chart Puzzles**

Cut up a hundreds chart along the grid lines into 5-6 interesting shaped pieces. Have students reassemble the pieces to make a complete chart. Photocopy hundreds chart puzzles onto coloured paper of various colours to keep the pieces distinct.

**Tray of Treasures**

Place a set of objects on a tray. Have students put them in order according to an attribute of their own. Explore and discuss what attribute they used (length, width, mass, etc).

**Scoop It!**

Provide a set of small containers and unifix cubes. Have students fill the jars and then count their cubes to see which one hold the most. Older students should record the total number and make statements of comparison (This one held three more than that one...). On another day, switch the unifix cubes for puff balls, erasers, stacking chips or foam counters and have students explore again.

**Simple Partner Games**

There is a wide array of quality games for practicing and mastering number relationships. Consider your favourites, from Concentration, Go Fish, and Snap to games from BEAM, and those drawn from other core resources. Be sure that students know how to play these games before setting them out. Even a set of dice, a stack of counters and a spinner can be used by students to play games of their own creation.

**Domino Targets**

Have students draw one domino from a pile and find the sum of the dots on it.

They should sort their remaining tiles into 3 piles:

- More than the target
- Less than the target
- The same as the target

Older children should also record an equation to match the total and place it in their chart.

**Rich Routines**

**Rich Routines - What are they?**

Rich routines are explored in more structured, less fluid ways. These questions - open-ended and interesting - are more often posed during a carpet time. Unlike a traditional calendar time, rich routines include far more opportunities for talk and modelling. Students engage with them in active ways and in a variety of groupings. These questions may be a springboard to another more involved investigation, but the focus is on connectedness and content. The power in rich routines is in their potential to revisit important content over time.

**All About Number**

For this rich routine, select a number within your students' range, and model with the whole group how to complete a set of prompts.

For example:

**17** is more than **12**.
**17** is less than **18**.
**17** is the same as **10 and 7**.

or

**17** is too many **hats for my head**.
**17** is too few **cookies**.
**17** is just enough **friends**.

Do a think aloud as you record your numbers to support students in understanding why you picked them. Invite some ideas from your students for a second number and record them. Then have students work collectively - in the whole group or in small groups - on numbers at their respective levels. That is, you might create a group of students and have them work on statements for the number 11, and have another group working on the number 20.

Consider your students and the number and kind of sentence frames you use each day. Don't use them all at one go!

Line masters for thinking prompts designed to explore number, mass, capacity, time and money are included in the resource for your use.

**Counting Collections**

Build opportunities into your daily routine to estimate and then count collections of different sizes. Start out with small collections (5-10 objects) and then increase them gradually. Changing the size of the objects to be counted will provide novelty for students, and force them to think hard about their estimates. Consider using unifix, counters, small beads, marbles, cotton balls, pennies, pencils, or fun counters in the shape of animals.

**Sort It out!**

Consider integrating a sorting task into your daily routine time.
Start with 8-10 objects that share more than just colour based attributes... Invite students to sort the objects in one way and have their peers guess their sorting rule. Then invite another student to sort the same collection again, using a different attribute. Celebrate the different ways we can sort a set of objects!

**Traditional Calendar – What to keep and what to let go**

A monthly calendar gives us interesting information. We can use it to mark important events, like an upcoming holiday, a student's birthday or a school celebration. Highlighting these events on a calendar and counting the days until they happen is fun for students. That said, the abstract nature of a calendar - the repeating 7-day pattern of days in a week, the recursive aspect of the chart itself and the random number of days per month - makes it virtually undecipherable for young students.

For many of us, calendar time (and all the activities associated with it) is ingrained in our script for primary teaching. It's important however to consider carefully the purpose of these tasks - and more importantly, their effectiveness.

Consider the following:

- Are the pieces of your calendar time truly relevant?
- Are students talking?
- Are they engaged?
- Are they doing math?

If you answered "no" to any of these questions, give yourself permission to let that piece go. Choose instead tasks that get students engaged, thinking and reasoning mathematically. You'll be glad you did!

To download a copy of the **Daily Math Investigations** document, visit my blog at: http://mindfull.wordpress.com. Click on the Daily Math Investigations button at the top of the page and enter the password DMI (all caps) to access the materials.

# Weaving Together: Aboriginal Education and Math

by Cheryl Adebar and Lynn Swift

Cheryl, (Numeracy Support teacher) and Lynn (Aboriginal Education Support teacher) from the Comox Valley collaborated to weave together the teaching of mathematical concepts with Aboriginal content and Principles of Learning to engage all learners.

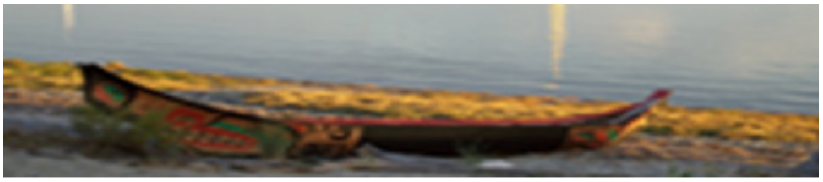
As elementary teachers, it is often apparent how we can integrate Aboriginal education with literacy, or social studies. Sometimes the connection is not as apparent in mathematics class. We asked ourselves,

How can we integrate Aboriginal education and mathematics, including not only a superficial context, but also authentic indigenous knowledge?

Our objective is to forge a strong appreciation of Aboriginal culture, perspectives and history for all, as well as a sense of identity for our Aboriginal students, by including some of the First Peoples' Principles of Learning in an engaging mathematics lesson. Including Aboriginal content into our entire curriculum begins the journey to understand more about the natural world around us, cultures, histories, as well as Aboriginal voice, perspectives and ways of understanding. We have included the First People's Principles of Learning poster to outline these ways of knowing, which can help us as teachers appreciate learning as culturally defined, and assist us in reaching a wide range and diverse set of learners who include all students, not just our Aboriginal learners.

**Canoe Story Problem**

A canoe has a perimeter of 12m. What shape would you make your design to fit the most people in? Which design would make the best canoe?



The west coast canoe was the main source of transportation on the ocean highway for thousands of years. There are many different types of canoes, some made for ocean travel, some made for rivers, and some for regular, daily travel. This canoe in the picture above is called I-Hos. It belongs to the K'ómoks First Nation and it was built around 1993. I-Hos is a mythical double-headed sea serpent. I also know of a famous Haida canoe called Loo-Taas and its name means wave-eater.

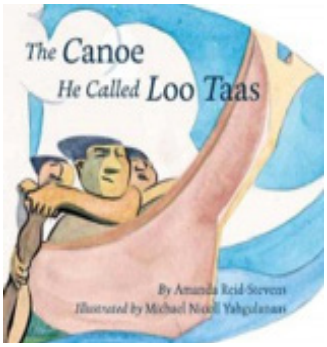
## Aboriginal Education Knowledge Connected to the Math Context

After introducing the math problem, we agreed that we needed to understand more about canoes, before solving the math problem. The following 4 resources were used to provide background knowledge about canoes.

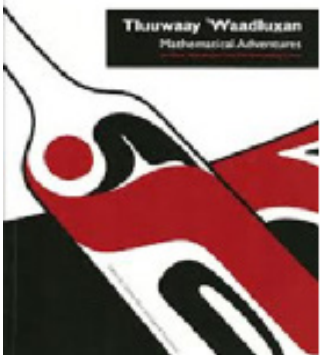
### I-Hos Canoe

In our community, a canoe was built for the Commonwealth Games by the people of the K'ómoks First Nation. A special canoe journey was made to Victoria, BC from our hometown of Comox, BC to coincide with the opening of the games. The band members bonded over the building of the canoe and the subsequent journey. For example, a member of the K'omoks First Nation, depicted in the image, is helping to carve out the hollow part of a canoe. It was built around 1993. You may be able to ask your own community members about special projects to help build and maintain culture.

### The Canoe; He Called Loo-Taas:




This book was written by Bill Ried's daughter. Bill Reid built the canoe called Loo-Taas and helped rebuild the knowledge of canoe building and the importance of cultural protocols in indigenous education such as learning the art of canoe builder from a master elder in the Haida culture.




Tluuwaay 'Waadluxan, Mathematical Adventures (Nicol & Yovanovich) has many references to canoes, including the story of The First Canoe, making a model canoe and the canoe house in Haida Gwaii. There are a lot of cultural math problems connected to examples in this book.

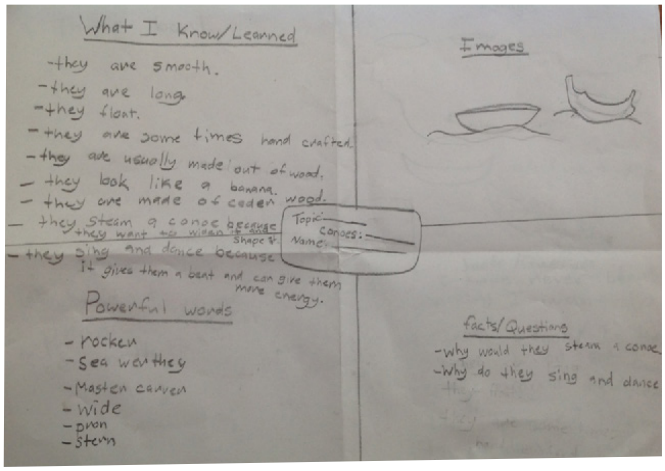
**Steaming a Canoe**
Canoes were steamed to make the canoe wider in the middle. A great video on steaming a canoe follows, (search for Nu-chah-nuulth Steaming a Canoe if the link below doesn't work)

http://www.youtube.com/watch?v=8qpwqzwIdgg

**Concept Map – The Importance of Canoes to Aboriginal Culture**

The students built upon their knowledge of canoes as we progressed through the resources, class discussions and a variety of activities. They were encouraged to add facts, ask questions, draw images and note any powerful words as they reacted to the various content pieces that were presented to them. From their written pieces, like the example below, and through conversations with students, we can observe what individual students know and how they are learning. This formative assessment, within the learning cycle allows us to plan for what the students will learn next about canoes and Aboriginal culture

Student Sample of a Canoe Concept Map




**Aboriginal Identity**
Through the sharing of this authentic knowledge, Aboriginal culture becomes more visible; enhancing identity within our Aboriginal students and developing an appreciation of Aboriginal culture by all.

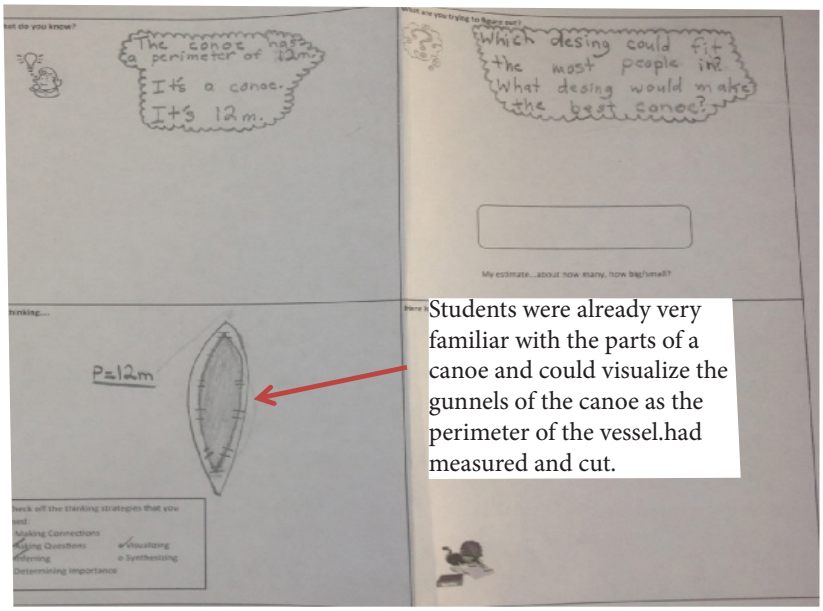
**The Mathematics**
We wanted the students to consider the effect that the shape of an object has on its area. In this question, with a fixed perimeter of 12m, students explore the relationship between area and perimeter. Key words become perimeter, area, dimensions, oval, rectangle, square, add and multiply.

During the initial stages of the lesson, students determined the important math information as:

• a perimeter of 12m and
• Which shape would give the largest area?

This 4 quadrant math sheet was used to lead students through their math problem:

* What do you know?
* My (metacognitive) thinking
* What are you trying to find out?
* My solution.




Students were already very familiar with the parts of a canoe and could visualize the gunnels of the canoe as the perimeter of the vessel.had measured and cut.

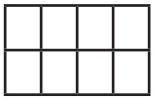
Once the students understood their math problem, we went OUTSIDE and allowed time for students to EXPLORE….and CREATE the various possible perimeters with the 12m pieces of rope that they had measured and cut.

We then made the shape of the canoe, holding the rope to show the perimeter gunnels and then asked other students to crowd into the canoe to count up how many students we could fit in.

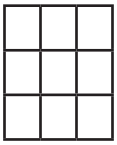
After the students noticed how crowded it was in the canoe, we agreed that each person would need 1m squared to be able to paddle and move within the canoe. We then starting exploring the effect shape had on area. We changed the shape of the canoe and made different size rectangles. The students determined that we could make 1x5, 5 x1. 2x4, 4 x 2 and 3x3 canoes. We made diagrams to organize our work, noticing how many people could fit into each canoe:

5 people

8 people



9 people

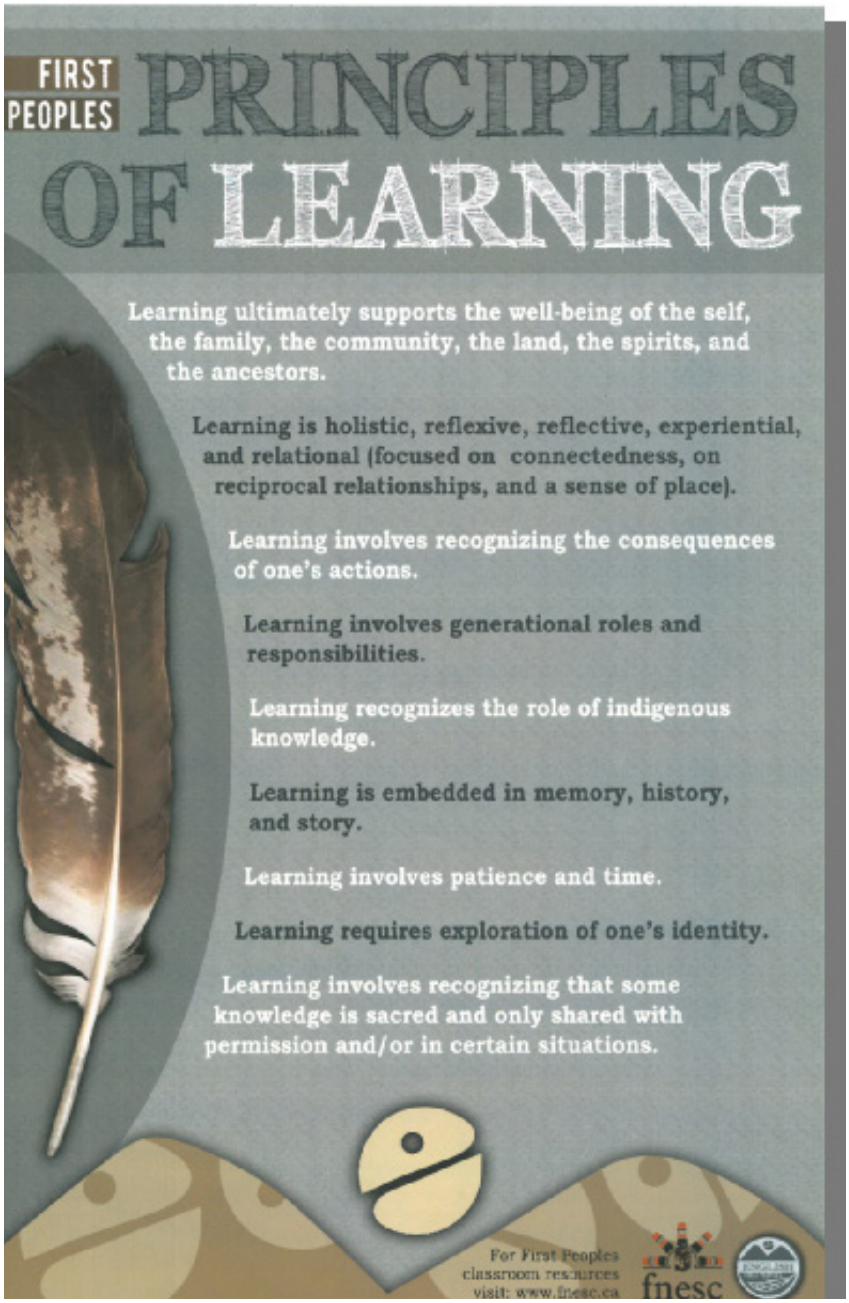


These diagrams were added into the 4 Quadrant math sheets, as we visualized the solution.

**Solution:**
**The 1x5 would fit 5 people, the 2x4 would fit 8 people, and the 3x3**

**Math Understandings**
There were 3 different possible areas, given the constant 12 m perimeter. We determined that the 3x3 would fit the most people (9). The students actively and visually noticed that the more square the dimensions, the larger the area. The smaller the width of the rectangle (skinny), the smaller the area. However, we also stated that a square canoe would not be a practical canoe, as it would create too much resistance to glide through the water effortlessly! Students acted out, orally discussed, as well as wrote about their math concepts, using images, words and number.

**Verifying Our Weaving of Aboriginal Education and Math**
In order to ensure that we have authentically woven these two areas together, we will find where we implemented the First People's Principles of Knowing in our math lesson. We know that an authentic Aboriginal education is done in connection with the land, is place-based and based upon the following principles. For example by taking our time and being patient with our learners, telling relevant stories, using knowledge from the Northwest Coast area in which we live and by experiencing the math content in a variety of ways and representations, we are embedding some of the Aboriginal worldview into our classrooms.


FIRST PEOPLES
PRINCIPLES OF LEARNING
Learning ultimately supports the well-being of the self, the family, the community, the land, the spirits, and the ancestors.
Learning is holistic, reflexive, reflective, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place).
Learning involves recognizing the consequences of one's actions.
Learning involves generational roles and responsibilities.
Learning recognizes the role of indigenous knowledge.
Learning is embedded in memory, history, and story.
Learning involves patience and time.
Learning requires exploration of one's identity.
Learning involves recognizing that some knowledge is sacred and only shared with permission and/or in certain situations.
For First Peoples classroom resources visit: www.fnesc.ca
fnesc

# Guided Math: A Book Study

## by Deanna Lightbody

Deanna Lightbody has been an elementary educator for 25 years in the Langley School District. Her current role is a District Teacher for Numeracy for grades K-8. She enjoys supporting teachers by providing professional development, team-teaching and implementing instructional strategies for an effective math classroom.

> *When a teacher tries to teach something to the entire class at the same time, chances are, one third of the kids already know it, one third will get it, and the remaining third won't get it. So two thirds of the children are wasting their time.*
> ~Lillian Katz

I can genuinely say in 25+ years as an elementary teacher, I frequently felt that whole class instruction approach, regardless of the subject, didn't always meet my needs or that of my students. So whenever I noticed students struggling or needing support, I would work with students in small groups. Does this ring true for you? This isn't new, it's common sense and it happens in most classrooms. I tried all sorts of differentiated instruction strategies, such as providing choice, creating engaging and hands on activities, providing a challenge for those that needed it and so on. The more I worked on my tool kit of strategies, the more impact I felt it had on my teaching.

Although I continually made changes to my math program, I wasn't truly satisfied. Something was missing. This can be a curse many teachers put on themselves. Actually, it's called reflection, and it is a good thing, continuous reflection on our pedagogy and instructional strategies.

As time went on, I noticed more challenges come my way while teaching my students math. The pressure to cover all the learning outcomes, the diverse learning needs and lack of time for math instruction were to name a few. So I decided to structure my math program differently. I developed different math centres or activities to create student independence, assessed my students more frequently and thought long and hard about what were the essential skills and concepts I wanted my students to learn. The bulk of the time was spent on whole group instruction but I scheduled mini lessons for small groups and meaningful activities for the rest. So what I set out to do at the time didn't have a name but it was my way of making positive

changes in my math program. Things were seeming like they were coming into place.

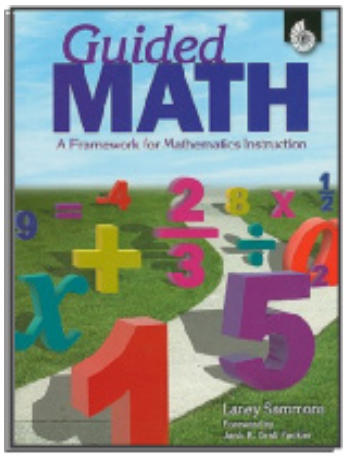
Flash-forward… a few years later. My role as an educator changed from classroom teacher to district numeracy teacher. (K-8) I left the classroom for new adventures, looking forward to working with teachers and their students, learning, leading and supporting along the way. Three years have been spent continuously building my toolkit with the help of all the math gurus along the way: Marian Small, Marilyn Burns, Kim Sutton, John Van de Walle et al. Having the opportunity to share my new found knowledge with teachers and learning from each other has been a rewarding experience.

One positive aspect of my role as a District Helping teacher is the chance to meet and work with hundreds of teachers. Lesson demonstrations, side by side teaching and presenting workshops on various math topics are the usual types of support provided. However, the most common request for support comes from an email or phone call from a teacher: a teacher who is feeling that what he or she is doing in the math classroom is just not working.

This email or phone call always starts off the same way. The teacher is challenged by the copious amount of learning outcomes expected to be taught, the different levels of student readiness and abilities, as well as the feeling that there is not enough time in the day to teach math. Sound familiar? I listen and remind teachers that many of their colleagues are feeling the same pressures. From here, I offer support through strategies, resources and perhaps some team teaching opportunities.

I noticed that teachers were trying new strategies and doing a great job of applying them in their math instruction. However, there were so many bits and pieces that didn't seem to come together. Other teachers confirmed this sentiment, as well.

I cannot pin point the exact event, but I experienced an "aha" moment while chatting with teachers. Why do we as teachers spend so much time with our literacy instruction worrying about just right text, leveling books, small group instruction etc. and not do the same for math? I presented this question over and over again as I worked with teachers. During this realization, I happened to come across a book called "Guided Math" by Laney Sammons.




Over one summer, as I was reading the book, I noticed the author had organized a book study

and an online group for teachers to post questions, make comments and offer ideas. Personally, this turned out to be a valuable professional development experience. So I began to make plans to share the book with my colleagues in the fall while using a book study as the format.

What is a professional book study? It's not an Oprah book club. It starts with a group of educators who have the desire to engage in critical reading, discussion, and continued learning. The purpose is to enhance teaching and increase student achievement. (2008 Professional Development Institute: Saint Mary's University of Minnesota)

A well-planned book study needs a facilitator to open the doors to discussion and keep it focused. The facilitator should provide opportunities for reflection, questions and sharing. Through these discussions and the readings, teachers can identify ideas that can be applied to their classroom and the potential obstacles for implementation. (Adapted from Zepeda, 2008)

The intent of the first session of the books study was to investigate what is guided math but first of all why are we here? Teachers spent time in groups discussing a set of guiding questions.

As teachers, how can we…
- Reach students at all levels of achievement?
- Provide diverse methods of learning?
- Allow more opportunities for observation and communication by students?
- Encourage active engagement by students?

Teachers expressed their challenges while teaching math and how they were looking for new ways to structure their program to meet the needs of all their students. They were asked to describe one negative and positive experience they have had while differentiating math instruction. These discussions were key to understanding why we were here and interested in guided math. I didn't need to convince anyone that the traditional approach to teaching math wasn't working.

The teachers admitted they were having their own "aha" moments. What seemed to have worked in the past wasn't effective in today's diverse classrooms. The conversations after reflection time revealed that teachers weren't going to need convincing to try different instructional strategies for teaching math. They were eager and ready for it. Teachers commented that the whole group instruction approach was holding them back from exploring other opportunities to work with their students.

We reviewed the components of guided math and the basic definition as described by the author.

What is guided math?

A flexible instructional framework that enables teachers to:

-determine students unique needs

-address those needs through a combination of whole class instruction and small group instruction (Laney Sammons, Guided Math 2009)

The word *flexible* resonated with the group. Using guided math as an instructional strategy gives you lots of flexibility. Your instructional structure can change from day to day. From large group to small group instruction, or even students working independently, the level of support provided by the teacher may depend on the mathematical content being taught or the needs of the students.

| Instrucional Approach | Level of Teacher Support | Teacher Activities | Student Activities |
|---|---|---|---|
| Whole-Class Instruction | Full Support | •Activating strategies<br>•Modeling<br>•Think-alouds<br>•Direct instruction<br>•Mini lessons<br>•Math Huddle<br>•Directed review | •Respond to teacher's questions<br>•Discuss with partners<br>•Become a member of a mathematical community |
| Small-Group Instruction | Moderate Support | •Introduce new concepts<br>•Provide intensive/targeted instruction<br>•Guide conversations<br>•Conduct informal assessments<br>•Reteach | •Practice new skills<br>•Work with manipulatives<br>•Engage in mathematical discussions<br>•Solve problems |
| Math Workshop | Limited Support | •Provide appropriate activities and tasks at students' independent work level | •Complete follow-up from whole-group or small-group instruction<br>•Practice previously mastered skills<br>•Conduct investigations<br>•Play math games<br>•Record in math journals<br>•Complete interdisciplinary work<br>•complete interdisciplinary work |

## Levels of Instructional Support

**Figure 1 –Levels of Support (Laney Sammons)**

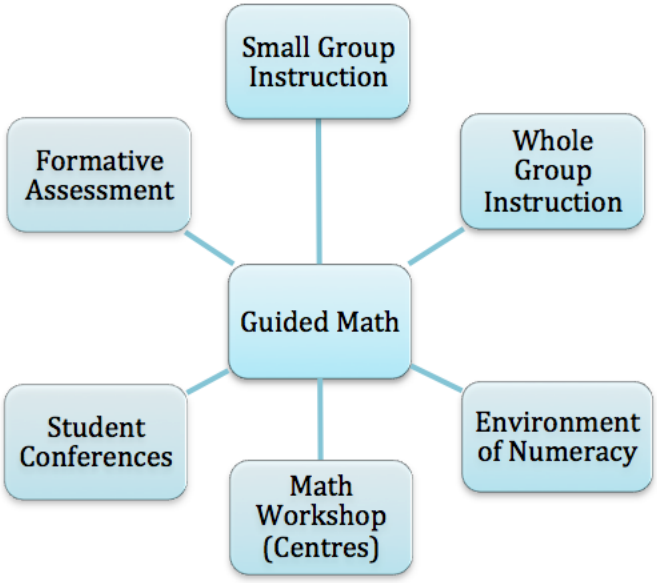
As we delved into the first few chapters, another point was emphasized. Guided math is part of a balanced math program. It takes place in a numeracy-rich environment. There are many activities and meaningful routines that can establish an environment of numeracy. These are only a few

• Create and display class-made charts to tell of math processes and concepts.
• Integrate math into other curricular areas
• Demonstrate, model, and do "think-alouds" of problem solving strategies.
• Link Math to Real Life
• Display a Mathematics Word Wall
• Read literature that promotes exploration and application of math concepts

The message I shared was that if you walked into someone's elementary classroom, could you tell that math was valued there. Can you see math, read math and hear math?

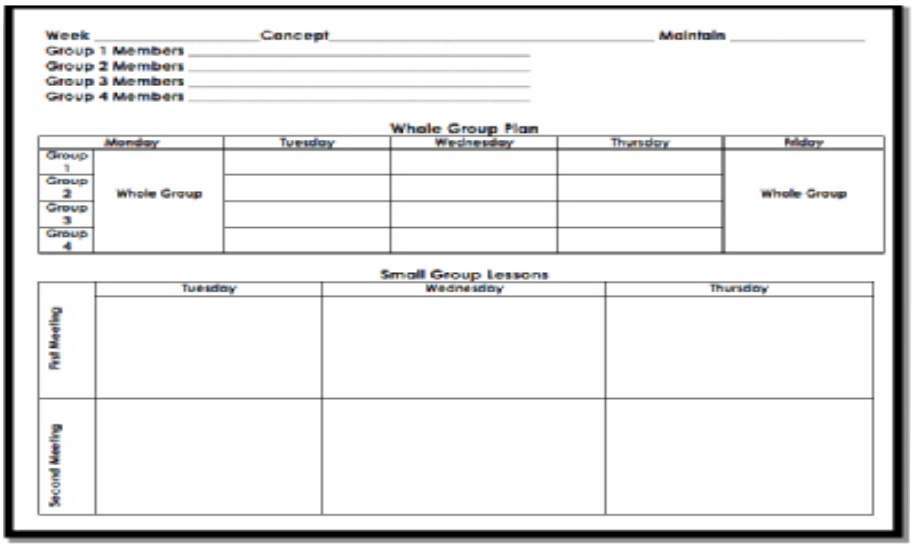
Math workshop works very similar to Literacy centres during guided reading time. You can call it what you want (math centres, work stations etc.) but it is essentially, "What are the rest of the kids doing" when the teacher is with a small group. Exploring this particular topic could take quite a bit of time as it has with guided reading. So we would deal with it at our second session together. Teachers left ready to read more of the assigned chapters and were asked to think about what changes they might want to make in their math classroom before next time.

The second time we came together we all agreed that there wasn't only one way of implementing guided math. But, there were important aspects or structures that need to be in place in order for it to be effective. This includes accurate ongoing assessment, formative and summative, informal and formal. Balanced assessment is the key to grouping students, checking for understanding and maintaining the flexibility of the groupings. In general, a guided math framework would usually include these elements.




Guided Math Framework (Adapted from Laney Sammons)

During this session, teachers also wanted to explore the different ways guided math could fit into their weekly schedule. Some were willing to dive right in and try afive-day a week model, similar to the plan included in the book, whereas others, wanted to ease into a plan and start with three days a week. Teachers knew that it was up to them to develop a plan that fit their style and comfort level.


Week _____ Concept _____ Maintain _____
Group 1 Members _____
Group 2 Members _____
Group 3 Members _____
Group 4 Members _____

Whole Group Plan

| | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Group 1 | Whole Group | | | | Whole Group |
| Group 2 | | | | | |
| Group 3 | | | | | |
| Group 4 | | | | | |

Small Group Lessons

| | Tuesday | Wednesday | Thursday |
|---|---|---|---|
| Red Meeting | | | |
| Second Meeting | | | |

Figure 3 - Guided Math Lesson Planning, Laney Sammons

We spent the third night investigating the types of activities we could plan for students to do while the teacher was with a small group. During math workshop:

1.Students work independently, in pairs, or in groups.
2.Procedures and routines must be established and practiced.

3.Activities should provide opportunities for exploration or practice of mastered skills.

Laney Sammons also offered some of her ideas about experiences that children should often have during math workshop. I encouraged us to talk with colleagues to add to or make our own list and it included the following:

- Math Games – math facts practice or to reinforcement previously taught concepts
- Problem Solving (include time for sharing of strategies)
- Manipulatives (Explorations or Investigations)
- Technology (iPads, laptops, SMART Boards, calculator puzzles)
- Independent Work (finish work from whole group or guided math group lesson)
- Children's Literature (read and write about math found in books)
- Math Journals

There is a wealth of resources and ideas for centre type of activities, such as our core resources, on-line sources or materials found in the classroom. I reminded teachers not to go overboard or get caught up by all that's available on-line. Have a critical lens and don't get enticed by the cutesy or glitzy ideas, even if they are free! Ask yourself these questions. Is this activity appropriate for my student's grade level? Does it build conceptual understanding? Does it fit with my beliefs about learning and understanding mathematics? If so, add it to your teacher toolkit.

After three sessions of collaborating, discussing, and reflecting on our own practice, our book study was coming to an end. Or so I thought!

A guided math movement has begun to percolate in our school district. Teachers who have read the book continue to collaborate, implement more ideas and share their successes with others within their schools. Next year, there are plans to organize further book studies on Guided Math and to extend the work with teachers as the try putting it into practice. Two questions were asked of teachers once they finished the book study.

1.How will you begin to implement the Guided Math framework into your classroom?
2.How can you create a professional learning community to support you as you make changes in your mathematics instruction?
(Adapted from Laney Sammons, Guided Math)

We know our students learn best when they are given opportunities to work with their peers and to feel a sense of community. Teachers also learn best with a network of teachers to share and learn together as professionals. This experience has allowed teachers to feel safe as they took risks with new ideas, knowing in the beginning that one size didn't fit all or there was

only one way of building a classroom of numeracy. I am looking forward to introducing Guided Math to a new set of colleagues next year. Plans are underway to connect teachers who are experienced with the guided math framework with those just beginning. Creating a Guided Math learning community will only make the process of change easier and more effective for all.

"*We shouldn't try to do something better until we first determine if we should do it at all.*" --Dwight D. Eisenhower

**Resources:**

Dana, N. F., (2009). Leading with passion and knowledge. Thousand Oaks, CA: Corwin.

Miles, K.H., and Frank, S. (2008). The Strategic School: Making the Most of People, Time, and Money. Thousand Oaks: Corwin Press.

Newton, Dr. Nicki (2010) Guided Math in Action. (2013) New York: Eyes on Education.

Sammons, Laney, (2010). Guided Math. A Framework for Mathematics Instruction. California: Shell Education.

Zapeda, S.J., (2008). Professional development: what works. New York: Eye on Education, Inc.

# Reggio-Inspired Mathematical Provocations


## submitted by Janice Novakowski, in collaboration with Louesa Byrne and Lauren MacLean

Janice, Louesa (K&1 teacher at Thompson Elementary) and Lauren (K&1 teacher at Blair Elementary) are teachers in the Richmond School District. They are involved in a collaborative project looking at ways that Reggio-inspired practices inspire mathematical thinking, understanding and engagement.


Drawing upon the philosophy of the early childhood schools of Reggio Emilia, Italy, many schools in North America are adopting a "Reggio-Inspired" approach to learning. Central to the philosophy of Reggio Emilia is the image of the child – viewing the child as capable and creative. The philosophy's other core beliefs include: connectedness to culture, community and the environment and the idea that every child has at least 100 languages in which he or she can communicate.

Provocations are presented for students to draw them in and engage them with materials and ideas. A provocation is beautifully presented and is an invitation to explore, investigate, learn, represent and create. In North America, we see similar invitations in a centres approach where open exploration and investigation is the intent.

Provocations, or invitations, inspire and invite students to explore, investigate and learn. Provocations are intentional in their intended purpose, such as being based on students' interests, linked to curriculum and for assessment for learning purposes. Provocations have an openness to them that allows for students to engage with the materials and the mathematical content at their level of understanding.

The following are some examples of mathematical provocations that have been presented to our Kindergarten and Grade 1 students in the Richmond School District, after teachers participated in a professional learning experience where they were introduced to the notion of Reggio-inspired mathematics.


In this provocation, a labeled photograph with the task prompt is set on an easel with the materials in baskets.

The mathematical focus of this provocation is counting 1-5 and one-to-one correspondence with other possibilities involving patterning and decomposing 5.

(inspired by a post on http://msbarbarasblog.blogspot.ca)

In this provocation, coloured gems are presented in bowls with an example of a repeating pattern on display.

The mathematical focus of this provocation is identifying, reproducing, extending and creating repeating patterns. Other mathematical areas include one-to-one correspondence and counting.

In this provocation, three containers are presented: one with small pebbles, one with wooden numerals and one with wooden ten frames.

The mathematical focus of this provocation is counting, one-to-one correspondence, representing numbers and relating numerals to quantity.

In this provocation, a basket of wooden geometric solids and another of natural materials is presented with a picture book.

The mathematical focus of this provocation is working with three-dimensional shapes with specific attention to their attributes – edges, faces, vertices.

The book used as inspiration for this provocation is **Shaping Up Summer** by Lizann Flatt and Ashley Barron.

In this provocation, a picture book and a nesting set of Matryoshka dolls are presented with mini clipboards for students to record their findings.

The mathematical focus of this provocation is comparing and ordering objects, identifying measurable attributes, developing mathematical vocabulary and cardinal number terms.

The picture book that inspired this provocation is **The Littlest Matryoshka** by Corine Demas Bliss and Kathyrn Brown.


In this provocation, containers of materials are presented with photographs of students' ways of making 7 with the question prompt, How many ways can you make 7?

The mathematical focus of this provocation is decomposing quantity, parts-whole relationships, subitizing, one-to-one correspondence and combining quantities.


In this provocation, a photo question prompt is provided alongside a collection of flowers. How many petals does each flower have? What different ways could you count the petals?

The mathematical focus of this provocation is one-to-one correspondence, counting, counting by 2's, 5s etc, (skip counting), repeated addition with possible extension to multiplication.

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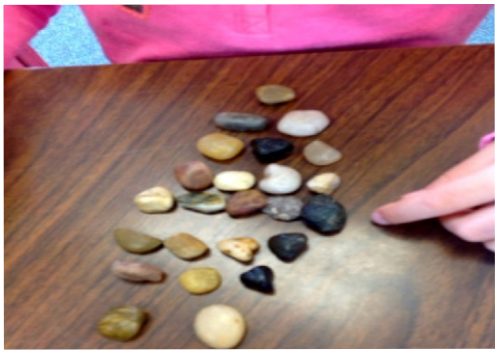
Teachers working with the provocations in their classrooms have noted high levels of interest, curiosity and creativity in mathematics and that much mathematics has been uncovered during the students' engagement with the provocations.

Lauren MacLean (K&1 teacher at Blair Elementary) noted that her students re-visited a bead patterning provocation "because of its open-endedness – they were never expected to create the same thing but learning about patterns was always the priority."

Louesa Byrne (K&1 teacher at Thompson Elementary) also noted the interest and engagement the students had with the materials. Her students were "drawn to materials that were new, "beautiful", and unexpected and

were very curious and inspired by natural images (flower petals, nature mandelas, stacked rocks, patterns in nature, etc.)". Louesa also observed that her students easily found some way to engage and play with the materials and that the varied materials appealed to the students' natural curiosities.

Lauren reflected on the creative problem-solving aspect of the provocations and how that uncovered mathematical content for her students:
"*I enjoyed using the natural materials and having the open ended activities because it supported a new type of math thinking in my classroom - creative problem solving. "How can I skip count with rocks?" "How can I make a growing pattern with materials that I can find outside in the playground?" I found that I could re-use the same lesson and switch out the materials and the students would continue to be excited to learn and explore.*"



Louesa's general reflections on her experiences with approaching mathematics centres in a Reggio-inspired manner include:

*"Using a Reggio inspired approach in our math centres seemed to help the students recognize the presence of math in many different areas of life. Introducing construction and design tasks helped the students to find math in their other classroom activities and make connections to their home life as well."*

*I found that these centres, with self-direction and free exploration time, gave me opportunities to observe the student's interests, strategies, strengths and needs in a low-risk and highly engaging environment. Based on my observations during these centres I was able to determine what mini-lessons were needed, who could be a mentor, what was most interesting to the students and what we were ready to move on from.*

By using loose parts, natural materials and imagery I think the children's understanding of "what math is" was expanded."

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A significant aspect of Reggio schools is the role of documentation in making learning visible. The documentation is for students, teachers, parents and the broader community and documents the process of student engagement and learning. Photographs, student artwork and quotes from students are included in the documentation, often created as documentation panels.

The image on the next page is a documentation panel, inspired by a conversation with a student in Louesa Byrne's K&1 classroom. The question that emerged, What is a pattern?  guided our mathematical inquiry.

Teachers in the Richmond School District will be continuing their investigation of how Reggio-inspired practices can inspire mathematical thinking and engage students in mathematical experiences in our primary classrooms. We will be compiling an anthology of provocations as part of our ongoing professional learning.

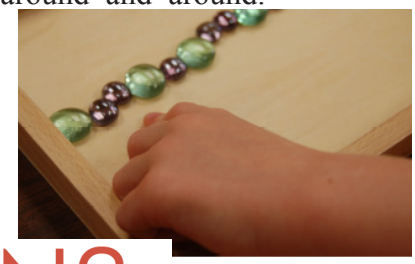
**Please contact Janice Novakowski for more information:**
jnovakowski@sd38.bc.ca

An invitation to create patterns…How many different patterns can you make?

When working with the trays, students naturally seemed to follow the shape of the tray and create a repeating pattern around the edge of the tray.

Riley had created a frame pattern in the middle of the tray. When I asked her to tell me about her pattern, she looked at it carefully and then replied, "I have an idea!" and she moved the single purple gems out of their places and replaced them with green gems. She exclaimed, "now it's a pattern!" When I asked her why the first one wasn't a pattern, Riley explained: "Because it had two purples on the top and bottom but only one here (points to the sides)." So that isn't a pattern?" I asked her and Riley paused before answering, "I guess it could be. Hmm."

We wondered…What is a pattern? Blake overheard our discussion and suggested, "It's a pattern because you can go around and around."



I wondered aloud, "Does it have to go around and around? What if it was in a line?" and I moved Riley's frame pattern into linear pattern. Riley read the pattern: "ABBABABBAB" and Blake added, "Yep, it's still a pattern!"

# WHAT IS A PATTERN?

*exploring, investigating, wondering, discovering*

September 2013

**Resources:**

The Hundred Languages of Children: The Reggio Emilia Experience in Transformation by Carolyn Edwards

Working in the Reggio Way by Julianne P. Wurm. Opal School in Portland Oregon. http://opalschoolblog.typepad.com

**Blog posts about this work in the Richmond School District:**

http://blogs.sd38.bc.ca/sd38mathandscience/2013/09/28/mathematical-provocations-in-k1-classrooms/

http://blogs.sd38.bc.ca/sd38mathandscience/2013/09/30/reggio-inspired-mathematics-professional-learning/

http://blogs.sd38.bc.ca/sd38mathandscience/2013/10/24/counting-on-fall-math-stories/

# "Make It Count" in your Classroom … Math Skills, Positive Dispositions and Financial Literacy of Course!

by Gurjit Pattar

Gurjit is an intermediate teacher in SD36 (Surrey). Her focus of professional development has been incorporating inquiry-based learning in the classroom, particaularly in math. By shifting her pedagogy to "learning through problem solving", she has found a way to effectively differentiating her instruction and greater success in students' mathematical learning.

I still remember the moment it sunk in. We were on the ferry for our year end field trip to Victoria. I ran into a couple of students in the gift shop who were admiring a pendant necklace; typical "souveniry" stuff that one would think would appeal to a couple of `Grade 5 girls. I admired it with them for a moment and asked if they were contemplating purchasing it. It was their response that took me aback.

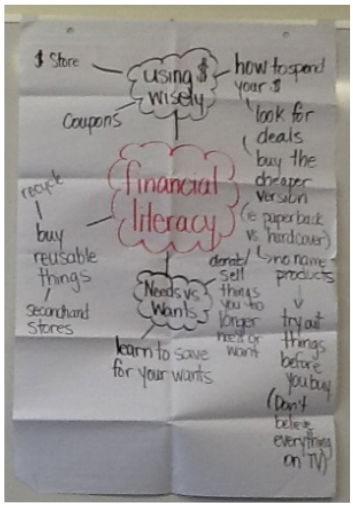
"Oh, we're not getting it yet. We're going to see if we find it in Victoria for cheaper. If not we'll buy it on the way back, find something else. It's 9.99 and with tax it'll be about $11 something. We each brought $20 and we've budgeted $8 each for dinner. We'll still have enough to split a dinner meal plus another burger on the way back."

I was left speechless as they walked away to continue their shopping. In that one conversation they'd shown me mental math, estimation and the ability to resist impulse buying. Not to mention the planning and budgeting! It was a conversation that I would never forget because that's when I really started to realize the value of the financial literacy lessons I had been teaching throughout the year.

When we say the words, "financial literacy", many conjure up images of budgets and spreadsheets. The truth is most people are unable to provide an

accurate definition. The Canadian Task Force on Financial Literacy (2010) defined financial literacy as "**having the knowledge, skills and confidence to make responsible financial decisions**." Next, when asked where people received their financial literacy skills most will answer, "on their own". They weren't taught by their parents, they did not learn in school and they were not born being a financial genius. So the question arises… if they are not taught how can they be expected to just know?

Does teaching financial literacy come down to another undertaking by schools? I must admit when I was first approached by my district Numeracy Helping teacher to participate in a financial literacy pilot project (in partnership with the Credit Counselling Society, B.C. Chapter) I was a little apprehensive about introducing something else to my already full teaching load. When I attended my first workshop I was convinced that being financially literate was a vital skill that the younger generation needed to be well versed in in order to have healthy financial futures. However, my colleagues and I agreed that in order to take this on we needed to find a way to integrate financial literacy into regular classroom activities. After scouring countless resources the team decided on "**Make it Count**", by the Manitoba Securities Commission. Little did I know at the time how integrating financial literacy would transform my teaching.




When I first broached the subject of financial literacy with my grade 5/6 class I was met with a variety of answers about their thoughts about financial literacy. Insert pic of chart paper here. I was surprised to see my students sharing their thoughts and the amount they already knew about the subject. I like describing financial literacy to my students as "making smart money decisions". As I tell my students, acquiring any skill takes practice and in the same manner students need to practice being financially literate. If you walk into my classroom during a financial literacy lesson you will see groups of students engaged in this practice through meaningful activities from "Make it Count". These activities are designed to allow students to acquire crucial financial skills that are needed to become knowledgeable and confident consumers. Through "Make it Count", my students have participated in lessons about money values, wants and needs, the importance of planning for a field trip, budgeting and planning for a class party, or coming to a class consensus on the amount to donate to a charitable cause.

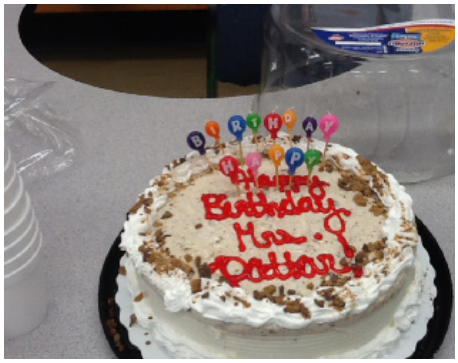
One of the most popular activities in "Make it Count" was the lesson on how to plan a party. As many of us know, planning a class party is something that is not usually an enjoyable experience for the teacher. It involves organizing food and activities and trying to ensure that students are not simply running wild for the course of the afternoon. When I asked

the class how much money they thought we needed to have a great party most students thought everyone should bring in $5 each. We discussed where this money came from. Was it fair to continually ask parents for this money when they weren't even a part of the party? I challenged them to do a party on $1 per student. I would put in $2 and we would have a total of $30. I remember students being apprehensive about the limited amount but they quickly rose to the challenge and formed themselves into committees, ranging from food and drink, entertainment and decorating. I'll never forget my feelings of amazement and astonishment as I was actually able to sit back and watch my students in action. I went from teacher to facilitator as students problem solved, assigned themselves roles, assigned a budget to each committee and quickly went to work. I remember one of my students, who very rarely participated in group work, circulating without any prompting as he did a tally chart to determine the type of drink and cupcake flavor that students in the class wanted. As he explained to me, his committee did not want to "waste any money buying food or drink that no one or hardly anyone would want."

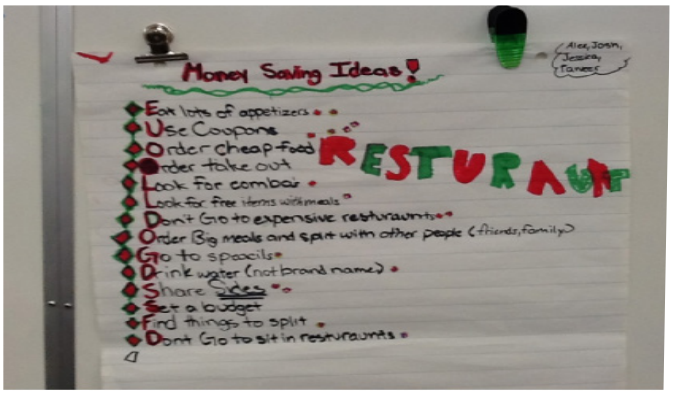
The entertainment committee was also hard at work. Using one of the class iPads they quickly found a variety of games on Pinterest that they felt would be appealing to most members of the class. They approached me with a list of items required for the games as well as a shopping list of supplies required. As they explained they would be able to keep the budget small by shopping for dollar store materials but they still could not afford all these materials on the $4 budget they had been allocated. With a little guidance from me, they started looking for suitable substitutes for the items. For example, one of the students determined that a class meter stick would do the same job as the broom handle called for in the game. As a result, by the end of their resourceful planning the entertainment committee ended up returning their $4 budget to the food and drink committee. On the day of the party the students from the entertainment committee led all the students through a rotation for the games. They had even pre-formed groups! All I had to do was circulate and I was even able to participate. The activities were so well done that I ended up taking them home over the holidays to play at my family's get together!

The decorating committee had to be extremely resourceful as well since the class had voted not to give them a budget. So they turned to our scrap paper bin to make some crafts and begged and borrowed decorations for our Christmas party from around the school and home. The day of the party we had an abundance of food and student comments included surprise about the quality of the party with such a small budget. Some stated that planning allowed for there to be no waste of food as they had seen in previous parties. As one boy stated, "planning ahead allows you to choose the right things and estimate how much you'll need. We thought we would need more money to have a party but this is [going to be] a great party!"

A few months later, on my birthday, I walked into my class after lunch and was amazed as the students had planned a party for me unbeknownst to me! When I exclaimed how did you do this? One of my students responded, "You taught us!" That was by far the best gift they could have given me! They had appointed a treasurer to be in charge of the money and as a group had decided on an amount of $1.50 each so that they could afford to get the ice cream cake I had once mentioned was my favorite. That was when I realized how powerful these lessons really were. They were transferring the skills from the lessons into real life examples. The most important lesson my students had learned was the power of planning.




The lessons continued through the course of the year. We talked about savings tips when going to a restaurant, activities to do while on Spring Break, comparison shopping, how to get the best value for your money. All the lessons had a similar theme of the importance of planning and budgeting. Whenever we could we incorporated the mental math skills we had been working on throughout the year. I saw students doing quick mental calculations when trying to stay within budget during the "Going to a Restaurant" lesson. I witnessed them doing front end estimates and discussing if they had reasonable estimates when calculating the cost of supplies.




As I mentioned at the beginning of this article, all year my students looked forward to our field trip near the end of the school year to Victoria. We had discussed early on the importance of saving and planning for this occasion. Due to limited time in Victoria students had decided to save their money for souvenirs, snacks and dinner on the ferry on the way back. When polled most students had budgeted $20 for the day. It should be pointed out that many students had earned this money during the year or been gifted it and chosen to save for this special day. We boarded the ferry at 7am with 126 Grade 5 and 6 students and the first thing I noticed was of course, a large group of our students congregating around the vending machines. A few teachers and I made our way over to comment on the students choices for "breakfast". Once there, I noticed that I didn't see any of my students in this group. I looked around and saw them seated in little clusters. A group of boys were pooling their $20 each and

giving it to one student to keep for safekeeping in a wallet he had brought along. When I inquired as to what they were doing they replied that they were pooling their money because they were going to share snacks during the day and then use the rest of their money to share dinner. They were using the skills they had acquired during our restaurant savings lesson!

During the ferry ride I saw the students looking at the dinner menu and planning ahead so that they knew how much they needed to save for dinner that night on the way back. Without my explicitly asking them, they had budgeted and planned for the day on their own. All of them had money to buy dinner on the way back. I noticed other students who had started the day off with as much as $50 returning on the ferry with very little money and unable to buy dinner. When asked where they had spent their money many could not remember. They had spent it on candy and snacks and a few knickknacks. One student from another class actually said, "I don't have any money left for dinner. I only have change left." I encouraged him to show me his change and then helped him count out over $10! He, in fact, did have enough for dinner but did not value the coins in his pockets!

Deciding to participate in the pilot program funded by the Credit Counselling Society of BC turned out to be one of the most fulfilling things I have undertaken in my teaching career. I have seen students develop real world skills from easily integrated lessons from "Make it Count" that they found engaging and meaningful. Math became more meaningful for them as they were able to see the relevance in practicing mental math skills and the importance of checking if your answer was reasonable. This resource empowers students to develop financially literate skills at their age level and provides them with opportunities to practice their math skills and see real life connections to what they are learning in school. As we focus on the importance of "whole child" education this resource is invaluable in instilling skills at a younger age as we place them on the path to financial security. In doing so we are also teaching them the importance of self regulation whereby students are learning to set limits on their own spending habits or learning the value of delayed gratification by saving for something special. I will never forget the looks of pride on my students' faces as they paid for things themselves with money that they had saved or earned. This resource allows students to make their own decisions and live with the consequences. The question is not can we afford to take the time to teach financial literacy in the classroom rather can we afford not to?


**Resource:**
"Make it Count" (Manitoba Securities Commission) available on the following link:
Credit Counselling Society, http://www.mymoneycoach.ca/for-teachers/resources-lesson-plans-financial-literacy.html

# Now Carry the One

by Corrine Merx

Corrine is a grade 2/3 teacher at John Muir Elementary School in the Sooke School District.



Looking back at my journey with math from elementary school through to university and finally to a teacher, I realize that despite getting excellent grades and graduating with distinction, there were some major gaps in my actual understanding of numerical literacy. Yes, numerical literacy. What, isn't literacy to do with reading and writing? That's what I thought too, but I now know to be literate in numeracy requires more than knowing you have to carry a "one" or that the "3" in "32" doesn't mean you have 3, but rather 30.

Flash forward to when I first became trained in First Steps. Our instructor gave us the "Dinosaurs" diagnostic task, and asked us to circle the value of the 5 in the picture using a red pen, and the value of the 3 in the picture using a blue pen referring to the number 35. That was my 'ah-ha' moment when I realized that I had never been taught what such digits actually represented.

Since then, I have had the opportunity to teach math in many grades, but when I had to teach math in a combined grade classroom, I was plagued with dread. I remember sitting on a colleague's classroom couch almost in tears because I could not figure out how I was going to teach math the next day to my grade 2/3 class. It was then that I knew it was time to change my perspective, and become more literate in the area of numeracy. I had always focused on developing my passion of literacy in reading and writing, but it was now time, to grow professionally in a new area.

I had been hearing lots of buzz about the Grade 3 Math Intervention in our school district, and about various math opportunities being offered to teachers. So I attended my first workshop with our Numeracy Coordinators and this sparked a new found interest in math, and what I could offer to my students! The learning has been endless ever since.

I now know and understand the utmost importance of working with students to help them understand the basic number concepts, because without these foundations, higher-level math will be a mystery to them. They will simply

learn how to memorize the language and process of various math topics, but they will never fully understand why or what they are doing at a deeper awareness.

This takes me back to my elementary years; I had wonderful teachers, but I do not recall learning basic math fact strategies, or being required to solve problems using mental math. It was based on memorization of facts without a true understanding what was actually happening. For example, we learned an algorithm, which is simply a process, but we never really learned that we weren't carrying a '1,' but rather we were bringing over a group of '10' or '100' and so forth.

Throughout the various workshops, I learned the importance of allowing my students to develop an understanding of patterns seen in numbers. We spend a great deal of time building and working with the 100s chart and beyond, to help gain an understanding and appreciation of how number patterns work and how they can aide us in solving various problems. Without this concrete understanding, children have a difficult time with higher-level thinking and numerical fluency.

I am still on this journey in math, and I look forward to further learning and understanding on my part so that I can take back various ideas, games, and tasks to my students. Speaking of games, that was also new to me – my principal kept saying, "Play games. Make it fun, and they will learn." However, I was hesitant at first, but having tried it this year, I wish I had listened to her previously. However, I was not ready to progress to that way of teaching yet, and it's the process and progress that need to go hand in hand in both teaching and the learning. I now look at the progress made by my students throughout the year, as that is key. They too, are on their own journey, and it is our job to facilitate their learning and understanding rather than simply saying, "This is how you have to solve it."

For those wishing to deepen their own understanding of mathematics, it's vital to ask questions and not be afraid to say that you don't know how to go about teaching a topic: colleague input and ideas are crucial. I recommend attending many professional development opportunities being offered around numeracy, and remember to look at the progress you are making as an educator and a person, while at the same time remembering to look at the progress made by your students; I promise, it will make you smile!

**Book recommendations:**
"Teaching Student-Centered Mathematics" by John Van de Walle

"How Children Learn Number Concepts: A Guide to the Critical Learning Phases" by Kathy Richardson

# Minecraft and More: Creating Excitement by Keeping it Simple, Yet Deep

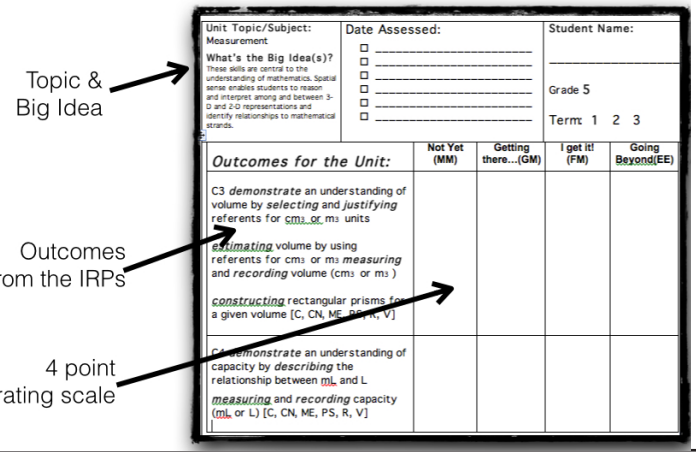
by Ray Appel

Ray has taught grades 2 -7, has been a District Math/Science Helping Teacher, spoken across Canada and the US, as well as having been an author of math curriculum. He is currently an administrator in a Middle School, and teaches art and math. He has many resources used by thousands of teachers world-wide. His website is zapple.ca

Sometimes I get asked what my math program looks like. That's not a simple answer, but it can get me going in excitement and passion as I try to explain what it looks and sounds like. On one hand, it's layered, complicated and detailed. On the other hand, it's very simple. Someone once said that in order to really understand something, you need to be able explain it to your grandmother. I liked that quote so much, I typed it out and hung it up so I can see it all the time. For me, that's true with teaching and learning math.

Simplicity rules.

I always begin with the outcomes. Not a textbook, stack of worksheets, or a 'program'. Years ago, I developed a "Unit Planner" (see below); in essence, a template where I write the overall concept, the big idea, as well as the outcomes for the unit/term. I copy it (one per student), and use it to record where each student is at, using a 4-point scale. It's great because it focuses on the student



and the Ministry outcomes. Since they're mandated, it is a great place to begin.

Now I have the freedom to look at resources on DVDs, CDs, Teacher Guides, textbooks, Youtube clips, novels and picture books as well as iPad apps. As longs as I keep the outcomes in mind, as well as the students' needs and wants, math becomes a place where all (including me) are learning and looking at math in a new way.

For example, last fall, I noticed a few students making detailed Minecraft characters on grid paper during recess and lunch. I couldn't believe it! Students were drawing the 'nets' for the various body parts, including gluing tabs, colouring them, building them, and then sharing and trading them with other students! Wow! I talked to a few of the students and then encouraged them to spread this around. They did.

Later, in the early spring, we began a unit on 'measurement', where the outcomes asks students to "demonstrate an understanding of volume by select and justify referents for $cm^3$ units, estimate volume by using referents for cm3, measure and record volume ($cm^3$), and construct rectangular prisms for a given volume". Of course, all of this can't be assessed in one project, but it was a great place to start! Notice the bolded words in the outcome above. I bold and italicize those words so that I can remember that they're verbs. I imagine the students doing those things, and it makes it much easier to imagine them engaged in their learning, and helps with assessment.

When the unit began, we studied Minecraft video clips, looked at real world examples of prisms, volume and more. Then, we had some mini-lessons on the concept of 'volume'. To do that, I simply looked in online resources, as well as those in print. I particularly love many of the Assessment Focus Questions in Math Makes Sense. I picked those, as well as a few other good questions, believing that getting deeply into fewer questions is important for learning. At the initial stages, I let the students flounder; pushing them away to struggle while pulling them in with supportive comments, questions and ideas.

Personally, I don't like doing a series of lessons and then ending with a project. There's nothing wrong with that, but I found it works well when we introduce a project idea, have a few mini-lessons, begin the project, look at understandings and misunderstandings, then back to the project, maybe another mini-lesson, some questions for review, then back to the project. To begin the project, I handed out 1 cm grid paper and asked the strong students (who made the 'nets' previously in the fall) to spread out in the class. To be fair, I also had copies of characters that have already been made (Google: 'minecraft papercraft') so that students with fine motor skills challenges could focus on the cm volume. After a lesson or two where

students began drawing, colouring and building, we began to develop the rubric (see below). I kept it simple, and simplified the outcomes on the sheet, while highlighting the verbs (understand and explain). I set a couple of 'must haves': colour and at least 24 $cm^3$. The 'at least' wording gave students a challenge if they wanted to go further and exceed expectations.

## MINECRAFT VOLUME!

**My Name: _____**

**Tape your character to this sheet.**

**The TOTAL volume of my character is _____$cm^3$**

**I figured it out this way… Use words, numbers and/or pictures:**

**MUST HAVES:**
**Colour**
**At least 24 $cm^3$**

**CRITERIA:**
**I'm looking for how you *understand* and *explain* "volume" in $cm^3$**
**How neat, clear is it?**

**4: I'm showing you in words, numbers AND pictures! It all makes sense! I've done more than asked! A VERY CLEAR understanding!!**

**3: I'm showing you in words, numbers AND/OR pictures. Most of it makes sense. A good understanding.**

**2: I'm trying to show you in words OR numbers OR pictures. Some of it makes sense. A fair understanding, with errors or difficulties showing learning.**

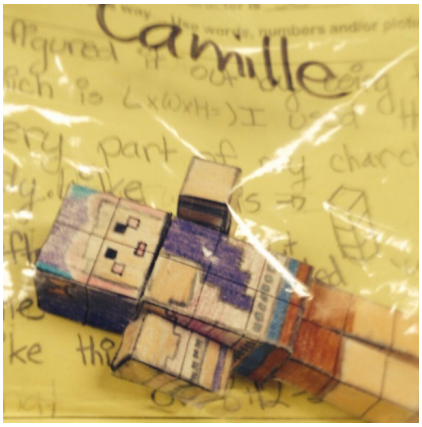
**1: I'm not yet able to show you in words OR numbers OR pictures. Some of it makes sense. I can't yet show an understanding, and I have errors and difficulties showing my learning.**

As well, I also wanted them to focus on the conceptual part of the outcomes by showing in words, numbers and pictures (concretely, pictorially, and symbolically). They loved the project and couldn't wait to do math the next day.

You can see by the Camille's example (see next page), that I placed each project in a plastic sandwich bag and stapled them to each Marking Guide described above. It saved us all from picking up and losing unfinished bits and pieces. As they recorded the volume in cubic cm, it was also important to have actual cm cubes in the classroom. Some students made a common error of counting the squares on each side of the head or arm and recorded an amount that was way too large. By having cm cubes, students could quickly build it and then see where they had a misunderstanding.

Most days in math class, I pick and choose from many places, and I love adapting really powerful questions. In a question which asked students to use the digits 3,7,8, and 9 to write all the 4-digit numbers between 7000 and

8000 (©Pearson Education), then order them from the least to the greatest, I asked the students to change the numbers 3,7,8 and 9 by rolling dice to pick the four numbers. As well, I asked that they not have all the same numbers as the student beside them. This encouraged discussion without getting worried about 'copying' from someone beside them. Then they picked the middle two of the four numbers to get their range (i.e., 2 and 3, would be between 2000 and 3000). Once you start thinking of good questions/ problems as adaptable, it begins to become second nature, and it can really encourage excitement.




Then, in full circle, I go back to the outcomes and marking guides as we assess and evaluate where we're at. It totally frees me up from a page-after-page, page-after-page, page-after-page approach. Instead, while focused on the outcomes and students, it becomes a bit more personal than the approach where sure that all the students do all the questions all the time in the all the same way at the same time. Although there's a time and place for 'sameness', variety works because the range in our classrooms are vast. If the range is vast, why seek sameness?

I am learning too as students share their ideas, insights, passions such as Minecraft! It's an exciting journey with rich discussion, insights, understandings and misunderstandings, struggles, a-ha moments and more. Through it all, I realize time and time again that if I can explain math to my grandmother, and simplify the mathematical concept to its core, then it's win-win all around.

# Moving Beyond Consumption Apps: Using CreativeApps in Mathematics to Transform Learning

by Jennifer Barker

Jennifer Barker is a Faculty Advisor at UBC and spends one day a week teaching in a grades three/four classroom in Richmond. She loves teaching and learning and is passionate about mathematics and using technolgy in meaningful ways.

A few weeks ago, a colleague and friend of mine who teaches Grades One/Two at a local Elementary School mentioned to me that her school had bought a class set of iPads at the beginning of the year. As a thoughtful teacher who is continually learning, she stated she felt confident using iPads when doing literacy activities, but was struggling to find ways to meaningfully integrate iPads in Mathematics. Knowing that I had just completed my Masters in Educational Technology, she asked for some suggestions.

I began by asking what apps she had used with her students. After hearing her list which included MathSpin3, MotionMath Hungry Fish, Todo K-2 Math Practice, Sushi and Math Bingo, it became clear to me that my friend seemed to be familiar using "consumption apps" in mathematics. Although engaging, these math specific apps are focused on specific skills and discrete concepts. We discussed the interactive nature of these types of apps and the attraction they hold for children; however, the reality is that these consumption apps are very similar to skill and practice worksheets, which many educators and researchers believe do not foster deep learning and understanding and students eventually tend to grow bored with.

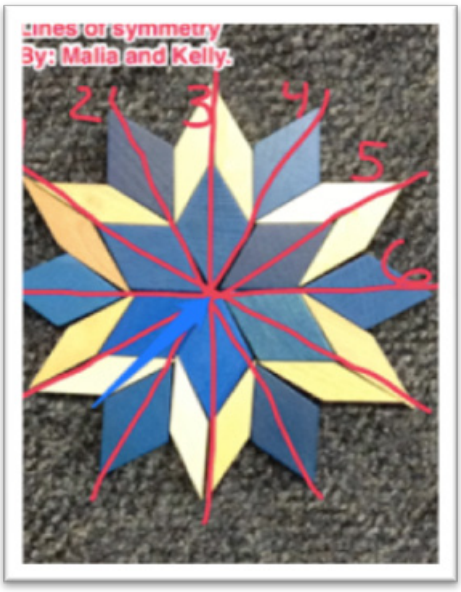
This sparked an interestingconversation about how we approach our math lessons and for what purpose. We agreed that prior to thinking about the technology (or iPad app to be used) it was important to firstdesign mathematically rich lessons; lessons that are relevant to students, emphasize the learning process, allow students to make connections between mathematical concepts and to the real-world, and would place students at

the centre of their learning prior to thinking about the technology.

I explained that when selecting iPad apps, I thought about which Mathematical habits of mind would be fostered. These habits go beyond numbers and symbols. They are the ability to create, visualize, communicate, reason, prove, evaluate, apply and analyze. The draft British Columbia curriculum refers to these as the cross-curricular competencies. I believe that through the development of these competencies, students develop confidence and a positive disposition towards Mathematics as well as a willingness to persevere with challenging tasks. Through this approach they come to see the beauty in Mathematics and approach it with enthusiasm and a genuine interest.

Since my friend was familiar with the basics of how to use an iPad, I showed her how she could use two free creative apps in combination with an inquiry approach, to foster learning and understanding. Below is a brief description of the two apps and some examples of the inquiry questions I have posed in my Grades Three/Four classroom.

- Free and easy to use
- Annotate images or PDFs
- Add arrows, tags, text, highlight, crop, or pixelate
-Users can easily share images


*Mathematical Inquiry Tasks Using Skitch:*
*How many lines of symmetry do you see?*

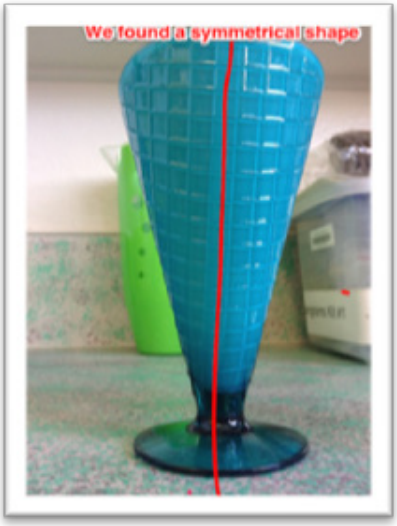
• Create a symmetrical design using pattern blocks
• Take a photo of your design
• Using Skitch find and label all of the lines of symmetry

*Where do you see symmetry in the environment?*

• Search images using Safari and take a screen shot of a symmetrical item – access your image throughthe camera roll

OR

• Take photos of symmetrical items in the School environment
• Using Skitch find and label all of the lines of symmetry



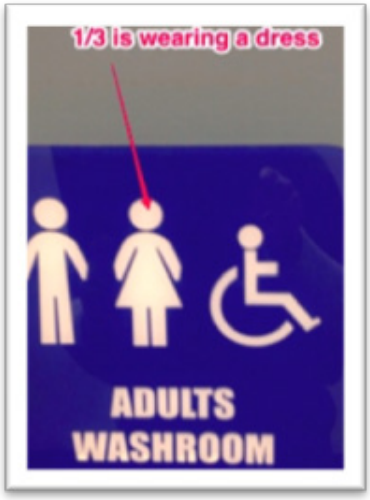


*What patterns can you create? Can you label and translate your pattern?*

• Create a pattern using any items
• Take a photo of your pattern
• Using Skitch label your pattern
• Trade iPads with a partner and see if you can make the same pattern in a different way.

*What fractions do you see in our school?*

• Take a photo of the fraction you see.
• Use arrows to point to the part you are describing
• State the fraction using text

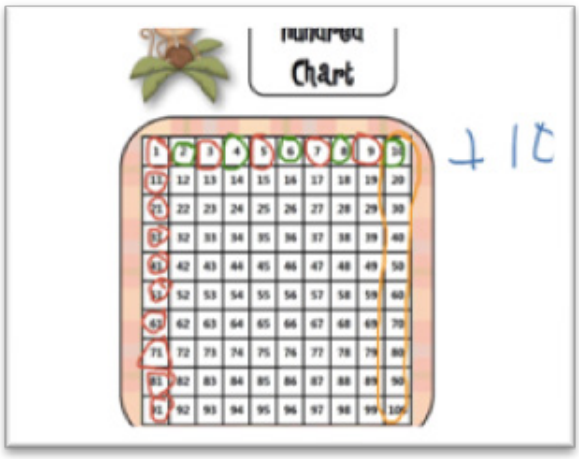


SHOW ME:


- Free and easy to use interactive whiteboard
- Teachers/students can set up an account
- Add images, while simultaneously narrating
- Ability to have multiple slides
- Users can share presentations through email or users can download digital video to their computer desktop via ShowMe on the Internet
- Allows privacy settings

*How many different ways can you solve this question?*

- Using the ShowMe app write the question
- Hit the record button
- Explain your strategy
- Use one slide for each strategy

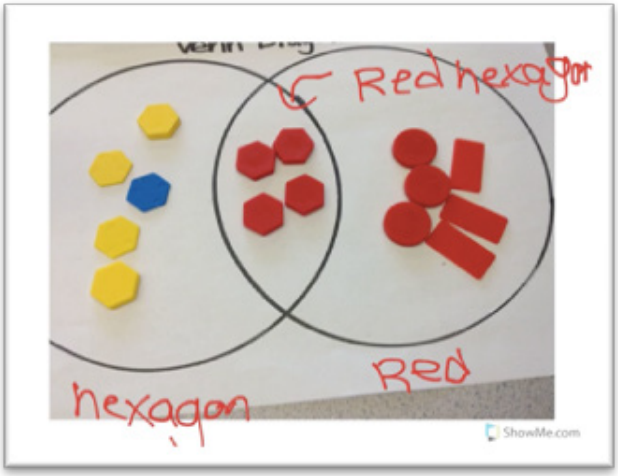



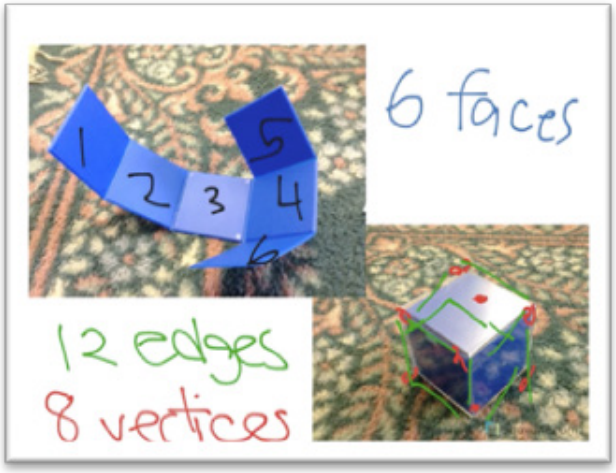

*What patterns do you see in the hundreds chart?*

- Tap the add photo icon and select from the web
- Type in “hundreds chart” and select one
- Label and/or explain orally the patterns you see

*How many ways can you sort the attribute blocks?*

• Sort the attribute blocks using your Venn Diagram
• Label and/or explain orally your sorting rules
• Use a new slide for a different sorting rule




*What can you tell me about this 3-D shape?*

• Take a photo of a 3-D shape
• Label and/or explain orally the attributes that describe your shape.
• Use a new slide for each shape

Upon completion of daily lessons, I ensure my students have time to share their strategies. My students understand that mistakes can be opportunities for learning. As each child shares, students often ask questions or seek clarification from each other. It is amazing and joyous to see their connections and how they socially construct knowledge. Often one student's idea sparks new ideas for another. The excitement becomes contagious.

Similarly, parents delight in hearing and seeing their child's learning. Whenever possible, I encourage my students to not only email me their digital videos or image, but also to send these to their parents email. Furthermore, I keep a digital file (portfolio) on my computer for each of my students and share these during parent teacher conferences.

If using creative apps is new to you, I recommend you start off by selecting one app and try it out on your own first. Then once you feel a beginning comfort level, using Apple TV, or a projector I would guide your students through a "how-to" tutorial together as a class. This gradual release of instruction will increase your success with the lesson. Then when your students are ready, I suggest giving them some time to explore and play with the app. Often my students discover new features that I had no previous

knowledge of. Then either the next day or later in the lesson, if time permits, provide your students with an inquiry task. I would continue to use the same app for many different lessons until they become proficient with it.

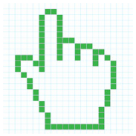
Below is a list of some of the many benefits I have discovered when combining inquiry based lessons with creative iPad apps.

**Creative iPad Apps have the potential to:**

• encourage creativity
• make student thinking visible – it allows students and teachers to document
understanding and share their learning beyond the walls of the classroom.
• permit students' connections across mathematical concepts as well as betweencurricular areas
• shift the focus from the answer to the process and allows students to uncover the"big ideas" or essential understandings
• are meaningful = engaging
• allow for misconceptions to become opportunities for learning
• support reflection
• emphasize higher order thinking
• foster 21st century skills such as gathering, comprehending, applying, analyzing, synthesizing, evaluating, and presenting
• become powerful assessment *for* and *of* learning

# A Few Notable iPad Apps ~ Intermediate

| | | |
|---|---|---|
| **Sharing/Communication** | | |
|  | **Explain Everything**<br>$2.99 | Explain Everything is an easy-to-use design, screencasting, and interactive whiteboard tool that lets you annotate, animate, narrate, import, and export almost anything to and from almost anywhere. |
|  | **Book Creator for iPad**<br>$4.99 | The simple way to create your own beautiful iBooks, right on the iPad. Read them in iBooks, send them to your friends, or submit them to the iBooks Store. |
|  | **Comic Life**<br>$4.99 | The Most Powerful Photo Comic Creation App.<br>Everything you need at your fingertips: speech balloons, photo filters, comic lettering, templates, shapes, shadows and effects. |
| **Virtual Manipulatives** | | |
| **Apps by Brainingcamp**<br>$0.99 each | | In addition to virtual manipulatives, these apps also have drawing tools for annotating. |
|  <br>Number Rods |  <br>Color Tiles |  <br>Pattern Blocks |  <br>Algebra Tiles |
|  | **Number Pieces, by the Math Learning Center**<br>Free | Number Pieces helps students develop a deeper understanding of place value while building their computation skills with multi-digit numbers. Students use the number pieces to represent multi-digit numbers, regroup, add, subtract, multiply, and divide.<br>[Note: These are virtual Base Ten Blocks] |
|  | **Geoboard, by the Math Learning Center**<br>Free | The Geoboard is a tool for exploring a variety of mathematical topics introduced in the elementary and middle grades. Learners stretch bands around pegs to form line segments and polygons and make discoveries about perimeter, area, angles, congruence, fractions, and more. |
|  | **Virtual Manipulatives!**<br>Free | I have provided a virtual set of fraction bars on www.abcya.com for several years. Many teachers have contacted me about creating a similar application for the iPad. Here it is! I offer this app for free because virtual manipulatives alone do not provide meaning for learners; they require a teacher to guide meaning and connections. |
|  | **Number Line, by the Math Learning Center**<br>Free | Number Line helps students visualize number sequences and model strategies for addition, subtraction, multiplication, and division. It can be used to represent sequences of numbers, including whole numbers and multiples of a variety of numbers. |

| | | |
|---|---|---|
|  | **Hands-On Math Hundreds Chart**<br>$2.99 | Creates a virtual math playground where students explore, investigate and discover mathematical concepts. Students use colored markers on the Interactive Hundreds Chart to represent patterns and number sequences. |
| **Games** | | |
|  | **Deep Sea Duel**<br>Free | Okta challenges you to a duel! Collect cards with a specified sum, and you win! But you better do it before Okta does! Choose how many cards (9 or 16), what types of numbers (whole numbers or decimals), and Okta's level of strategy (easy to hard). |
|  | **Math Concentration**<br>Free | By yourself or against a friend, match whole numbers, shapes, fractions, or multiplication facts to equivalent representations. Practice with the clear panes or step up the challenge with the windows closed. How many socks can you win? |
|  | **Pick-A-Path**<br>Free | Help Okta reach the target (maximum, minimum, or a specific value) by choosing a path from the top of the maze to the bottom. Seven levels with seven puzzles will test your skills with powers of ten, negative numbers, fractions, decimals, and more. How many starfish can you earn? |
|  | **Motion Math HD - Fractions!**<br>$3.99 | Motion Math HD follows a star that has fallen from space, and must bound back up, up, up to its home in the stars. Moving fractions to their correct place on the number line is the only way to return. |
|  | **Questimate!**<br>Free (also has in-app purchases) | **Get the new ESTIMATION GAME where YOU make the questions!** How many giraffes would be as tall as the Statue of Liberty? How fast is the world's fastest train? How many jelly beans would it take to fill up a soccer ball? In what year was the cell phone invented? |
|  | **Math Doodles**<br>$2.99 | A place where anyone can discover the joy, wonder, and fun of mathematics. "Math Doodles" introduces four challenges. Each Challenge provides plenty of mathematical practice, within a recreational math setting. The mathematical puzzles allow users to play, explore, and experiment with mathematical concepts, while developing and strengthening their strategy and problem solving skills. Math Doodles challenges are designed to allow for multiple solutions and strategies. There isn't only one correct answer. |
|  | **Slice It!**<br>$0.99 (free version also available) | "Slice It!" is all about slicing shapes into pieces that are equal in size.<br><br>Sound easy? It may start out that way, but soon you'll be cutting shapes that will puzzle you like never before. |
|  | **Chocolate Fix**<br>$2.99 (free version also available) | The Chocolate Fix game app comes with an incredible 400 challenges ranging from Easy to Expert! To complete a challenge, you must use the clues provided to fill the tray by placing the nine chocolate pieces in their correct positions. |

**British Columbia Association of Mathematics Teachers**
2014-2015 Awards Information and Nomination Form
Deadline: May 4, 2015

The BCAMT sponsors awards in three categories to celebrate outstanding achievements of its members. Winners are honoured at a BCAMT conference and receive a commemorative plaque.

## Awards and Criteria

### Outstanding Teacher Awards

Offered: Elementary, Secondary, New Teacher (less than 5 years teaching experience)

- shows evidence of significant positive impact on students, staff and parents
- has initiated innovative and effective programs in their classroom, school, district, or province (teacher research, technology, active learning, assessment, etc.)
- has and continues to demonstrate excellence in teaching mathematics regularly in British Columbia (teaching style, knowledge of the curriculum, current curriculum trends, etc.)
- has made significant contributions to mathematics education at the district or provincial levels over several years (workshops, seminars, conferences, community projects, curriculum development, publishing, etc.)
- is not a current member of the BCAMT Executive

### Ivan L. Johnson Memorial Award

The Ivan L. Johnson Memorial Award is awarded in honour of long-time BCAMT executive member Ivan Johnson. Ivan donated money to the BCAMT for an award in which the recipient will receive significant funding to cover costs of attending the NCTM Annual Conference.

Note: Nominees for the BCAMT Outstanding Teacher Awards will automatically be considered for this award. Previous winners of BCAMT Outstanding Teacher Awards may be also be nominated.

- inspires teachers to try new ideas that improve the quality of mathematics education
- consistently seeks ways to innovate practices in the math classroom
- actively engages in professional dialogue involving mathematics pedagogy
- is not a current member of the BCAMT Executive

### Service Award

- has provided extraordinary service to mathematics education as an active member of the BCAMT for a significant period of time

## Selection Process

- all nominations are reviewed by the BCAMT Awards committee (consisting of a minimum of five previous award recipients) who recommend the recipients to the BCAMT Executive for ratification
- each nomination is considered for two years, after which time the application can be re-submitted with updated information

## How to nominate

Required documentation:

- a completed nomination form (one person per form - see next page);
- nominee's curriculum vitae which demonstrates evidence of teaching, contribution, innovation, professional involvement and impact;
- nominator's summary (one page only) explaining concisely the reasons for the nomination;
- two letters of support (one page each) with concise information about how the nominee fulfills the criteria

Send all of the above in an envelope to **BCAMT Awards c/o Dave Ellis, 2086 Newport Ave, Vancouver, BC, V5P 2H8.**
**DEADLINE: May 4, 2015**

# Nomination Form

Select Award(s):

- □ Outstanding New Teacher
- □ Outstanding Elementary Teacher
- □ Outstanding Secondary Teacher
- □ Ivan L. Johnson Memorial Award
- □ Service Award

## Nominee information

Nominee's Name

School / District

Address

City/Town Postal Code

Work Phone Home Phone

Email address

## Nominator information

Second Nominator's Name

School / District

Address

City/Town Postal Code

Work Phone Home Phone

Email address

Signature of First Nominator Signature of Second Nominator

SFU SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

## Curriculum & Instruction: Numeracy (M.Ed.)

This two year cohort-based M.Ed. program is designed for elementary and middle school teachers who wish to examine multiple perspectives on teaching and learning of mathematics, explore interconnection between mathematics and numeracy, and enhance their own personal problem solving skills.

Designed around the definition of numeracy as 'mathematics in action', the program is based on the principle that mathematics is best learned, and hence, best taught through an emphasis on 'doing' mathematics.

## FACULTY OF EDUCATION GRADUATE STUDIES

www.educ.sfu.ca/gs

We are currently accepting expressions of interest for a **September 2016 Program Start Date**.

Please indicate your location and interest in the link below. The location showing the most interest will be chosen.

**http://bit.do/numeracy2016**

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Please spread the word about this opportunity to friends and colleagues who may be interested.