2013-2014 AESN Case Study

School: Lake Trail School **District:** SD71 Comox Valley

Area of focus: Transitions

Inquiry Team Members: Cheryl Adebar, Lance Lloyd, Lynn Swift

Contact Information: Lance.Lloyd@sd71.bc.ca, Lynn.swift@sd71.bc.ca, Cheryl.adebar@sd71.bc.ca

Question / focus area: How can we use the reading strategies that are embedded in our classroom instruction as math thinking strategies in our math lessons?

We worked together as a district team, which included the district math support teacher, Aboriginal education curriculum support teacher, and grade 9 math teacher. We wanted to check in with our Aboriginal learners to see how this process worked for them. We have been working on a similar inquiry for the last two years in the elementary schools. We wanted to see how using the reading/thinking strategies worked or could be adapted to our older learners.

Scanning: We found that many of the same stumbling blocks existed with the older students. We found that the more time spent creating a context, the more effective the students were at solving the problem. We did find that many students liked and eventually saw the benefits of slowing down the problem solving thinking process. There were still some students who wanted to quickly solve the problem. We noticed that the students needed much more practice with connecting their mental images/schema to algebraic thinking. It seemed that the developmental age of the student was not as important as the 'experience' of math problem solving.

Focus: Although concepts in mathematics are very different than concepts in language, there are cognitive processes that underlie both. Braiding together thinking, language and mathematics (and perhaps other subjects), just like braiding individual strands of rope, results in stronger, more durable and more powerful learning" (Hyde, 2006).

With our elementary school learners, kindergarten to grade 6, we were noticing that the students were experiencing difficulty finding a process to breakdown a problem solving question and to determine the important information. We were noticing that they were needing explicit teaching to effectively breakdown and understand a problem solving question. We noticed that many students got overwhelmed with the amount of language in a word problem solving situation and they often gave up or guessed the answer. We

also noticed that some students thought the problems were too easy because the wording was not difficult and they couldn't see the "math" behind the problem.

Some students were solving the problem on a basic level and some were beginning to connect the problem on an algebraic level with a formula that could be used with any number. We also noticed that students are more worried about the right answer rather than the process involved. From and indigenous perspective, we also wondered about the connection of math to story and how this might help all learners. We wondered, "Can our students create a mental image and connect these problems to a math-story schema such as a combination problem? Also, we wondered how this thinking and process would work with our middle school learners?"

Hunch: We have been working on this process in the elementary schools for the last two years and we have wanted to see how this would transition and be important for our middle school learners. Some of our grade 7 teachers in the elementary schools were noticing that the students not feeling positive about the "slowed down" nature of the framework we were providing. We wondered how we could make this framework relevant to our older learners as well as how we could help slow down the process in a deep and meaningful way. We notice that there may be a difference between elementary and Middle school instruction from explicitly teaching skills to expecting that students know how to proceed with a project or problem. We notice that there is a lot more curriculum to cover in higher grades and that some common language and frameworks between elementary and middle schools would be beneficial.

To make things better for our learners, the students definitely need more practice with the process and seeing the connection to algebraic thinking or more abstract processes, and developing ways to create their own mental images. Time spent on helping students see that connection would be beneficial. It is important for students to know that there are diverse ways to solve the problems and create a mental image of the problem. We think that it is important to use the template in the beginning, but to let students have ownership over the use of the template once the components of the problem solving process are familiar.

New professional learning:

- We continued to use a math comprehension resource as a motivating text for teachers.
- We used a book with Aboriginal context and connection to land
- We added lessons to our district Math website http://web.sd71.bc.ca/math/

Our group continues to use the math thinking skills as we teach mathematics in classrooms and we share these strategies with others through team-teaching within our schools, or throughout the district schools.

We think that the most important thing we learned was the continued attention and respect for diversity of our learners. We constantly strived to find entry points for our learners.

Taking action:

- To develop 21st century learners that can think creatively, critically and whom can communicate effectively, we are interested in developing thinking strategies in mathematics that are already being explicitly taught and practiced in our elementary classrooms in reading. We used math problems that focus on key concepts in math to formatively assess student strengths and weaknesses around this subject. Explicit lessons were designed and implemented to address student needs and to respond to diversity within the classroom. As a team in the classroom we constantly discussed how to meet the diversity of the class. It was very helpful to have each other to discuss ideas.
- We will scaffold student learning as we progress through the thinking strategies and we will use student samples to code their learning in comparison to our criteria, based on the thinking strategies assessment guide.
- In our team we provided a variety of experiences to practice word problem solving. More practice was needed.
- In math word problem solving we focused on content areas and knowledge from a variety of subject or curricular areas, mostly algebraic thinking, including Aboriginal content, to inspire motivation and engagement with our students.
- This is part of a district-wide inquiry that includes teachers from grades 2 to 6, in both English and French. We team taught the lessons through the use of the numeracy support teacher, the Aboriginal support teacher and curriculum support teacher and grade 9 math teacher. We discussed our formative assessments, our explicit teaching ideas based on our formative and summative assessments. We noticed even with the older age students, many did not have an immediate mental image of how to solve math problems.
- We gave lots of discussion time in an inquiry setting. We noticed how important it was to give lots of time for discussion and listening amongst students and teachers. Students changed the minds of each other and the teachers and steered the course of instruction.

Checking: Math word problems were used as a formative assessment to determine areas of strengths and weaknesses. Explicit lessons were designed and carried out with grade 9 students. Student performance was compared to the criterion-referenced assessment guide which was designed last year. Once lessons were taught and students practiced the strategy, lessons were be discussed and modified to improve them. A plan to support struggling learners was also discussed for those students who were not learning, or learning little through this instruction. A plan was also discussed for those students who were quickly creating mental images and solving these problems without a lot of support.

We could see how the process was benefitting most students and we could see how more practice with using the thinking/reading strategies in math would be helpful in creating context and greater understanding for solving math problems. We found the older students needed as much explicit teaching and modeling as our younger students. Some needed more convincing of the usefulness and that it would be helpful when presented with tougher problems in the future. We could see that they needed a lot more practice and that we just touched the surface.

High school support teacher schedules and amount of curriculum needed to be "covered" made it difficult to team teach, though the benefits of the team were obvious as we could discuss and manage the diversity in the class. All of our students were not yet at guided practice or independent stage. They all needed more practice. A small portion in each class attempted algebraic thinking strategies or could see the potential. Most were at the concrete stage and needed to act out, use smaller numbers, or draw the problem.

Reflections/Advice:

- We thought these things were important: Students need to…
    - Be prepared with math vocabulary
    - Be able to defend math thinking position
    - Have an inquiry habit of mind to become more effective with open ended questions
    - Have a common language/vocab/experience around math problem solving
- Inquiry allows us that time to explore, consider, and reflect (experience!) algebra.
- Inquiry draws the concrete to the abstract - joins them together, applies meaning to abstract thinking.
- Inquiry created engagement – the students were arguing about math with each other
- Inquiry allows us to go deeper by staying on one topic, and allows students to connect to that mathematical learning instead of moving on to an unrelated topic
- Communication amongst students and teachers is very critical. In English/Language Arts, students are encouraged to talk. Math should be the same. This approach to math encouraged communication and the students could not opt out.
- Using reading strategies (i.e. determining importance making connections, visualization) for math problem solving was very helpful, as students did not have to learn a new set of vocabulary. These strategies can be used as general critical thinking strategies for any subject area.
- We saw the value of the concrete to abstract developmental sequence and that it is just as important at the older grades. Explicit teaching and modeling is still very important at this age and no assumptions could be made.
- Using the Aboriginal principles of learning helped us when thinking about meeting the needs of a diverse set of students (especially when we used story and context to help students move from the concrete to abstract in math problem solving).

.