MATH KNOWLEDGE NETWORK
CRITICAL TRANSITIONS COMMUNITY OF PRACTICE
K-1 COLLABORATIVE INQUIRY

BACKGROUND
The Math Knowledge Network Critical Transition Community of Practice and Greater Essex County District School Board (GECDSB) have partnered to support math learning during Early Years Critical Transitions from Child Care to Kindergarten and from Kindergarten to Grade 1. On September 8, 2017, the MKN Critical Transitions Community of Practice supported a day of learning with all Kindergarten educators – both teachers and Early Childhood Educators. The day of learning highlighted important learning for Kindergarten students and highlighted research-based practices to ensure key mathematical concepts and effective pedgagogy supported critical learning for Kindergarten students.

Greater Essex County District School Board (GECDSB) has a unique opportunity to explore how educators might support mathematical learning for students who are currently learning in five (5) combined Kindergarten-Grade 1 classrooms. This proposal builds on work begun in the 2016-2017 school year which saw K-1 educators work to compare and align curriculum expectations using the Kindergaraten Program document and the Grade One currciulum documents. This year the team is interested in exploring how the pedagogical approaches outlined in *How Does Learning Happen (2014)* might be imagined and enacted in mathematical learning within the context of a K-1 combined class.

INQUIRY GOALS
The GECDSB and Queen's researchers will:
- Use data from our collaborative inquiry sessions to identify areas of interest and challenge with a view to providing supports
- Review documentation from the group processes to look for learning that is happening in the CI to support mobilization of learning across systems
- Co-create resources (e.g. infographic or knowledge brief) demonstrating CI learning
- Compile an unfolding narrative of mathematical learning in K/1 classrooms to share with the broader educational community (e.g. TEACHONTARIO; Early Years Network)

ALIGNMENT TO THE PURPOSE OF THE CRITICAL TRANSITION COMMUNITY OF PRACTICE
Facilitating capacity building
- Building educators' math content knowledge through an exploration and comparison of Kindergarten math expectations and Grade 1 math expectations
- Developing educators' math content knowledge through an exploration and comparison of the math expectations and Clements' learning trajectories

Creating opportunities for information and knowledge exchange
- Participating in classroom visits to K-1 and Grade 1 classrooms
- Providing debrief opportunities and information and knowledge exchange following classroom visits
- Sharing of classroom practices through pictures, videos and artifacts of student learning

Providing access to tools and resources
- Creating of a resource to support educator planning for math learning that links the expectations to the Learning Trajectories

- Developing of a resource that aligns overall expectations from all subject areas and specific expectations for mathematics for Kindergarten and Grade 1
- Exploring and implementing small group math activities from www.learningtrajectories.org

COLLABORATION PLAN
- Two full days of release with support from Queen's University, ECE partners (St. Clair College), two GECDSB Teacher Consultants and GECDSB Early Years Lead. (December 13, 2017 and January 18, 2018). Participants included K-1 educators and three members from our K to 3 Leadership Committee.
- 2 additional full days of release in February 26, 2018 and May 14, 2018

DAY 1: Exploration of Collaborative Inquiry Cycle as a model of professional learning

- *PROBLEM OF PRACTICE*: How do the math expectations support a continuum of math learning in K-1 classrooms? How do we do a "better" job of meeting the math learning needs of students?

- *PURPOSE* – The purpose of this inquiry is to create a differentiated roadmap for instruction to support math learning.

- *THEORIES OF ACTION:*
  - If we use math-learning trajectories for assessment and instruction, then we will be better able to differentiate instruction for students.
  - If we align the curriculum expectations to the skills outlined in the Learning Trajectories, then educators will develop their content knowledge to support instruction and assessment/evaluation.

- *POSSIBLE INQUIRY QUESTION:*
  - How does deepening educator math content knowledge support implementation of precise and personalized math differentiation for student learning?
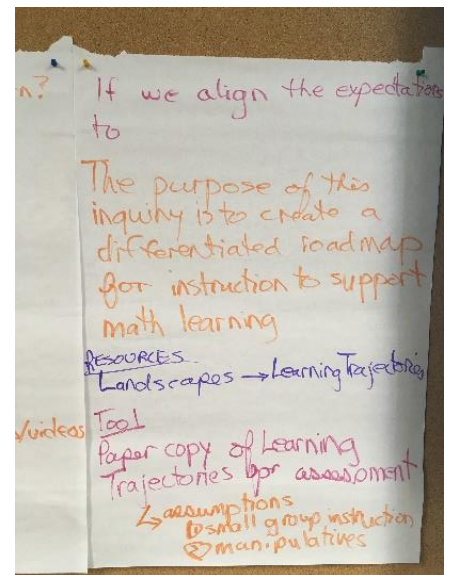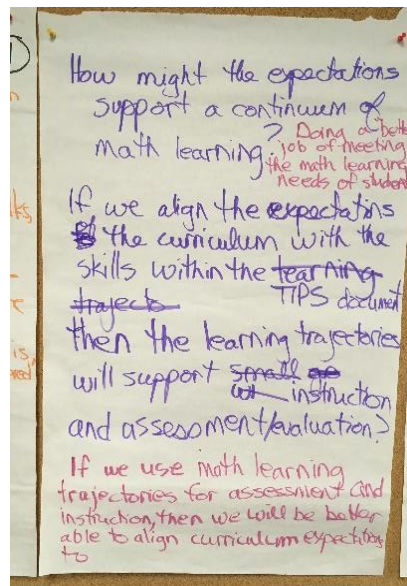
DAY 2:
- Examined and practiced pedagogical documentation to support educator learning
- Classroom visit to K-1 classroom and Grade 1 classroom to observe and document student math learning and activities
- Review of on-line Learning Trajectories tool www.learningtrajectoires.org
- Exploration of the alignment of Learning Trajectories tool with Kindergarten and Grade 1 math expectations to support the development of a resource to support educator math knowledge

DAY 3:
- Classroom visit to partner implementation of math learning activities and documentation of learning using the Learning Trajectories' small group instruction strategies
- Refinement of K-1 expectation and learning trajectory resource
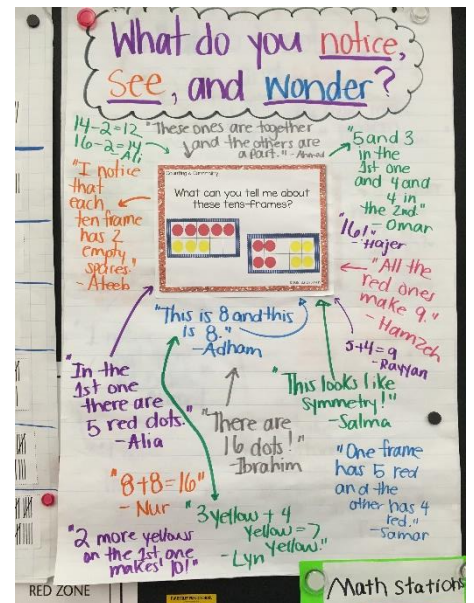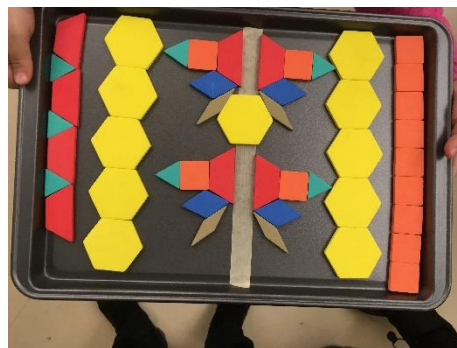
- *REVISED THEORIES OF ACTION:*
  - If educators use math-learning trajectories for assessment and instruction, then we will be better able to differentiate instruction for students.
  - If we align the curriculum expectations to the skills in the learning trajectories, this will support educator understanding of assessment/evaluation and math instruction.

- *INQUIRY QUESTIONS*
  - How does applying math learning continuums in the classroom support precise differentiation for student learning?
  - What are the opportunities, successes and challenges of implementation of the math learning trajectories?

EMERGING THEMES AND WONDERINGS FROM K-1 EDUCATORS

1. Human Capital challenges:
   - Inclusion of Kindergarten educator teams in a school's professional learning - Often kindergarten educators have 'different' professional learning opportunities rather than being part of the entire school's focus. "Our Kindergarten teams have their own staff meetings and PD opportunities."
   - Challenges around presenting K-1 combined classroom opportunities to parents - There may be misconceptions and biases around the students' perceived learning opportunities. "Some parents of the Grade 1 students feel some sort of shame that their child is in a K-1 classroom while the Kindergarten parents may be thrilled. It takes work to 'sell' it to parents."
   - Variances in administrator non-negotiables between Kindergarten and Grade 1 (i.e. small group instruction/free play; on-going assessment for learning/specific diagnostic assessments required)
   - Social-emotional readiness of students can vary significantly within each class - Educators expressed frustration that their students may not be getting the same depth of program they would in either Kindergarten or Grade 1.
   - Confidence of K-1 educators regarding the content and pedagogy of Early Mathematics - Noticing and Naming as the Kindergarten Growing Success Addendum suggests is challenging.
2. Technical challenges:
   - Scheduling of prep providers to ensure consistency of programming, assessment and documentation of student learning

DAY 4 - Consolidation:
- Review and make revisions to K-1 Math Resource for K-1 educators (Expectations and Learning Trajectories)
- Development of strategies to mobilize the work across GECDSB Early Years classrooms
- Celebration of learning

**EVIDENCE OF LEARNING SHARED BY EDUCATORS ON DAY 4**

"Here is the pic of my little buddy discovering that 1+2+3+4=10!"

"I had to share some more math learning from today. We had an open math task in small group today. 'How many ways can we make 10 using Cuisenaire rods?' "

"This student worked independently for 15 minutes, focused the entire time. Take a peek at the equations he created. So excited to see his learning bloom! :)"

"Thanks for all your support this year. Being part of the action research team was has helped me to try new things and deepen my own math learning. Many thanks!"
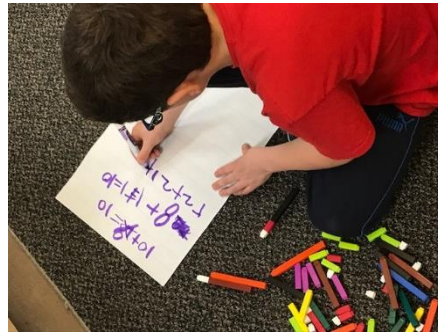
"My students weighed items sold in our "Eco-Health" store by dropping cubes in the balance. The price was the number of cubes. They showed me cash or stamped the coins and printed the price on paper. It was so much fun! I did this as a center (popping in) but also small group for assessment of their learning. They also used their knowledge to prepare vegetable trays for the entire school for Fit week."

EDUCATOR REFLECTIONS AT THE END OF OUR COLLABORATION

SUCCESSES:

- As I have dug deeper into my own math learning and biases, I have discovered how much I do not know. Uncovering and learning new math understanding has been deeply meaningful to me as an educator. Exploring new concepts and tools with my students has provided many exciting new learning opportunities in my classroom. Our school SBL math focus, along with the work we have been doing as a K-1 research team has provided my students with deeper knowledge in many areas of math (number lines, spatial awareness, and proportional reasoning).

  A student in my class who has some learning difficulties (was a challenge at the beginning of the year, is now seeing himself as a learner, able to self-regulate) has made great gains in understanding number. He entered Grade 1 only being able to identify 1-6. This past week we were exploring Cuisenaire rods and he

was the first to understand the growing order of the rods and explained to the class, "If you put 1 rod and 2/3/4 rod together, it's the same as the 10 rod." All the work is worth it!

- Having moved down to Grade 1 from the older grades, play-based learning was uncomfortable for me. Now I am seeing the power of it, recognizing that kids can play all day and be self-directed. Often children do not get to self-direct their time at home. This means the teacher is needing to let go of the control a little and allow students move things from one area of the classroom to another and to allow students to choose what they want to do when (i.e. make books when that would typically be later in the day). I have noticed increased social skills. I have also used lessons from *Taking Shape* with "Let's pretend …" being a common way to start math. Playing and imagining connects to being able to visualize in math.
- "Connect not correct." This was the greatest learning for me.
- I think the kids are getting their excitement from us … I never liked math and now I am so excited about it – the deeper learning that results from tools such as number lines will translate into greater math success in the years to come.
- Kids are recognizing when to use number lines to help understand their thinking (i.e. using it for probability).
- We sometimes get into things we do not expect to learn. For example, when we talk about temperature in the winter, we venture into negative numbers in early years organically.
- I found Leaps and Bounds very helpful to identify where the students are at and then connected it to the trajectory.
- The Learning Trajectories website is helpful to pinpoint where students are and plan to meet their needs.
- I am fearlessly attempting new things and risk-taking in my own classroom.
- Years ago, I controlled the amount of "play" in my class because the students would grow tired and conflict would ensue. Now they never tire of it and find it quite a novelty because sadly they never play at home with their families or other children. Play is powerful.
- In learning about learning trajectories on the website, I found the resource helpful to use for small group or to help me identify pre-skills when I found a student having difficulty, but I was not sure why. While working on documentation with a partner, I could see how I still use judgements to increase efficiency and how this is not as accurate as only writing what you see and I feel that I have improved in this area as a result.
- Working with other teachers and talking about our ideas helped to support my planning in the classroom.
- I am better able to meet the needs of students who may be above or below grade level expectations and am seeing their needs on a continuum, instead of fitting them into a category.

CHALLENGES:

- There is a lot of math in the trajectories that I still do not understand.
- Math is such a deep subject matter. There is so much to focus on. The deeper we go, the more there is to explore. Working with Fosnot's landscape and Clement's trajectories, I often found myself more confused than I expected. As there is not one universal math continuum, it can be overwhelming with everything else we have to focus on in the classroom. However, it is important, interesting, and worthwhile work.
- Hard to share the learning … it is messy and intimidating – people are open to sharing 'ideas' but when you present the trajectories, people get scared.
- Time … it is so vast and the job is already vast.
- To avoid the feeling of "will the grade 1's be ready for grade 2?"
- Which direction should we go to focus the work?

- How do we spread this learning to the rest of the system … while at the same time going deeper because we are not done our learning?
- Math is vast … not linear … teachers are on a learning continuum for math as well.
- Doing two separate types of report cards is a challenge for SK/1.
- It is time consuming to figure out which trajectory is the issue and the activities that will support the learning, because we aren't familiar with them.
- It is challenging to use the trajectories in a K-1 setting as there are many distractions.
- It is hard to find time to meet with individual students to determine their needs.
- I need to know more to understand trajectories.
- So many resources…which direction to go?
- In working through this project, sometimes the path felt unclear. I would like to continue to work through the learning trajectories because there are so many that I still do not know and the progression of mathematical concepts is still not something I am sure of. The activities (on the website) were good. A quick reference would be helpful as it took a lot of time to use.
- It is challenging to develop a program that supports all learners in the classroom.

IMAGE PROTOCOL

Differentiation for student math learning is like the pile of rocks because every rock is different. It is not like the pile of rocks because there is no clear path.

It is like a mud run … messy with unexpected obstacles and sense of accomplishment. It is not like a mud run because when you look at the needs and range of abilities sometimes you feel like you are on your own.

It is like a mud run … messy with lots of obstacles and a celebration at the end. It is not like a mud run because we are never finished.

Differentiation for student math learning is like the rocks … you need the strong base and scaffolding. It is not like the rocks because it is not linear … more like a tree.

Differentiation for student math learning is like the dandelion … there are so many different paths.

Differentiation for student math learning is like the dandelion because some people see it as a negative, but if you look at the beauty and where it has popped up, it is in the most unusual spot; it shows resilience. It is not like the picture of the dandelion because there is more everywhere.

It is like the dandelion because all the petals are like all the different subskills.

Differentiation for student math learning is like the rocks, building on what kids already know. It is not like the rocks because maybe they are not the ones that can be stacked.

Differentiation for student math learning is like the mountain … small goals … It is not like the mountain because today matters … celebrate the small victories.

INDIVIDUAL NEXT STEPS:

- Learning the importance of helping students to have a much deeper understanding of the benchmarks of 5 and 10 and lots of varied counting opportunities
- Look forward to trying to use the trajectories and spiraling to understand how the skills build
- Excited to work deeper with TIPS for Math and trajectories with Grade 1 next year
- Focus on one area (strand) and build on students' knowledge from there
- Use number lines to explore numbers – vary the starting and ending points
- List of activities to correspond with curriculum expectations/trajectories
- Using this perspective to plan for Grade 2 and 3 next year
- Sharing our math knowledge with open colleagues
- Looking deeper at the trajectories – connecting activities to the overall topics we identified
- I look forward to using our Tips4Math document to spiral the math next year. I am interested to see if I make more connections between mathematical concepts and development as a result. I am interested to see if the trajectories will help me see math in new ways – better understand expectations.
- Team up with other teachers continuing the learning. Next year I will be in Grade 1 with another Grade 1 teacher that previously taught Kindergarten. We will dig deeper into the Tips4Math and Trajectories together.

NEXT STEPS FOR OUR SYSTEM:

- Looking at the counting continuum and different strategies for counting
- Start with the existing Tips4Math and Expectations document and continue moving forward by adding tasks and more specific trajectory learning
- Co-plan and co-teach some lessons that match the expectations/trajectories/Tips4Math
- Invitation for those interested in delving deeper into expectations/trajectories/Tips4Math
- Explore the learning within K-3 teams