Making a Difference for Educators, Making a Difference for Students: Exploring Practice-Based Learning in Math

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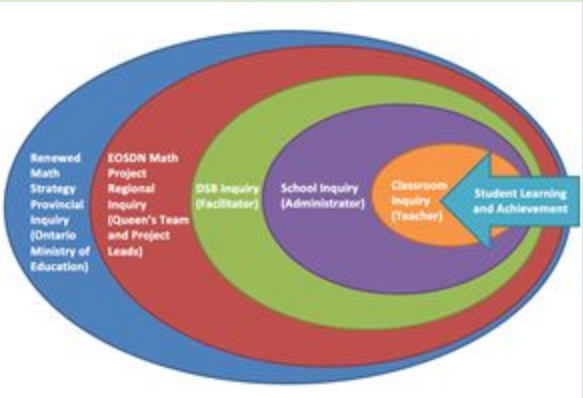
Our Context

EOSDN, a consortium of Eastern Ontario District School Boards and the Faculty of Education at Queen's University, provides ongoing collaborative professional learning opportunities for administrators, teachers, and researchers in the region. Supported by funding from the Ontario Ministry of Education, EOSDN is coordinating a multi-year (2013-present) regional mathematics study that aims to enhance professional discourse, instructional practice, and outcomes for students. Educators in various roles (classroom teachers, school support teachers, school administrators, district facilitators, and others) are networking across the region and within their districts with a collective focus on building educator fluency (i.e., applying understanding in practice) in mathematical *big ideas* and the process of representation in mathematics. This work is supported by recognized experts in mathematics education, Queen's University researchers, Ministry of Education Student Achievement Officers, and educators with experience in mathematics, special education, technology, and school leadership. In 2016, the EOSDN sustained its regional focus on educator fluency, *big ideas* in mathematics, and the process of representation of mathematical thinking, and expanded to include the RMS priorities of supporting students who struggle in mathematics, especially students with identified learning disabilities, through a whole-school approach—leveraging asset-based learner profiles, responsive instruction, targeted accommodations, and assistive technology. Knowing the student first (i.e., adopting a SWST-like stance) enabled greater precision in our work.

Nested Regional Inquiry Model

Within the project, we developed a nested regional inquiry model to illustrate that authentic inquiry begins with knowing our students' strengths and needs. The questions teachers ask themselves are in response to those specific student needs. Inquiries in district school boards (DSBs), the region, and province are developed around how we support teachers and students in classrooms.



5 Key Areas of Practice-based Learning

Through our regional work, five interconnected areas of practice-based learning emerged. Collectively, these areas have impact on student learning in classrooms. The purpose of this monograph is to elaborate on each area and provide actionable implications for work in classrooms and work that supports classrooms.

5 Key Areas of Practice-based Learning

1. Cultivating educator fluency in classrooms, schools, and districts

Educator fluency (i.e., applying understanding in practice) is critical. Educators operate within multiple forms of fluency, including fluency with mathematics, facilitation, inquiry, and data literacy. When middle leaders (e.g., system facilitators or school administrators) engage in sustained regional professional learning and networking, they are able to cultivate their own fluency as well as the fluency of colleagues in classrooms, schools, and districts.

What does this mean for my practice?

In the classroom:	Supporting classrooms:
-continue to develop professional fluency in: · *mathematics*—further my understanding of math content, processes, and concepts · *facilitation*—facilitate math talk in ways that connect math learning to big ideas · *inquiry*—design instruction and assessment to support student thinking · *data literacy*—explore tools and methods of gathering and analyzing classroom data that provide evidence of impacts on student learning	-recognize and build collective fluency among school teams through a whole-school approach: -promote and engage in professional thinking and dialogue with school teams (teachers, support teachers, school administrators) -support the development of professional fluency through resources, tools, and expertise ***"This project has helped me to become much more precise in meeting the needs of principals, teachers, and students in math!"*** *(District School Board Math Facilitator)*

2. Building mathematical concepts by integrating content and process

It is through the mathematical processes that students acquire and apply mathematical knowledge and skills. For students to form math concepts, they need multiple experiences with math content integrated through the math processes. Mathematical processes, by requiring students to think about content, give students access to concepts. For students, the experience of sharing their thinking about solving a problem promotes conceptual understanding for themselves and their peers. Educators need to allow students to represent their thinking in multiple ways (e.g., verbally and visually) and help students notice and name concepts as they emerge. Students may not recognize concepts unless they are made explicit. Conceptual understanding allows students to make connections between ideas and representations, and to use prior knowledge and experience in future learning.

What does this mean for my practice?

In the classroom:	Supporting classrooms:
-recognize that the math processes, curriculum expectations, and achievement chart are intended to be interconnected -have students learn math content through the math processes -provide math problems that require students to represent and share their thinking -use math talk to elicit student voice and *ah-ha* moments -facilitate students' noticing and naming of concepts through math talks or guided discussions -use consolidation to connect today's learning to broader math concepts, or *big ideas*	-know the curriculum and how it's intended to be used as a cohesive, integrated document -access resources to support classroom practice and learning (e.g., expertise, materials, tools, time) -build capacity around the big ideas/concepts in math -support educators with the integration of math content and processes -support noticing and naming of math concepts

5 Key Areas of Practice-based Learning

3. Knowing each student: Personalizing instruction and assessment practice

In our classrooms and schools, we start by acknowledging students who are struggling in mathematics—our 'students of mystery'. In order to support these students, we must focus on:

- Personalization: Develop a learner profile describing the strengths, interests, and learning needs of each *student of mystery*.
- Professional Learning: Investigate and determine strategies best suited to each student's strengths and needs.
- Precision: Implement strategies best suited to the student's learning.
- Assessment: Gauge the impact of these strategies and respond as appropriate.

What does this mean for my practice?

In the classroom:	Supporting classrooms:
-develop a learner profile for each *student of mystery* -take stock of available resources to support these students -access appropriate human resources (e.g., support teachers, administrators, coaches) -purposefully choose and implement instructional and assessment strategies -monitor student learning through differentiated assessment opportunities over time (observations, conversations, demonstrations, products) ***"The development of the learner profile has provided me with an opportunity to see the whole child as a learner and has helped me to choose the most appropriate path to push their learning forward."*** *(Classroom Teacher)*	-clarify the purpose and benefits of the learner profile (i.e., to capture current knowledge and understanding about the student's strengths and needs for the purpose of addressing needs through strengths) -provide information about learning disabilities and associated instructional strategies -explore developmental continua to guide instruction and assessment -provide appropriate technology-enabled strategies to support students -provide opportunities for educator collaboration in and out of classrooms

4. Knowing our impact: Constructing evidence via ongoing data collection and analysis

As educators, it is important that we know our impact on individual students and across various contexts—classroom, school, district, region, and province. We benefit from expert advice on tools and methods for data collection and analysis that allow us to (a) triangulate observations, conversations, demonstrations, and products, and (b) build evidence of our impacts on students. Purposeful, precise data collection allows us to generate evidence of impact and elucidate what makes a difference for students. This knowledge informs our next steps.

What does this mean for my practice?

In the classroom:	Supporting classrooms:
-identify the desired learning outcomes (i.e., *look fors*) -determine how to best access student thinking, with special consideration to the strengths and needs of *students of mystery* -determine what I will collect from my students through observations, conversations, and/or demonstrations -analyze student data to find evidence of learning and learning gaps/needs -determine next steps for instruction and assessment	-support precision in data collection (more is not necessarily better) -promote observations, conversations, and demonstrations as trustworthy sources of evidence -leverage resources, experts, and technology to support purposeful data collection and analysis

5 Key Areas of Practice-based Learning

5. Designing and implementing inclusive practices for all students

Through our regional work, we developed a framework to guide intentional thinking about designing inclusive practices for all students. Starting with *Student Learning* and what we know about our students, we determine content and process from the curriculum. We reflect on *Educator Fluency* and what we need to assist students. We choose the data we need for *Knowing our Impact* and gauging progress toward our *Desired Impacts*.

What does this mean for my practice (in the classroom or supporting classrooms)?

Desired Impacts	Student Learning	Educator Fluency
Educators situate math content within math concepts (schema) Students give evidence of a higher level of mathematical thinking	We start with what we know about our students, and particularly about our ***students of mystery***. How will their learning strengths support new learning? What specific **curriculum content** will be the focus of student learning? How will we connect this content within the big ideas of mathematics? • *Knowledge* of content and skills from selected expectations • *Understanding* of mathematical concepts (within number sense, proportional reasoning, spatial reasoning, algebraic reasoning)	Building Professional Fluency in Supporting Student Learning To promote the learning of all students: • What are we trying to understand about our learners? • In what ways will our practice become more precise/refined? • What school/system/external expertise will we access? • What tools, technology and resources will we use?
Educators embed math processes within design for learning (strategy) Students give evidence of greater fluency in mathematical processes	Which **mathematical processes** will allow students to demonstrate and describe their thinking as they develop and apply *knowledge and understanding*? (problem-solving, reasoning and proving, reflecting, selecting tools and computational strategies, connecting, representing, communicating) How will we support students in connecting this learning to prior learning and to the big ideas? (math talks, noticing and naming the big ideas, consolidation of thinking)	
Knowing our Impact Analyze data to uncover themes, learning, evidence of progress, degree of impact.	What will serve as **evidence** of student knowledge of content, understanding of concepts, and use of thinking, planning, and processing skills? What tools/methods will we use to **collect and analyze data** to gain evidence about student learning? What criteria/tools/methods will we use to assess our professional growth and impact on student learning? Gather data through observation, conversation, and collecting artefacts of students and educators at work (demonstrations). Gather products from student work.	

Resources Supporting Our Learning:

Learning for All: A Guide to Effective Assessment and Instruction for All Students, Kindergarten to Grade 12 (Ontario Ministry of Education, 2013)

http://www.edu.gov.on.ca/eng/general/elemsec/speced/learning.html

Supporting Students with Learning Disabilities in Mathematics (YCDSB, 2012)

http://www.edugains.ca/newsite/SpecialEducation/prolearnfac/learning_disabilities.html

Facilitating Mathematics Professional Learning (2014)

http://www.edugains.ca/newsite/math/prolearnfac/facilitation_supports.html

5 Practices for Orchestrating Productive Mathematics Discussions
Margaret S. Smith and May Kay Stein (National Council of Teachers of Mathematics, 2011)

"As professionals, we have focused on curriculum content and processes, on research into math teaching and learning, on strategies for assessment and instruction, on gathering and analyzing data – all to build educator fluency so that we can hear and respond with precision to the student voice." (Project Director)