Collaborative Developmental Evaluation Report for the Eastern Ontario Staff Development Network Mathematics Project Year 6

Prepared by
Danielle LaPointe-McEwan, Queen's University
Eleanor Newman & Tammy Billen, EOSDN
June 28, 2019

Table of Contents

Section 1: Background

Introduction

Effective professional learning opportunities for educators are critical to developing and enhancing instructional practices that support desired student outcomes. Contemporary professional learning initiatives prioritize ongoing school- and classroom-embedded opportunities that enable recursive cycles of collaborative learning among educators, guided by systemic goals but rooted in local needs and priorities (Hargreaves & Ainscow, 2015; Opfer & Pedder, 2011). Cycles of professional learning are informed by relevant evidence from research and practice (Bryk, 2015; Donohoo, 2013), and are often supported by middle leader facilitators—typically former classroom teachers who have demonstrated capacity and interest in supporting professional learning among school-based educators (Fullan, 2015; Timperley, 2011).

Approaches to Networked Professional Learning

In recent years, networked professional learning facilitated by middle leaders has emerged as a promising approach to support collaborative professional learning within and across educational systems. Networked models aim to build educators' knowledge and stimulate changes in practice, with the goal of systematically improving students' learning outcomes (Campbell et al., 2017; Katz & Earl, 2010; Muijs & Ainscow, 2010; Moolenar, 2012). Networked professional learning is characterized by simultaneous activities across individual teachers, schools, and collectives engaged in learning within and across contexts of educational systems (Opfer & Pedder, 2011). These networked initiatives endeavour to simultaneously meet micro (individual), meso (local), and macro (systemic) needs among educators (Bore & Wright, 2009; Davis & Sumara, 2006).

With the expanding prevalence and capability of technology, virtual networked professional learning has become more widespread across educational systems. Groups of educators are increasingly engaging in blended collaborative professional learning opportunities that involve both face-to-face and virtual elements (Blitz, 2013; Dede et al., 2009). In a recent review, Blitz (2013) reported that effective blended professional learning for collaborative groups of educators entails: a clear purpose, strong leadership and facilitation—both formal and informal, diverse group members representing different roles and/or perspectives, and a strong community-building element. Although limited in quantity and quality, empirical research does not indicate significant differences between the outcomes of face-to-face and virtual professional learning for educators or students (Fishman et al., 2013; McConnell et al., 2013). Moreover, virtual professional learning offers several benefits over face-to-face learning, including: common content that can be scaled to large numbers of educators across contexts and geographical areas, flexible implementation of asynchronous sessions, access to expertise, proximity to practice, and reduced travel costs (Dede et al., 2009). However, researchers and practitioners acknowledge that virtual professional learning models limit the development of trusting collegial relationships and emergent discussions among educators that occur during face-to-face sessions. In addition, educators require sufficient access to technology to participate in virtual professional learning (e.g. hardware, software, high-speed Internet) (McConnell et al., 2013). As a relatively new mode of professional learning, more research is needed regarding the design and implementation of effective virtual professional learning and particularly (a) how virtual professional learning opportunities achieve desired impacts on educators and students, and (b) how much latitude

educator participants should have to determine the content, direction, and pace of virtual professional learning initiatives.

Whether face-to-face, online, or blended approaches, researchers and practitioners alike have acknowledged the complexity associated with supporting and demonstrating widespread change among educators and students through networked professional learning initiatives. First and foremost, it is difficult to determine causal impacts of professional learning on educators and students because systems are constantly changing (e.g., students changing grades or schools, teachers changing placements, leadership changing in schools or districts, priorities changing in districts or governments) (Desmine & Garet, 2015). Second, it is often easier to measure near outcomes (e.g., educators' perceptions) than far outcomes (e.g., students' learning) (Earl & Katz, 2006), with impacts on students often more evident in teachers' classrooms the year following their participation in professional learning (Kennedy, 2016). Third, while system-level funders typically seek evidence of effectiveness through large-scale student achievement measures, qualitative data sources (e.g., classroom observations, classroom video, or student works samples) often provide more nuanced practice-based evidence of emerging professional learning impacts, especially in classrooms and schools (Bryk, 2015; Darling-Hammond, 2010; LaPointe-McEwan, DeLuca, & Klinger, 2017). Fourth, educators vary in their response to the same professional learning opportunities—what they want to learn, what they are ready to learn, and how they want to learn it—due to prior experiences, prevailing beliefs, and perceived needs (Desimone & Garet, 2015; Vangrieken, Meredith, Packer, & Kyndt, 2017). Finally, achieving desired professional learning outcomes for educators and students requires substantial time and educator commitment. According to Guskey (2014), change in educational systems occurs in five stages: participant reactions, participant learning, organizational support and change, participant use of new knowledge, and student learning outcomes. Moreover, Kennedy (2016) asserts that, "Any new idea offered by [professional learning] requires not merely adoption but also abandonment of a prior approach" (p. 948). The result is that there will be substantial variation between the learning that educators obtain, and their subsequent actions in response to that learning. While educators may demonstrate very high commitment to professional learning, the impacts on their instructional practice and pedagogy may be less pronounced and/or difficult to determine.

Professional Learning Framework

Given the potential benefits and prevailing challenges associated with face-to-face, virtual and blended networked professional learning facilitated by middle leaders, system educators and professional learning funders are consistently seeking a deeper understanding of the factors that contribute to desired shifts among educators and students in order to maximize investments in professional learning and realize desired outcomes for both educators and students. In a review of contemporary professional learning literature initiated through the MISA EAST PNC regional inquiry, LaPointe-McEwan, Heggie, and Klinger (2018) constructed a framework that identifies and describes eleven categories of factors that contribute to shifts in educators' thinking and practices, with the underlying assumption that these shifts ultimately support valued student outcomes (see Figure 1). These categories are organized into three broad themes—focus, enactment, and supports. According to the framework, professional learning focused on relevant content that is directly linked to student outcomes and aligned with both local and systemic priorities enhances professional learning outcomes among educators. In addition, educators are impacted by professional learning that is enacted through sustained cycles of collaborative, inquiry-based learning embedded in their contexts of practice and differentiated to respond to their personal needs, beliefs, and interests.

Finally, educators engaged in professional learning are supported by formal and informal networked leadership across educational contexts rooted in trust and respect, as well as opportunities for capacity building with knowledgeable others and relevant resources and tools.

Kennedy (2016) offers an additional insight into the development and implementation of professional learning within educational systems. She suggests moving away from conceptualizing effective professional learning as a set of design features because these features may be unreliable predictors of success. According to Kennedy, in the absence of an overarching theory of educator learning, effective professional learning should be rooted in a "more nuanced understanding of what [educators] do, what motivates them, and how they learn and grow" (p. 974). In her review of 28 quasi-experimental studies of professional learning, she found that the greatest impacts on educators and students occurred when the professional learning:

- combined a focus on curriculum content with another focal area (e.g. revealing student thinking);
- helped educators develop strategies and insights into practice; and
- supported educators' capacities to apply new learning and make professional judgements on behalf of students in classrooms.

Taken together, the professional learning framework (Figure 1) and Kennedy's (2016) articulation of effective professional learning offer research-based evidence to guide educators' purposeful planning and reflection with respect to professional learning in educational systems.

Factors that Contribute to Shifts in Educator Thinking and Practice		Key Findings from Literature Review
Focus	Relevant content	Professional learning content is evidence-informed, focused on content and pedagogical knowledge, and connected to classroom implementation.
	Student outcomes	Professional learning prioritizes links between educator practices and student outcomes and is considerate of how students interact with content and pedagogy.
	Coherence and alignment	Professional learning content and activities are consistent with curriculum goals, students' and educators' needs, as well as system policies and priorities.
Enactment	Job-embedded collaboration	Educators learn collaboratively with colleagues in their context of practice to build an engaged professional learning community that collectively supports valued student outcomes.
	Sustained momentum	Professional learning provides ongoing, supported opportunities for educators to learn new content, explore new ways of thinking, and refine implementation of new practices.
	Active learning	Educators engage in cycles of inquiry-based learning with opportunities to explore problems of practice, challenge beliefs, receive feedback from colleagues, and analyze student learning.
	Differentiated opportunities	Professional learning provides collective experiences that are responsive to educators' beliefs, needs, interests, learning preferences, and contexts of practice.
Supports	Networked leadership	Formal and informal leaders across educational contexts promote a supportive culture that fosters positive shifts in educator practice and student outcomes.
	Knowledgeable others	Knowledgeable others provide capacity building that shifts educators' knowledge, beliefs, and/or practices in ways that support of student outcomes.
	Trust and respect	Trusting relationships among educators promote professional risk-taking, common knowledge building, shared learning experiences, and collective responsibility for student outcomes.
	Resources and tools	Educators leverage current resources and tools to help them learn about content, implement new practices, and assess impacts on students.

Figure 1. Professional learning factors that contribute to shifts in educators' thinking and practice. (Source: MISA EAST PNC Regional Inquiry, 2018)

Principal Leadership Framework

In addition to the critical role that middle leaders play in facilitating networked professional learning across systems, school principals play a central role in supporting and spreading systemic professional learning initiatives within their school contexts. This is particularly true when school-based educators are involved in system initiatives that leverage virtual or blended collaborative professional learning models. Consequently, it is important to understand principals' roles in school-based professional learning. In a recent review of principal leadership literature initiated through the MISA EAST PNC regional inquiry, LaPointe-McEwan (2019) constructed a principal leadership framework (Figure 2) as a complement to the professional learning framework (Figure 1). The principal leadership framework identifies and describes twelve categories (i.e., leadership moves) associated with factors that contribute to shifts in educators' thinking and practice in order to support valued student outcomes.

Like the professional learning framework, these leadership moves are organized according to three broad themes—focus, enactment, and supports. Notably, school principals focus on providing capacity-building for educators in order to enhance pedagogy and desired student outcomes, recognizing that principals have an indirect impact on student outcomes but a more direct impact on the quality and consistency of educators' practice across classrooms in their schools (Heck & Hallinger, 2014; Hitt & Tucker, 2016; Leithwood et al., 2008). Moreover, principals ensure consistent, interrelated goals for teachers and students within capacity-building opportunities that reflect both systemic priorities and local needs (Bush & Glover, 2014; Neumerski, 2012). While there is no singular approach to principal leadership that is effective across all contexts (Hallinger, 2011; Hitt & Meyers, 2018), there is relative agreement that principals must enact instructional leadership moves that include their active engagement in teaching and learning through participation in collaborative, school-based professional learning (Hitt & Meyers, 2018). Furthermore, effective principals purposefully combine instructional and shared leadership approaches—leveraging the thinking and experiences of middle leaders, school-based educators, and students to support the attainment of professional learning goals and priorities in schools (Bush & Glover, 2014; LaPointe-McEwan, 2019).

Neumerski (2012) highlights that most studies isolate coach (i.e., middle leader), principal, and teacher leadership, thus constraining our knowledge about how shared leadership across roles supports enhanced pedagogy and student outcomes. Therefore, it is important to consider the professional learning framework (Figure 1) in conjunction with the principal leadership framework (Figure 2) to more fully understand how middle leaders, school principals, and other educators can work together to support shifts in instructional practice and valued student outcomes through face-to-face, virtual, and blended professional learning initiatives.

Principal Leadership Factors that Contribute to Shifts in Educators' Thinking and Practice		Key Findings from Literature Review
Focus	Vision, values, and goals	Principals create, articulate, and foster shared vision, values, and goals among their school community that reflect local needs and interests as well as system policies and priorities.
	Pedagogy and student outcomes	Principals emphasize high quality pedagogy and learning experiences for all students in order to attain equitable achievement and well-being outcomes.
	Capacity-building for educators	Principals support individual and collective capacity-building among educators through purposeful professional learning aligned with school vision, values, and goals.
	Positive school culture	Principals cultivate a positive school culture in which all educators, students, parents, and community partners feel safe, supported, and valued.
Enactment	Evidence-informed decision making	Principals—in collaboration with their school community as appropriate—use evidence from classrooms, schools, and the district to identify trends in student outcomes, determine directions for school improvement, and monitor progress toward school goals.
	Efficient organizational structures	Principals establish and manage efficient organizational structures that enable productive collaboration among their school community and improve physical, social, and emotional conditions that support quality instruction and learning.
	Strategic resourcing	Principals advocate for and allocate financial, human, instructional, professional learning, and program resources that support the attainment of valued student achievement and well-being outcomes.
	Active engagement in teaching and learning	Principals are actively involved in collaborative planning and monitoring of curriculum, instruction, and assessment programs through school-based professional learning and instructional rounds in classrooms.
Supports	Responsive approach	Principals adapt their approach to leadership in response to the contextual and cultural needs of their educators, students, parents, and community partners.
	Shared leadership	Principals promote shared leadership among educators, students, parents, and community partners, building on capacity within the school community to collaboratively work toward school goals.
	Trust and respect	Principals recognize and build on diversity to build relationships with educators, students, parents, and community partners that are rooted in trust and respect.
	Open Communication	Principals communicate openly with their school community regarding school vision, goals, and progress; listen to and act on feedback from community members; and engage in courageous conversations to maintain collective focus on school vision, values, and goals.

Figure 2. Principal leadership factors that contribute to shifts in educators' thinking and practice. (Source: MISA EAST PNC Regional Inquiry, 2019)

The EOSDN Mathematics Project

Supported by funding from the Ontario Ministry of Education, the Eastern Ontario Staff Development Network (EOSDN), a consortium of Eastern Ontario District School Boards (DSBs) and the Faculty of Education at Queen's University, worked together for the past six years to enhance professional discourse, instructional practices, and student outcomes in mathematics. Through this project, the nine Eastern Ontario English language DSBs collectively and collaboratively focused on building educator fluency among school-based educators (classroom teachers, school support teachers, and school administrators), district educators (system principals, mathematics leads, and special education leads), and researchers in the region.

Beliefs

This six-year project was developed and implemented on the foundational belief that networked opportunities to explore, examine, and challenge beliefs and practices about teaching and learning math would lead to significant, positive shifts in instruction, pedagogy, and student outcomes. Through collaborative opportunities to learn with experts, study research and resources, share approaches for supporting classroom implementation, select problems for building math concepts and skills, observe and assess students' learning, and analyze student work using protocols and developmental continua, educators developed fluency in: (a) the observation, description, and analysis of students' learning and their learning products (i.e., knowing what to look and listen for); and (b) posing questions, providing feedback, and consolidating learning in ways that promote student thinking (i.e., knowing the learner and applying precision in advancing the learning).

Math Curriculum Content and Processes

The math content focus of the EOSDN Math Project (EMP) was on fundamental concepts, or *big ideas*, in math that cut across strands, have relevance for K-12 curriculum, and for which the Ministry has produced current policy and support materials. During the first three years of the project, the content focus was proportional reasoning; based upon feedback from teachers and Ministry priorities, the focus shifted to number sense and number operations in the final three years. Throughout all six years, the math process focus for the project was representing mathematical thinking, linking to the goal of developing educators' fluency in observation, description, and analysis of student thinking.

Strategies for Representing Thinking

Learning in math classrooms comes when students think about mathematics while working on open, relevant problems. Educators in the project developed precision in instruction and feedback by applying strategies to engage students in math talk so that student mathematical thinking while problem-solving was revealed. They guided students in understanding and naming the important foundational concepts in math being developed. Students also illustrated their thinking through the use of manipulatives, models, and demonstrations. The focus for educators was observing and analyzing, posing questions, providing feedback, and consolidating learning in ways that promoted student thinking and development of concepts and skills.

Resources

The work within the EMP was based on Ontario Ministry of Education Mathematics curriculum policy documents, the teacher guide *Focusing on the Fundamentals of Math, Learning for All,*

Growing Success, and the *Paying Attention to Mathematics* monograph series. In addition, the EMP has leveraged various professional resources (e.g., YCDSB's *Supporting Students with LD in Mathematics* and YRDSB's *Understanding Learning Disabilities: How Processing Affects Learning Waterfall Chart*) and professional literature (e.g., *Five Practices for Orchestrating Productive Mathematics Discussions, The Four Roles of the Numerate Learner*, and *What to Look For:Understanding and Developing Student Thinking in Early Numeracy, How the Brain Learns Mathematics, Visible Learning for Mathematics, Mastering the Basic Math Facts, Extending Children's Mathematics*).

Research and Implementation

External math and research experts were engaged to support effective implementation and to monitor and document the impact of educator moves. Experts provided advice on strategies and tools for assessing and collecting evidence of the learning of students and for gauging the impact of strategies being incorporated into classroom practice – both within the project inquiries, as well as in relation to Board and School Improvement Planning for Student Achievement (i.e., BIPSA and SIPSA) goals and strategies.

Across the six years of the project, collectively we have learned, and continue to learn, about our own professional learning needs, the structures that effectively support shifts in mathematics instruction, and the ways in which these shifts impact educators and students. The results from each year have provided critical insights for our learning and efforts in subsequent years.

Year 1 (2013-2014)

In Year 1 of the project, math leaders from each district school board (DSB) met monthly to learn more about strategic implementation and monitoring with support from recognized experts in the teaching of math, Queen's University researchers, Ministry of Education Student Achievement Officers (SAOs), and an EQAO School Support and Outreach Education Officer. As a result, Eastern Ontario math leaders enhanced their own fluency with regards to facilitating and supporting educators within each of their DSBs. The 1100 educators involved in Year 1 of the project collaborated within and across schools, focusing on local, specific needs that related to the parameters of the regional project. All participants had access to math and research experts to develop, refine, and reflect on their math content knowledge and instructional strategies, both at regional and district gatherings. The first year of the project initiated the study of the five key areas impacting teaching and learning: Beliefs, Curriculum, Strategies for Representing Thinking, Resources, and Research and Implementation. See Appendix A for a summary of Year 1 activities and key findings.

Year 2 (2014-2015)

In 2014-2015, the EMP provided continued opportunities to further enhance professional discourse and instructional practice in the EOSDN region with a sustained focus on building educator fluency (i.e., applying understanding in practice) in mathematical *big ideas* (e.g., proportional reasoning) and the process of representation in math. Throughout Year 2, 700 educators involved in the project collaborated within and across schools focusing on local, specific needs that related to the five key parameters of the regional project: math curriculum content/process and mindset, designing effective collaborative inquiry for student learning, inclusive practices for all students, gauging our impact

through qualitative research methods, and collaborative leadership among educators. This collaboration extended to include working partnerships with math and research experts to develop, refine, and reflect on the educators' math content knowledge and instructional strategies, both at regional and district gatherings. See Appendix B for a summary of Year 2 activities and key findings.

Year 3 (2015-2016)

In its third year, (2015-2016), the EMP provided an opportunity for 700 regional educators to continue their focus on educator fluency, mathematical *big ideas*, and the process of representation in math. In Year 3, the project adopted a more precise emphasis on evidence-use to support math teaching and learning within and across contexts of the network (i.e., classrooms, schools, districts, and the region). Moreover, Year 3 participants explored various approaches to cultivating collaborative leadership among educators in schools and districts to spread and sustain regional learning beyond the project. See Appendix C for a summary of Year 3 activities and key findings.

Year 4 (2016-2017)

In Year 4 (2016-2017), the EMP was informed by the Renewed Math Strategy (RMS), introduced by the province in Spring 2016. The project was refocused to align with the provincial emphasis on a whole-school approach and purposeful inquiry focused on supporting students struggling in mathematics. Specifically, while the EMP sustained its regional focus on educator fluency, *big ideas* in math, and the process of representation of mathematical thinking, the project also incorporated 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. See Appendix D for a summary of Year 4 activities and key findings.

Year 5 (2017-2018)

In Year 5 (2017-2018), the EMP continued to be informed by the Renewed Math Strategy (RMS), aligning with the provincial emphasis on a whole-school approach and purposeful inquiry focused on supporting students struggling in mathematics. As in Year 4, the EMP sustained its regional focus on educator fluency, developing mathematical concepts/big ideas, and the process of representation of mathematical thinking, concurrently incorporating 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. Forty-two schools and approximately 200 educators participated directly in regional learning sessions. See Appendix E for a summary of Year 5 activities and key findings.

Year 6 (2018-2019)

In Year 6 (2018-2019), the EMP continued to focus on supporting students struggling in mathematics and was informed by the new provincial focus on the fundamentals of math. Building on Years 4 and 5 of the EMP, regional learning in Year 6 emphasized developing learner profiles for students of mystery, collaboratively analyzing students' math thinking (CASMT) in school teams, and using developmental continua of math thinking to understand and support students' learning. Forty-one schools and approximately 200 educators participated directly in regional learning sessions, a majority of which were conducted virtually due to current provincial restrictions on

funding and face-to-face collaborative professional learning. Year 6 project activities are summarized in Figure 3 and described more fully below. Findings from Year 6 are included in Sections 4 and 5 of this report.

2018-2019 EOSDN Mathematics Project Activities		
Month	**Participants**	**Agenda**
September 7, 2018	Supervisory Officers, System Principals, System Leads (Math and Special Education), SAOs, Project Leads	Leveraging the Regional Learning across DSBs
November 1-2, 2018	System Leads (Math and Special Education), SAOs, Project Leads	Regional Math Lead Learning Session Facilitator: Heather Wark
December 2019	Project Coordinator	Created EOSDN Math Project Archive
January 11, 2019* & February 15, 2019*	System Leads (Math and Special Education), SAOs, Project Leads	Virtual Book Study for Regional Math Leads: *How the Brain Learns Mathematics* by David A. Sousa
February 12, 13, & 14, 2019*	System Leads (Math and Special Education), School Teams, SAOs, Project Leads	Virtual Regional Orientation Sessions for Participating Educators
March 19 & 26, 2019*	System Leads (Math and Special Education), School Teams, SAOs, Project Leads	Virtual Regional Learning Sessions for Participating Educators Facilitator: Connie Quadrini
March 22, 2019*	System Leads (Math and Special Education), Project Leads	Virtual Networking/Book Study for Regional Math Leads Resource: *How the Brain Learns Mathematics* by David A. Sousa
April 9 & 11, 2019*	System Leads (Math and Special Education), School Teams, SAOs, Project Leads	Virtual Regional Learning (after-school) Sessions for Participating Educators Facilitator: Connie Quadrini
April 17, 2019	Project Leads	Planning for regional consolidation
April 26, 2019*	System Leads (Math and Special Education), SAOs, Project Leads	Virtual Networking/Book Study for Regional Math Leads Resource: *How the Brain Learns Mathematics* by David A. Sousa
May 27, 2019*	System Leads (Math and Special Education), SAOs, Project Leads	Virtual Networking for Regional Math Leads
June 4 & 5, 2019*	System Leads (Math and Special Education), School Teams, SAOs, Project Leads	Virtual Regional Consolidation Sessions for Participating Educators Facilitator: Connie Quadrini
June 7, 2019	System Leads (Math and Special Education), SAOs, Project Leads	Regional Steering Committee Meeting/Project Consolidation

Figure 3. Year 6 EMP activities. (* denotes virtual sessions)

Summary of Year 6 Project Activities

The funding for 2018-2019 provided for release time for participating school teams but did not provide for travel to face-to-face meetings so all learning "gatherings" for school staff became virtual as of January 2019. Following is a detailed account of the activities of this year:

Leveraging the Learning across DSBs – September 2018
Directors, Superintendents, System Principals and DSB Project Leads came together to consolidate and share the learning from the 2017-18 EOSDN Math Project and to determine the potential impact of that learning within schools across the district school boards in the 2018-2019 school year. Participants delved into the Developmental Evaluation Report; the EOSDN Math monograph; MISA PNC Literature Review on factors that contribute to shifts in educator thinking and practice; and the Ontario Ministry of Education resource, Focusing on the Fundamentals of Mathematics (teacher guide). DSBs were also alerted to professional resources, multiple copies of which were recently provided for distribution to participating schools and to the core math teams to support their work in districts. Significant among the resources were: Alex Lawson's *What to Look for: Understanding and Developing Student Thinking in Early Numeracy*; *Mastering the Basic Math Facts in Addition and Subtraction and in Multiplication and Division*, both by Susan O'Connell and John SanGiovanni; and *Extending Children's Mathematics: Fractions and Decimals* by Susan Empson and Linda Levi.

Link to PPT and resources referenced during the learning session

EOSDN Math Project Math Lead Learning Session – November 2018
Beginning in the spring of 2018, the core group of DSB middle leaders had six days of face-to-face learning with Heather Wark, a colleague of Dr. Alex Lawson and a sessional instructor in mathematics at Lakehead University. In three two-day sessions, the group focused on how primary-junior students develop concepts and skills in numeracy working through problems, analyzing student work samples, and viewing videos to illustrate student growth in conceptual understanding. Heather provided practical strategies for applying the developmental continuums beginning with subitizing and counting, and progressing through addition and subtraction, multiplication and division, and operations with fractions. November marked the final session of these six days of learning, which was aligned with the math guideline, *Focusing on the Fundamentals of Math*.

EOSDN Math Project Archive – December 2018
The EOSDN Project Coordinator developed an archive of the EOSDN Math project learning for Years 1-5 for the purpose of regional sharing of the learning journey 2013-2018.

Virtual Book Study for EOSDN Math Regional Math Leads – January and February 2019
Resource: *How the Brain Learns Mathematics* by David A. Sousa Chapters 1-2 and 3-4
EOSDN Math leads reflected on how Sousa's research aligned with their current thinking and experiences in the context of research-informed and practice-based research; the Ontario Ministry of Education, *Focusing on the Fundamentals of Math*, as well as other resources that have been utilized in our EOSDN Math Project (purchased through the project and/or referenced by Math Experts such as Heather Wark). Participants also considered and shared how Sousa's research impacted/altered their current thinking around teaching and learning of mathematics.

Virtual Regional Orientation Sessions for Participating Educators – February 2019
Note: due to inclement weather several half day sessions were offered
School teams participated in a half-day virtual orientation session facilitated by the EOSDN Project leads to understand the focus, goals and process of the EOSDN Math learning for this year. Participants were also given the opportunity to discuss their students of mystery; develop and/or refine learner profiles for each of their students of mystery; and become familiar with parallel math tasks by 'doing the math' for the purpose of implementing a question with each student of mystery (pre-data).

Link to PPT and resources shared with participants

Link to audio recording of the orientation session

Virtual Regional Learning Sessions for Participating Educators – March 2019
School teams participated in a half-day interactive virtual session facilitated by Connie Quadrini, Ontario Student Achievement Officer. The focus was Collaborative Analysis of Student Math Thinking (CASMT). Educators focused on analyzing their 'students of mystery' math thinking to identify learner strengths, partial and/or transitional understandings, and needs for the purpose of determining next steps for learning ensuring that precise next steps aligned with strengths and needs identified on the learner profile.

Link to PPT

Virtual Networking/Book Study for EOSDN Math Regional Math Leads – March 2019
During this one-hour networking session DSBs teams reflected on and shared school learning experiences to date within the context of the EOSDN Math project and the book study resource *How the Brain Learns Mathematics* by David A. Sousa. Impressive in the sharing was the degree of spread of the EOSDN project approaches - student of mystery, learner profiles, doing the math, collaborative analysis of student thinking, use of development continuum, focus on mathematics fundamentals, and use of resources for closing gaps in mathematical learning. Most of the participants have worked together as a regional team in face-to-face learning sessions for a number of years and have a high level of trust in sharing successes and challenges knowing that participants will use the information to support (and not to judge) each other's work. As a result the dialogue and sharing was deep, honest, open and reflective.

Virtual Regional Learning (after-school) Sessions for Participating Educators – April 2019
Voluntary after-school sessions were facilitated by SAO, Connie Quadrini, with a focus on deepening understanding and fluency with the process of Collaborative Analysis of Student Math Thinking (CASMT). Planning for this session was responsive to regional needs/interests. DSB Math leads were given the opportunity to provide input into the specific learning focus by indicating educator need with regards to CASMT. Student work from the region was also provided by math leads for Connie to analyze and suggest next steps - modelling the process for educators.

Link to power point

EOSDN Math Project Lead Meeting – April 2019
EOSDN Math Project leads (Coordinator, Researcher, Student Achievement Officers, EOSDN Executive Director) met face-to-face to reflect on the regional learning to date and plan for the regional consolidation in June. Reflections focused primarily on the impact of virtual learning as compared to face to-face learning sessions and how to structure a virtual half-day of regional consolidation while attempting to maintain the integrity of previous face-to-face full day regional consolidation.

Virtual Networking/Book Study for EOSDN Math Regional Math Leads – April 2019
This one-hour networking session began with Chris Stewart, SAO sharing his synthesis of Chapter 5 & 6 of David Sousa's *How the Brain Learns Mathematics* alongside Peter Liljedahl's Thinking Classroom research. DSBs teams then reflected on 'virtual' learning experiences to date in the context of the EOSDN Math project and guiding questions developed by Queen's Researcher, Danielle LaPointe-McEwan. The session concluded with discussion about the tentative agenda for the June 4-5 regional consolidation days for the purpose of DSB leads providing feedback.

Virtual Networking for EOSDN Math Regional Math Leads – May 2019The purpose of this session was to provide regional math leads the opportunity to preview and refine the learning agenda for the June 4-5 virtual regional consolidation. DSB Math leads expressed that having this opportunity would allow them to better prepare and support the school teams as we endeavoured to adjust to an environment where the actual student and teacher work cannot be displayed.

Virtual Regional Learning Sessions for Participating Educators – June 2019
School teams participated in one half-day virtual session facilitated by the EOSDN Math project lead team and Connie Quadrini, Ontario Student Achievement Officer. This session provided an opportunity for educators to share their journey of learning through the lens of both student and teacher. School teams were given the opportunity to reflect on their learning; share student and teacher voice with regards to the math learning; and identify next steps, questions and wonderings that have surfaced from participation in the project. The professional dialogue from the day was a basis for our Eastern Ontario contribution to provincial efforts to enhance understanding of effective teaching and learning in mathematics.

Link to June 4-5 Agenda

Regional Math Leads Steering Committee Meeting – June 2019
This face-to-face gathering of EOSDN Math project steering committee leads marked the end of six years of regional collaboration through the EOSDN Mathematics Project. The day provided time for regional consolidation as the group reflected upon its journey of learning to refine instructional, coaching, and leadership moves so that effective strategies for learning mathematics were supported and implemented by classroom educators. Each DSB team engaged in an in-depth analysis of data collected from the school team consolidation of June 4-5 and produced a DSB summary report (i.e., DSB story slide show) which included stories of student success and claims statements about the impact of specific educator practices on improving student outcomes. The DSB reports served as foundational data for this regional 2018-2019 Collaborative Developmental Evaluation Report for the Eastern Ontario Staff Development Network Mathematics Project Year 6 particularly within section 4 Regional Findings and section 5 Key Findings and Recommendations below. The DSB reports and the Regional Report will support spread of the approaches, strategies and resources which have been found to be effective in improving outcomes for students. The day concluded with

celebration of key successes of the regional project and acknowledgement of long-standing members of the regional group. (For examples of the DSB Claim Statements, please refer to Appendix G.)

Section 2: Evaluation Questions

Formulating Evaluation Questions

Each year, the EOSDN Math Project (EMP) was guided by a collectively determined regional inquiry question developed by regional Steering Committee members (i.e., project leads and district facilitators). The regional inquiry question operated as the overarching developmental collaborative evaluation focus for the EMP each year.

In Years 1 through 4, the regional inquiry question remained consistent:

> **How will a regional focus on proportional reasoning, educator fluency, and the process of representation impact math teaching and learning in eastern Ontario?**

In Year 5, the regional inquiry question was revised to reflect the most current Ministry of Education priorities associated with the Renewed Math Strategies (RMS) and Year 4 findings:

> **How will a regional focus on sense of number, educator and learner fluency, and the process of representation impact math teaching and learning in eastern Ontario?**

In Year 6, the regional inquiry question was further revised to reflect current Ministry of Education priorities associated with the fundamentals of math, recent reviews of professional learning and leadership literature, and Year 5 findings:

> **How might evidence of student learning inform instructional and leadership moves in order to support the development of fundamental math concepts and skills among our students of mystery?**

Section 3: Evaluation Method

Project Evaluation Methodology and Plan

Our six-year, collaborative developmental evaluation explored the EOSDN Math Project (EMP) occurring in Eastern Ontario. This evaluation endeavours to: (a) understand and refine the implementation of the EMP over six years under complex, emergent, and dynamic conditions; (b) understand how the EMP achieved its desired outcomes in relation to the larger educational context surrounding it; and (c) actively engage stakeholders in evaluation processes in order to enhance the overall quality of the evaluation and increase the utility of findings (Patton, 2012). Each phase of this evaluation is summarized below.

Phase 1: Building a Program Theory

One of the more difficult tasks for a program committee is to represent their program in a way that is both comprehensive and useful to initial program development and evaluation planning. The development of a *program theory* can address this dilemma. There are typically two components to a program theory. The *theory of action*, describes the assumptions underpinning program operations. The *theory of change* captures the processes intended to bring about the changes in individuals, organizations, and communities (Rogers, 2011). Together, these two aspects of a program theory can be used to first create links between the underlying framework for an initiative, the intended and enacted actions, and the expected results and changes that may occur as a result. In order to operationalize a program theory it is useful to develop a logic model connecting the theory, actions, and expected products and outcomes. There are many advantages to representing the complete program theory in a logic model:

- It provides a baseline from which to compare the program-in-theory with the program-in-action.
- Identifying the intended effects of a program also sensitizes evaluators and program personnel to unintended effects.
- If it is not possible to test the program model against a comparative or control group, a program logic model allows evaluators and program personnel to begin developing defensible causal arguments (Miles & Huberman, 1994) and offers a framework for continued program developments (i.e., developmental evaluation).

Phase 1 of the EMP evaluation was completed in the winter of 2014 and focused on building a program theory for the subsequent evaluation and research. The purpose of Phase 1 was to begin to "fill in" the theory of action and change that underpinned the EMP. The development of the program theory was an iterative process among the Queen's researchers/evaluation team and the EOSDN project leads. The logic model was also shaped by the evaluators' regular participation in Steering Committee sessions and visits to participating DSBs. The program theory helped guide the initial evaluation questions and design.

Phase 2: Exploring the Impact of the EOSDN Math Project Year 1 (2013-2014)

Phase 2 of the evaluation involved collecting data on the effectiveness of EMP activities to meet the EMP's initial aim as stipulated in the program theory. The evaluation used a collaborative developmental methodology to guide data collection and analyses. Data were collected from multiple participants including: project leads, district facilitators, teachers, school administrators, and expert learning partners (i.e., math and research experts). Data were collected in Spring 2014, at the end of Year 1 of the EMP, to provide an interim sense of the project's impact on participants' learning and practices, and to identify the structures that supported the project's success. In addition, data were obtained during project activities (i.e., Steering Committee sessions, DSB school visits, and year-end sharing sessions) to determine immediate and sustained value of project activities on professional learning and practice. See Appendix A for Year 1 Steering Committee and data collection activities, as well as key findings and recommendations.

Phase 3: Exploring the Impact of the EOSDN Math Project Year 2 (2014-2015)

Phase 3 of the evaluation continued the collection of data on the effectiveness of EMP activities to meet the EMP's initial aim as stipulated in the program theory through a collaborative developmental approach. As in Phase 2, data were collected from multiple participants including: project leads, district facilitators, teachers, school administrators, and expert learning partners (i.e., math and research experts). See Appendix B for Phase 3 (Year 2) EMP Steering Committee and data collection activities, as well as key findings and recommendations.

Phase 4: Exploring the Impact of the EOSDN Math Project Year 3 (2015-2016)

Phase 4 of the evaluation extended the collaborative developmental approach to collecting data on the effectiveness of EMP activities. As in Phases 2 and 3 (Years 1 and 2), data were collected from multiple participants including: project leads, district facilitators, teachers, school administrators, and expert learning partners (i.e., math and research experts). See Appendix C for Phase 4 (Year 3) EMP Steering Committee and data collection activities, along with key findings and recommendations.

Phase 5: Exploring the Impact of the EOSDN Math Project Year 4 (2016-2017)

Phase 5 of the evaluation maintained the collaborative developmental approach to collecting data on the effectiveness of EMP activities. As in Phases 2, 3, and 4 (Years 1, 2, and 3), data were collected from multiple participants including: project leads, district facilitators, teachers, school administrators, and expert learning partners (i.e., math and research experts). See Appendix D for Phase 5 (Year 4) EMP Steering Committee and data collection activities, along with key findings and recommendations.

Phase 6: Exploring the Impact of the EOSDN Math Project Year 5 (2017-2018)

Phase 6 of the evaluation maintained the collaborative developmental approach to collecting data on the effectiveness of EMP activities. As in Phases 2, 3, 4, and 5 (Years 1, 2, 3, and 4), data were collected from multiple participants including: project leads, district facilitators, teachers, school administrators, and expert learning partners (i.e., math and research experts). See Appendix E for Phase 6 (Year 5) EMP activities, along with key findings and recommendations.

Phase 7: Exploring the Impact of the EOSDN Math Project Year 6 (2018-2019)

Phase 7 of the evaluation occurred during the project's sixth year of implementation (2018-2019). The Queen's University research partner, project director, project coordinator, district facilitators (math and special education leads), and SAOs worked collaboratively to refine evaluation questions, data collection instruments, and evaluation methods used during Phase 7. Data were collected from project leads, district facilitators, SAOs, and school teams (school administrators, school support teachers, classroom teachers, and ECEs) at multiple points throughout Phase 7 (Year 6). Data were primarily collected through qualitative methods including documentation of regional project activities, focus group interviews, and artifacts. In addition, all educator participants were invited to complete a survey in Spring 2019 and all students of mystery completed a common pre- and post-task at the beginning and end of the project. These multiple data collection methods were used in order to triangulate findings and to establish trustworthy results. Data collection tools are presented in Appendix F. Table 1 provides a summary of the data collection activities for each participant group by context of practice (i.e., regional, system, school, and classroom).

Table 1. *Data Collection by Context of Practice and Participant Group*

Participant Group	Data Collection Activity	Number	Type of Data
Regional Context **Project Leads** -project director -project coordinator -research partner -SAOs (N = 6)	Ongoing Documentation of Regional Project Activities (February-May)	n/a	– Observation – Conversation – Artifacts
	Consolidation Day Documentation (June 4. 5. 7)	3	– Observation – Conversation
	Focus Group Interview (June)	1 (n = 5)	– Interview
System Context **District Facilitators** -math leads -special education leads -SAOs (N = 32)	Feedback Questionnaire (March)	9	– Open-response
	Focus Group Interview (April)	1 (n = 8)	– Interview
	Educator Participant Survey (May-June)	29	– Fixed-response – Open-response
	DSB Story Slide Show (June)	9	– Artifacts
School & Classroom Contexts **School Teams** -school administrators -school support teachers -classroom teachers -ECEs (N=179)	School Team Documentation of Educator & Student Learning (February-May)	41	– Observation – Conversation
	Student of Mystery Pre- and Post-Task Results (March, May)	166	– Product
	Educator Participant Survey (May-June)	133	– Fixed-response – Open-response
	School Story Slide Show (June)	41	– Artifacts

Data Analyses

With respect to Phase 7 (Year 6), qualitative data were analyzed using a standard thematic coding process (Namey, Guest, Thairu, & Johnson, 2008; Patton, 2002). Data were analyzed in relation to participants' context of practice: regional, system, and school. From an initial analysis of data, a code list was generated after which codes were grouped into broader thematic categories across participants' contexts of practice. Codes with a high degree of co-occurrence (i.e., two or more codes used for same data) were collapsed into broader categories if they represented similar themes. Themes were then clustered based on their relation to: (a) the professional learning model, and (b) math teaching and learning.

Quantitative survey data collected from educator participants were analyzed through descriptive statistics and one-way ANOVAs. These data provided information about the impacts of the project on instructional practice, school and system leadership, and students of mystery in math. In addition, student pre- and post-task data were analyzed using TinkerPlots software to elucidate trends and relationships among regional student data through data visualization and modelling.

Findings from the EMP evaluation are presented in the next section. Taken together, these findings provide the basis for key findings and recommendations for next steps in regional networked professional learning, presented in Section 5 of this report.

Section 4: Regional Findings

Educator participants across contexts—regional (project leads), system (district facilitators and SAOs), school (school administrators and school support teachers), and classroom (classroom teachers and ECEs)—offered various perspectives on their experiences with the EMP. However, consistent across each group was a valuing of the EMP because it provided: (a) opportunities to enhance instructional practice, leadership, and students' learning through common approaches and strategies; (b) time for networking and collaboration among educators across roles and contexts; and (c) a professional learning process that can be effectively spread to educators not officially involved in the EMP.

Educator participants' perspectives are presented according to: (a) educator participant demographics, (b) the regional professional learning story, (c) the math teaching and learning story, and (d) suggestions moving forward.

Educator Participant Demographics

In total, 217 educators from the Eastern Ontario region participated in the EMP during the 2018-2019 school year. In the regional context, EMP project leads included one project director, one project coordinator, one research partner, and three SAOs. In the system context, 27 district facilitators (i.e., math and special education leads), approximately three per DSB across the nine regional DSBs, and five SAOs supported teams of educators in 41 schools. These school teams included educators from both school and classroom contexts and ranged in size from one to seven educators. Most commonly, school teams included five members: one school administrator, one school support teacher, and three classroom teachers. In schools involving Kindergarten teachers, ECEs were typically included in the team. In total, 33 school administrators, 21 school support teachers, 114 classroom teachers, and 11 ECEs were involved in Year 6 of the EMP (see Table 2).

The project director, project coordinator, and research partner were involved in the EMP for all six years. District facilitators had an average of 2.8 years of experience in the EMP, with two facilitators (7.4%) new to the project this year and four (14.8%) who had been part of the project for its six-year duration. Among school team members (i.e., school administrators, school support teachers, classroom teachers, and ECEs), most participants were new to the project in Year 6: 75 (41.9%) were in their first year and 67 (37.4%) in their second year (see Table 3).

Each school team contributed a *school story* slide show (n = 41 schools) and each group of district facilitators contributed a *DSB story* slide show (n = 9 DSBs) at the end of Year 6 to consolidate school and system learning in the project. In addition, each educator participant was invited to complete a survey in Spring 2019. In total, 162 educators completed the survey for an overall response rate of 74.7%. Among these educators, 25 were district facilitators (92.6% response rate), 4 were SAOs (80.0% response rate), 20 were school administrators (60.6% response rate), 14 were school support teachers (66.7% response rate), 92 were classroom teachers (80.7% response rate), and 7 were ECEs (63.7% response rate) (see Table 2). Of the 162 educators who responded to the survey, 80 (49.4%) were in their first or second year of the project, 64 (39.5%) were in their third or fourth year, and 18 (11.1%) were in their fifth or sixth year.

Table 2. *Frequency and Survey Response Rates of Educator Participants by Role*

Role	# of Educator Participants (N = 217)	Frequency (% of total)	# Survey Responses (n = 162)	Response rate (% of participant group)
		Regional Context		
Project lead	6	2.8	n/a	n/a
		System Context		
District facilitator	27	12.4	25	92.6
SAO	5	2.3	4	80.0
		School Context		
School administrator	33	15.2	20	60.6
School support teacher	21	9.7	14	66.7
		Classroom Context		
Classroom teacher	114	52.5	92	80.7
ECE	11	5.1	7	63.6
		All Contexts		
TOTAL	217	n/a	162	74.7

Table 3. *Frequency of Years in EMP for District Facilitators and School Team Members*

Years in EMP	District Facilitators (N = 27)	Frequency (% of subgroup total)	School Team Members* (N = 179)	Frequency (% of subgroup total)
Less than one	2	7.4	75	41.9
1-2	7	25.9	67	37.4
2-3	6	22.2	30	16.7
3-4	3	11.1	6	3.4
4-5	1	3.7	1	0.6
5 or more	8	29.7	0	0.0

Note. School team members include school administrators, school support teachers, classroom teachers, and ECEs.

The Regional Professional Learning Story

The regional professional learning story emerged from multiple data sources including project lead and district facilitator focus groups, educator participant surveys, DSB story slide shows, and documentation of project activities. These data illustrated how the EMP supported educators in Year 6 and highlighted differences in educators' experiences in the current year compared to previous years of the project.

As in Years 1 through 5, the work of each DSB and associated school teams was guided by the EMP's Year 6 regional inquiry question.

> **How might evidence of student learning inform instructional and leadership moves in order to support the development of fundamental math concepts and skills among our students of mystery?**

This regional inquiry was nested within the current provincial emphasis on the fundamentals of math (see Figure 4) and focused on school teams: (a) supporting students of mystery in math using learner profiles and responsive instruction, (b) collaboratively analyzing students' math thinking (CASMT) on common pre- and post-tasks, and (c) using developmental continua to understand and support students' math learning with precision. Each DSB determined the schools, educators, and grade levels of students that would participate in Year 6 of the EMP. Most DSBs chose to focus on Primary students of mystery, with some including Junior students and one including Intermediate students. In several DSBs, EMP goals and strategies were also reflected in their BIPSAs and SIPSAs, contributing to the spread of learning beyond project participants and contributing to coherence and alignment across all contexts—provincial, regional, DSB, school, and classroom—in service of students' learning in math.

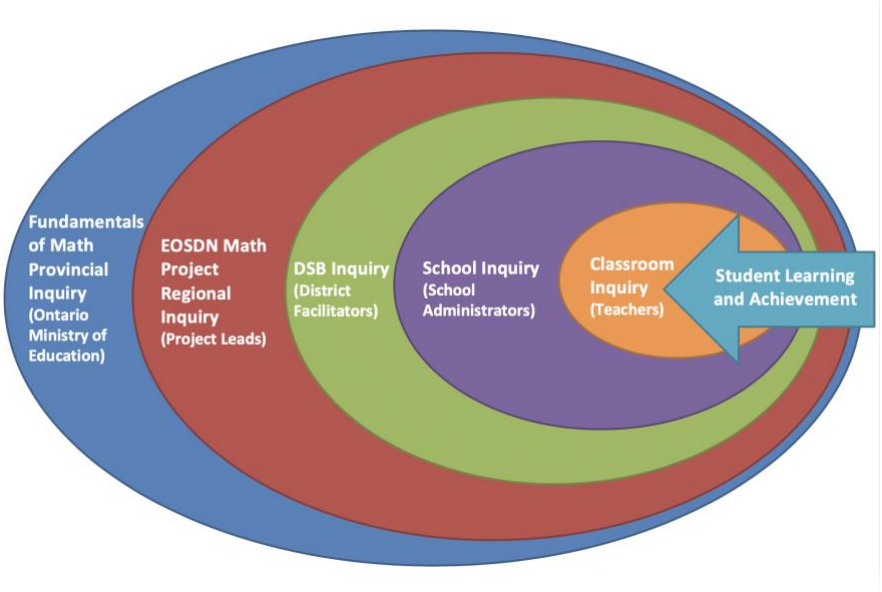

Figure 4. Nested regional inquiry model.

Across all six years of implementation, the EMP leveraged dedicated funding from the Ontario Ministry of Education to enable project activities though human, financial, structural, and research supports allocated to participating DSBs and educators. Regionally, the EMP adopted a "loose-tight"

approach—with a regional inquiry informed by provincial math priorities that guided the work in DSBs and schools while allowing participating educators the flexibility to engage in DSB and school inquiries that were rooted in their local needs and interests. The project director explained, "A loose-tight approach invites everyone's brain into the work. If you're overly tight, people don't need to bring their brains with them. In a project like this one, all thinking is going to be important. So, be tight on what we're trying to achieve for students and be loose by creating room for all the experience, expertise, and innovative thinking from the classrooms, schools, and systems that will move us forward". Moreover, the learning each year of the EMP built on the previous year's learning and maintained alignment with current provincial math initiatives. As one SAO reflected, "It seemed as though we enacted a cohesive 6-year plan, even though you were planning year to year based on the availability of funding, because you build on each year's regional findings."

> *We now understand how to build capacity among middle leaders—our middle leader facilitators work with an assurance that their approaches have impact. It's just phenomenal to see.*
>
> Project Director

In Years 1 through 5 of the project, the EMP's regional professional learning model entailed 11 monthly face-to-face regional sessions, September through June. Eight of these sessions each year were attended by project leads, district facilitators, and SAOs (i.e., the Steering Committee) and provided: (a) scaffolded capacity-building with recognized experts in key areas such as adult facilitation, math content and processes, data fluency, CASMT, and developmental continua of math thinking; (b) opportunities for networking, collaboration, and reflection within and across DSBs; and (c) time to consolidate DSB and regional learning at the end of each year. Three sessions each year included school teams (i.e., school administrators, school support teachers, classroom teachers, and ECEs) along with Steering Committee members and provided: (a) capacity-building with math experts, (b) opportunities for networking, collaboration, and reflection within and across schools and DSBs; and (c) time to consolidate school and DSB learning at the end of each year. The opportunity to meet face-to-face in monthly Steering Committee sessions was particularly valued by district facilitators who, as middle leaders in their DSBs, benefitted from networking and collaboration with like-role colleagues, and applied strategies across DSBs. (See Appendices A-E for a summary of project activities Years 1-5.)

> *The virtual format allowed us to sustain and continue to build on the capacity and relationships we built [with district facilitators] over the first five years and spread learning among school teams in Year 6.*
>
> Project Coordinator

The EMP adopted a blended professional learning model (i.e., both virtual and face-to-face elements) in Year 6 in response to provincial restrictions on funding and face-to-face collaborative professional learning. In Year 6, the majority of regional learning occurred virtually and over a shorter timeline from February through June (see Figure 3). Despite these restrictions, the EMP, in collaboration with DSBs, provided four full-day face-to-face regional sessions for Steering Committee members: in September (leveraging the learning across DSBs), November (2-day regional math lead learning session with Heather Wark), and June (regional project consolidation). The remainder of Year 6 regional sessions were facilitated virtually by the project leads with input from district facilitators and included: five book study and networking sessions for math leads, three orientation and learning sessions for school teams supported by Connie Quadrini, and one school team consolidation session. Virtual sessions were typically one to two hours in

length. Project leads offered multiple times and dates for each virtual session to accommodate school day schedules and weather conditions.

Navigating Virtual Professional Learning

Project leads and district facilitators appreciated that the virtual platform allowed regional networking and collaborative learning to continue in Year 6. As virtual networked professional learning was new for the EMP, project leads, district facilitators, and school teams offered insights regarding the opportunities and challenges associated with this approach.

Opportunities

Participants identified two primary opportunities associated with virtual networked professional learning. First, they agreed that virtual EMP sessions served to support the regional focus and common message for learning that had emerged from the work of previous years and allowed for spread of this focused work among school teams across DSBs. Moreover, the PowerPoint slides and resources that accompanied virtual sessions contributed useful content that helped district facilitators support face-to-face learning with their school teams. Participants particularly valued the support of the math expert during interactive virtual sessions where educators explored and applied the CASMT protocol with common pre- and post-tasks completed by their students of mystery.

Second, all EMP participants agreed that virtual professional learning was an efficient model that allowed for collaborative learning among regional educators and access to expertise without the need to travel. Project leads highlighted that virtual sessions optimized time within the condensed Year 6 timeline (February through June) and provided a middle ground between informational memos/emails and face-to-face collaboration. Both project leads and district facilitators appreciated that virtual sessions allowed for continued regional networking and collaboration among educators and agreed that pre-recorded virtual sessions allowed for flexible scheduling and implementation with school teams (e.g., watching in advance of school team sessions, scheduling at convenient times based on school schedules, pausing for discussion during school team sessions, and re-watching for clarity). In some cases, school administrators were able to involve more classroom teachers in the EMP because school teams could participate in virtual sessions within their school context. Moreover, some classroom teachers indicated that they were able to apply learning from virtual sessions immediately because they participated in school-based virtual sessions then returned to their classrooms the same day.

> *In a way, the virtual format forced the gradual release of responsibility from us as regional leads to our math leads.*
>
> Project Coordinator

Challenges

> *I did not find the virtual sessions to be helpful. What I did find informative was the chance to collaborate with colleagues (i.e., teaching partners) to discuss ideas and resources used to further student learning within the classroom.*
>
> Classroom Teacher

Despite the opportunities that virtual regional professional learning enabled, EMP participants identified four central challenges associated with this mode of learning. First, all participants articulated the challenge of time. In particular, half-day sessions were found to be too limited for school teams to engage fully in both virtual learning and face-to-face collaboration. To allow for the professional thinking that leads to refined practice, facilitators and school teams needed to build relationships, discuss new content and instructional strategies, identify students of mystery, develop learner profiles, analyze student work using CASMT, plan for next steps, and reflect on educator and student learning. Several DSBs navigated this challenge by scheduling full-day school team sessions—allowing sufficient time for collaborative learning. Moreover, district facilitators indicated it was challenging to find half-day occasional teacher coverage for teachers.

> *We need to be aware of the needs of our learners~especially those new to the project.*
>
> Project Coordinator

Second, participants highlighted challenges with the content of virtual sessions. District facilitators and school teams agreed that PowerPoint slides presented during virtual sessions were content heavy and were not differentiated based on educators' needs (e.g., experience in project, role, grade, previous professional learning). In Year 6, many school team members were new to the project and would have benefited from more scaffolded learning about new language and content central to the EMP (i.e., identifying students of mystery, developing learner profiles, implementing CASMT, exploring developmental continua). Furthermore, when virtual sessions were synchronous (i.e., live), district facilitators were not able to pause and respond to their school teams' questions and needs in real time, creating frustration for both facilitators and school team educators. As one district facilitator summarized, "Educators reported that their most valuable learning took place through discussions with each other and moderating student work. Educators did not find they learned as much from the virtual opportunities. They really appreciated more coming together as a school to work with each other face-to-face."

> *I preferred the face-to-face sessions we had last year, as I appreciated being able to see what other teams were doing in the way of professional learning. I was more distracted when participating in the virtual professional learning sessions compared to the face-to-face sessions. I like connecting with speakers and this can be difficult with virtual learning experiences.*
>
> Classroom Teacher

Third, EMP participants elaborated challenges with the format of virtual professional learning. Project leads acknowledge that they were "in a learning curve" during Year 6 with respect to structuring and facilitating networked virtual professional learning across nine DSBs and 41 schools. When reflecting on Year 6, project leads identified that they did not leverage the expertise and wisdom of district facilitators as much as in previous years—due to the condensed timeline, lack of monthly Steering Committee sessions, and virtual element of the project. As such, the project was not as collaborative as it had been in the past and the purpose of the project was not clear to all participants, especially those new to the project. District facilitators and school team educators described virtual sessions as "prescriptive," "lecture-style," and "too passive"—with limited opportunities to discuss content or ask questions, leading to difficulties staying focused and engaged. Project leads agreed that they spent considerable time pre-planning detailed virtual content and couldn't be as fluid and responsive to educators' needs during virtual sessions as they would have been during face-to-face sessions (e.g., reading body language and facial expressions, answering questions, responding to participants' energy). As such, project leads relied heavily on written feedback from participants during and after virtual sessions to inform and enhance their planning of subsequent sessions.

Finally, in some instances, technology was a challenge to engaging in virtual networked professional learning. One project lead with prior experience and expertise in e-learning contexts played a critical role in structuring and implementing regional virtual sessions using Google Meet. During virtual sessions, this project lead provided troubleshooting for participants with respect to connectivity, log-in, and audio/visual issues, responded to comments from participants in the chat area and via email, and recorded sessions for future implementation and referencing. Given the increased provincial emphasis on virtual professional learning models, project leads noted the need to create an infrastructure for virtual professional learning and maximize the potential of virtual platforms in order to accommodate large numbers of participants, enable real-time discussions, and "make virtual learning as real as it can be."

The Math Teaching and Learning Story

The regional math teaching and learning story emerged from various data sources including educator participant surveys, student of mystery pre- and post-tasks, and DSB and school story slide shows. Findings regarding EMP impacts on math teaching and learning are reported according to: (a) instructional moves that supported students of mystery, (b) leadership moves that supported teaching and learning, and (c) impacts on students of mystery.

Instructional Moves that Supported Students of Mystery

Instructional moves, or practices, that supported math teaching and learning were derived from the professional learning framework presented in Section 1 (see Figure 1). According to classroom

educators (i.e., classroom teachers and ECEs), the instructional moves that most supported the math learning of their students of mystery were: using a developmental continuum to support students' conceptual understanding of math fundamentals, using evidence from analysis of student work to inform next steps in instruction, and analyzing student work purposefully using the collaborative analysis of students' math thinking (i.e., CASMT) approach. Classroom educators with more experience in the EMP (i.e., 2 or more years) tended to report greater impacts of instructional practices than classroom educators new to the project (i.e., < 2 years) (see Table 4).

Qualitative survey data from classroom educators confirmed and further elucidated how instructional moves related to assessment supported math teaching and learning. Approximately half of classroom educators (n = 51, 51.5%) indicated that their approaches to assessment differ for students of mystery, some classroom educators (n = 27, 27.3%) stated that they approach assessment similarly for all students, and the remainder approach assessment differently on a case-by-case basis (n = 21, 21.2%).

All classroom educators agreed that diagnostic assessments provide critical baseline information regarding all of their students' conceptual understanding and use of strategies in math, highlighting each student's strengths and needs. These diagnostic assessments help classroom educators—primarily classroom teachers—plan for differentiated instruction, guided groups, and parallel tasks in math for all students. In many cases, classroom teachers conducted additional diagnostic assessments with their students of mystery to obtain a deeper and more detailed understanding of these students' strengths and needs in math. One classroom teacher added, "The students of mystery were assessed in some additional ways that other students were not, but the results from the students of mystery assessments sometimes pointed me toward needs of the whole class for specific strategies or skills."

> *My approach to assessment for my students of mystery is slightly different. I have spent more time analyzing the "why" behind their completed tasks. I have also spent time with them to better understand their thinking and their procedures. I take their oral explanation into consideration as many of them are better able to explain orally.*
> Classroom Teacher

Classroom educators also prioritized formative assessment for all students, implementing regular and ongoing check-ins through a variety of assessment opportunities. However, for students of mystery, many classroom educators described providing more frequent and differentiated assessments—often using oral assessments and individual conferencing/interviews to reveal these students' math thinking—and rarely implementing summative assessments as these students were often "not ready." In addition, classroom educators analyzed the math thinking of their students of mystery in more depth and detail—using developmental continua and the CASMT protocol as guides and, in some cases, analyzing video of students' solving problem. As one teacher stated, "Using the CASMT tool has helped me see and think clearly about where my students are in their math journeys and where they need to go." Most classroom educators encouraged the use of manipulatives and tools to support all students' thinking during formative assessments; although, many indicated that they particularly emphasize the use of manipulatives and tools with their students of mystery. For students with IEPs, classroom educators provided designated accommodations on math assessments; however, for students of mystery without IEPs, many teachers reported providing accommodations such as reading questions to them, scribing for them, allowing additional time to complete tasks, and providing quieter work spaces.

Table 4. *Mean Impacts of EMP on Classroom Educators' Instructional Practice in Math by Years in Project*

Thinking about the EOSDN Math Project, please indicate the extent to which each of the following factors has supported your instructional practice in math:				
	Classroom Educators			
	All Classroom Educators M(SD) (n = 99)	*Years in Math Project M(SD)*		
		<2 (n = 64)	*2-4 (n = 32)*	*>4 (n = 3)*
Focusing on 2-3 students of mystery per classroom	3.64(.87)	3.53(1.15)	3.73(.87)	3.67(.58)
Developing/refining learner profiles for each student of mystery	3.42(.87)	3.25(1.16)	3.33(.87)	3.67(.58)
Using responsive pedagogy to support students' identified strengths and needs	3.66(.64)	3.33(1.12)	3.63(.81)	4.00(0.00)
Using a developmental continuum to support students' conceptual understanding of math fundamentals	4.08(.82)	3.78(1.09)	4.14(.79)	4.33(.58)
Using common math tasks across classrooms	3.77(.64)	3.53(1.15)	3.79(.77)	4.00(.00)
Analyzing student work purposefully (e.g., CASMT approach)	3.92(.80)	3.87(1.05)	4.23(.77)	3.67(.58)
Using evidence from analysis of student work to inform next steps in instruction	3.99(.75)	4.07(.91)	4.23(.77)	3.67(.58)

Note. Survey question 4. Five-point scale from 1 = None at all to 5 = A great deal. Highest means. Classroom = classroom teachers and ECEs.

I really enjoyed being a part of this project. I feel that it benefited my students of mystery, and I could see their progress with the strategies we targeted. Our math lead did a great job of guiding us through this project. I look forward to using the strategies I learned throughout this project in my future teaching.
~Classroom Teacher

Leadership Moves that Supported Math Teaching and Learning

Leadership moves that cultivated supportive conditions for math teaching and learning in schools and classrooms were derived from the leadership framework presented in Section 1 (see Figure 2). According to school (i.e., school administrators and school support teachers) and system (i.e., district facilitators and SAOs) educators, the leadership moves that most contributed to supportive conditions were: promoting shared leadership among school teams, establishing trust and open communication among school teams, and prioritizing opportunities for collective capacity-building among school teams. Overall, school and system educators who had been involved in the EMP for two to four years reported the greatest impacts of their leadership on cultivating supportive conditions.

> *Educators are excited and immersed in collaborating with one another. They are using the subitizing continuum and sharing it with their colleagues who did not participate in EOSDN. They are speaking the same language and are choosing appropriate intentional moves based on assessment tools.*
>
> School Administrator

Qualitative survey data from school and system educators elaborated how their leadership moves supported enhanced math teaching and learning in their contexts of practice. First and foremost, school and system educators reported that capacity-building opportunities for school teams promoted educators' understanding of students' math thinking and the student of mystery approach to supporting students' learning (i.e., identifying two students of mystery per classroom, developing learner profiles for each student of mystery, and implementing precise instructional and assessment strategies to support these students' conceptual understanding in math). Accordingly, school teams developed a common language and common approaches that facilitated noticing and naming math strategies and purposeful instructional planning and discourse among EMP educators.

Secondly, school and system educators noticed that school-based educators became more collaborative as a result school team capacity-building sessions, contributing to a sense of shared leadership among educators. In particular, school teams co-analyzed student thinking on common pre- and post-tasks using the CASMT protocol with district facilitator support. They then co-planned intentional next steps for students, often to move students along a developmental continuum. In some schools, this collaborative approach to supporting students' math learning spread beyond educators directly involved in the EMP to other school and classroom educators. One school administrator stated, "The frequent conversations and collaboration among educators about math and the sharing of strategies has made the change."

Finally, through school team capacity-building, classroom educators became more confident to try new strategies to support their students' learning such as engaging math games, number talks, using manipulatives and tools. In many cases, classroom teachers intentionally planned lessons for students of mystery based on learner profiles and pre-task solutions, creating parallel tasks and providing guided group instruction that allowed students of mystery to participate with the entire class.

> *Most of the educators involved in the math project actively worked to apply new strategies and new information they have acquired during our math meetings. They have had their students engage more in the use of manipulatives to show their thinking and use math materials that they have previously not used in a more purposeful way.*
>
> School Administrator

Table 5. *Mean Impacts of EMP on School and System Educators' Leadership in Math by Years in Project*

Thinking about the EOSDN Math Project, please indicate the extent to which each of the following factors has cultivated conditions that support math teaching and learning in your context of practice:				
	School & System Educators			
	All School & System Educators M(SD) (n = 63)	*Years in Math Project M(SD)*		
		<2 (n = 15)	*2-4 (n = 34)*	*>4 (n = 14)*
Defining clear goals for instructional practice and student learning outcomes	4.03(.82)	3.88(.81)	4.13(.74)	4.08(.90)
Prioritizing opportunities for collective capacity-building among school teams	4.20(.88)	4.25(.93)	4.27(.80)	4.08(.90)
Focusing goals and capacity-building on responsive pedagogy and valued student outcomes	4.00(.86)	3.81(.83) *	4.53(.52)	3.67(1.23) *
Using classroom, school, and district evidence to inform goals and collective capacity-building	4.19(.74)	3.81(.91)	4.40(.63)	4.36(.67)
Providing organizational supports for collective capacity-building	3.98(.95)	3.94(1.00)	4.00(.85)	4.00(1.00)
Allocating resources strategically	3.90(1.00)	3.75(1.06)	3.87(.99)	4.09(.94)
Engaging in teaching and learning activities through collective capacity-building opportunities	4.12(.94)	3.81(1.22)	4.47(.64)	4.09(.94)
Promoting shared leadership among school teams	4.25(.95)	4.31(1.08)	4.27(.88)	4.18(.87)
Establishing trust and open communication among school teams	4.23(.88)	4.19(.83)	4.40(.99)	4.09(.83)

Note. Survey question 5. Five-point scale from 1 = None at all to 5 = A great deal. Highest means. School = school administrators & school support teachers; System = district facilitators & SAOs. * = significant difference.

By focusing on students of mystery, we have been able to identify gaps and implement strategies to address them, which has put the focus on clear learning goals and responsive instruction.
~School Administrator

Impacts on Student of Mystery

Classroom, school, and system educators reported positive impacts on their students of mystery in math. The greatest impacts reported by educators were on these students: engagement during math class, confidence and risk-taking with math tasks, and ability to work with numbers (see Table 6). Educators with more experience in the EMP (i.e., > 2 years) consistently reported greater impacts on students of mystery than educators new to the project (i.e., < 2 years of experience). Moreover, educators with two to four years of experience in the EMP reported significantly greater impacts on students of mystery than educators new to the project (i.e., < 2 years of experience) in five out of nine areas (see Table 6). In addition, educators with the most experience in the EMP (i.e., 4 or more years) reported the greatest impacts on students' development of mental math skills and development of proficiency with operations. Overall, educators indicted the least impacts on these students' mastery of math facts.

Table 7 further elucidates impacts of the EMP on students of mystery by educators' contexts of practice—classroom, school, and system. There was consensus among classroom, school, and system educators that the greatest impacts were on students' engagement during math class and ability to work with numbers (see Table 7). However, classroom and school educators noticed greater impacts on students' confidence and risk-taking with math tasks in comparison to system educators who indicated greater impacts on students' ability to recognize and apply their understanding of number properties. Classroom, school, and system educators agreed that the EMP had the least impacts on students' development of mental math skills, development of proficiency with operations, and mastery of math facts. With respect to these lesser areas of impact, classroom teachers reported the most mixed impacts, while school and system educators tended to report greater impacts than classroom educators.

> *I have noticed that students are talking more in different math classes. The teachers have embraced setting conditions that require student discourse. When I visit classes students can tell me what they are learning and show multiple ways of finding their answers.*
>
> School Administrator

Qualitative survey data collected from classroom, school, and system educators further elaborated impacts on students of mystery. First and foremost, these educators most frequently articulated changes in students' confidence and risk-taking in math. Increased confidence was most commonly observed in students' increased engagement in math learning activities, increased class participation, and enhanced perseverance with math tasks. In some cases, educators reported that students of mystery were more focused during math class, exhibited more positive attitudes toward math, and were more independent with math tasks.

Second, classroom, school, and system educators also identified that students of mystery were better able to communicate their math thinking verbally, using math language to name the strategies they used to solve problems. Educators also reported that students of mystery began using a greater variety of strategies to solve math problems, often more efficient strategies, and used manipulatives and other tools to support their problem-solving. In some instances, educators reported that students of mystery exhibited more flexible and deeper thinking when solving math tasks. One classroom teacher summarized, "Students have built more confidence in their abilities to approach new learning

tasks and they are able to choose efficient strategies depending on the task. They are able to do so more independently with less prompting and are able to better explain their thinking."

Finally, classroom, school, and system educators reported greater math skills and conceptual understanding among their students of mystery. This was demonstrated in students' fluency with numbers, counting strategies, subitizing skills, ability to find differences, use of friendly numbers, and accuracy in computations. While many of these changes were identified through educators' observations or conversations with students, collaborative analysis (i.e., CASMT) of common pre- and post-tasks completed with all students of mystery provided evidence of change via products. (Pre- and post-task results are described in the following section.)

Students are better able to think flexibly about problems. They are learning to consider the numbers and how they are related, rather than focusing on key words. They are learning that different strategies work better, depending on the numbers and the situation. They are learning about how mathematical tools and models can support their thinking.
~District Facilitator

Table 6. *Mean Impacts of EMP on Students of Mystery in Math by All Educators' Years in Project*

Thinking about your students of mystery in math, please indicate the extent to which your participation in the EOSDN Math Project has enhanced these students':				
All Educators (Classroom, School, & System Roles)				
	All Educators M(SD) (n = 162)	*Years in Math Project M(SD)*		
		<2 (n = 80)	*2-4 (n = 64)*	*>4 (n = 18)*
Confidence and risk-taking with math tasks	3.53(1.02)	3.35(1.16)	3.69(.95)	3.57(.94)
Engagement during math class	3.57(.97)	3.27(1.21)	3.51(.95)	3.92(.76)
Ability to identify their personal strengths and needs in math	3.25(1.07)	2.92(1.22) *	3.35(1.05) *	3.47(.92)
Ability to work with numbers	3.50(.88)	3.27(1.03)	3.58(.87)	3.64(.74)
Ability to recognize and apply their understanding of number properties	3.33(.92)	3.08(1.09)	3.38(.93)	3.53(.74)
Mastery of math facts	3.07(.92)	2.74(1.09) *	3.12(.94) *	3.36(.74)
Development of mental math skills	3.32(.93)	2.99(1.12) *	3.40(.93) *	3.57(.76)
Development of proficiency with operations	3.13(.93)	2.77(1.01) *	3.20(1.02) *	3.57(.76)
Ability to represent math thinking in diverse ways	3.39(1.04)	3.13(1.04) *	3.51(1.08) *	3.53(.99)

Note. Survey question 6. Five-point scale from 1 = None at all to 5 = A great deal. Highest means. Classroom = classroom teachers & ECEs; School = school support teachers & school administrators; System = district facilitators & SAOs. * = significant difference.

Table 7. *Frequency of Impacts on Students of Mystery in Math by Educators' Context of Practice*

Thinking about your students of mystery in math, please indicate the extent to which your participation in the EOSDN Math Project has enhanced these students':				
Educators by Classroom, School, & System Roles				
		A Great Deal/ Quite a Bit (%)	Somewhat (%)	A Little/ Not at All (%)
Confidence and risk-taking with math tasks	Classroom	51.5	25.7	22.8
	School	62.0	20.7	17.3
	System	52.9	29.4	17.7
Engagement during math class	Classroom	47.5	29.7	22.8
	School	60.0	23.3	16.7
	System	66.7	5.6	27.7
Ability to identify their personal strengths and needs in math	Classroom	36.6	30.7	32.7
	School	40.0	40.0	20.0
	System	42.1	26.3	31.6
Ability to work with numbers	Classroom	42.2	37.3	20.5
	School	58.1	38.7	3.2
	System	66.6	16.7	16.7
Ability to recognize and apply their understanding of number properties	Classroom	37.6	31.7	30.7
	School	45.2	45.2	9.6
	System	57.8	21.1	21.1
Mastery of math facts	Classroom	23.0	41.0	36.0
	School	20.0	60.0	20.0
	System	33.3	50.0	16.7
Development of mental math skills	Classroom	32.3	36.3	31.4
	School	36.7	53.3	10.0
	System	50.0	27.8	22.2
Development of proficiency with operations	Classroom	28.7	32.7	38.6
	School	30.0	50.0	20.0
	System	41.2	41.2	17.6
Ability to represent math thinking in diverse ways	Classroom	41.6	33.7	24.7
	School	58.1	29.0	12.9
	System	52.6	21.1	26.3

Note. Classroom = classroom teachers & ECEs; School = school support teachers & school administrators; System = district facilitators & SAOs.

Pre- and Post-Task Results

All students of mystery identified by school teams across the region (N = 228; 2 students per each of 114 classroom teachers) completed common pre- and post-tasks at the beginning and end of the project. School teams, with the support of their district facilitators, used the CASMT protocol to analyze phases of students' thinking evident in pre- and post-task solutions. In total, 166 complete sets of pre- and post-tasks were collected regionally, representing 72.8% of students of mystery. Among these students, a majority were in the Primary division (n = 102, 61.5%), while 53 were Junior (31.9%) and 11 were Intermediate (6.6%) (see Table 8). Fourteen of these students of mystery (8.4%) had formally identified learning disabilities.

Table 8. *Frequency of Students of Mystery by Division and Grade*

Grade	Number of Students (n = 166)	Frequency (%) of Students
Primary	102	61.5
Kindergarten	41	24.8
Grade 1	34	20.5
Grade 2	13	7.8
Grade 3	14	8.4
Junior	53	31.9
Grade 4	25	15.1
Grade 5	15	9.0
Grade 6	13	7.8
Intermediate	11	6.6
Grade 7	4	2.4
Grade 8	5	3.0
Grade 9	2	1.2

The most common strategies used by students of mystery on the pre- and post-tasks were M1 *counting 1 by 1* and M5 *counting on/back* (see Table 9). On the pre-task, 35 students (21%) used the M1 strategy, and 30 students (18%) used M5. On the post-task, fewer students (n = 26, 16%) used the M1 strategy, and more used M5 (n = 40, 24%). Figures 5 and 6 provide additional information about the grade levels of students who used various strategies on the pre- and post-tasks. Notably, while many Kindergarten and Grade 1 students maintained the M1 strategy on both pre- and post-tasks—considered developmentally appropriate for early Primary students—most Grade 4 students moved from M1 on the pre-task to a more advanced strategy on the post-test. In addition, more Grade 1 and Grade 3 students advanced to using the M5 strategy on the post-task from earlier phases of math thinking on the pre-task.

Table 9. *Frequency of Phases of Students' Math Thinking on Pre- and Post-Tasks*

Phase of Math Thinking	Pre-task (%) (n = 166)	Post-task (%) (n = 166)
More: Student was able to determine who had more, but not how much more	6 (4%)	3 (2%)
M1: Counting 1 by 1	35 (21%)	26 (16%)
M1,2: Counting 1 by 1 & Subitizing	11 (7%)	5 (3%)
M2: Subitizing	16 (10%)	5 (3%)
M3: Matching sets	9 (5%)	13 (8%)
M4: Counting three times	10 (6%)	12 (7%)
M5: Counting on/back	30 (18%)	40 (24%)
M6: Add/subtract to nearest benchmark, then add/subtract by friendly numbers	10 (6%)	19 (11%)
M7: Decompose second number, then remove set(s) of friendly numbers	6 (4%)	7 (4%)
M8: Jumps of friendly units backward/forward, then compensate	4 (2%)	8 (5%)
M9: Constant difference	2 (1%)	1 (1%)
M10: Eliminate quantities that are equivalent, identify difference	5 (3%)	7 (4%)
M11: Create common units then add/subtract	4 (2%)	7 (4%)
MO: Other strategy	18 (11%)	13 (8%)

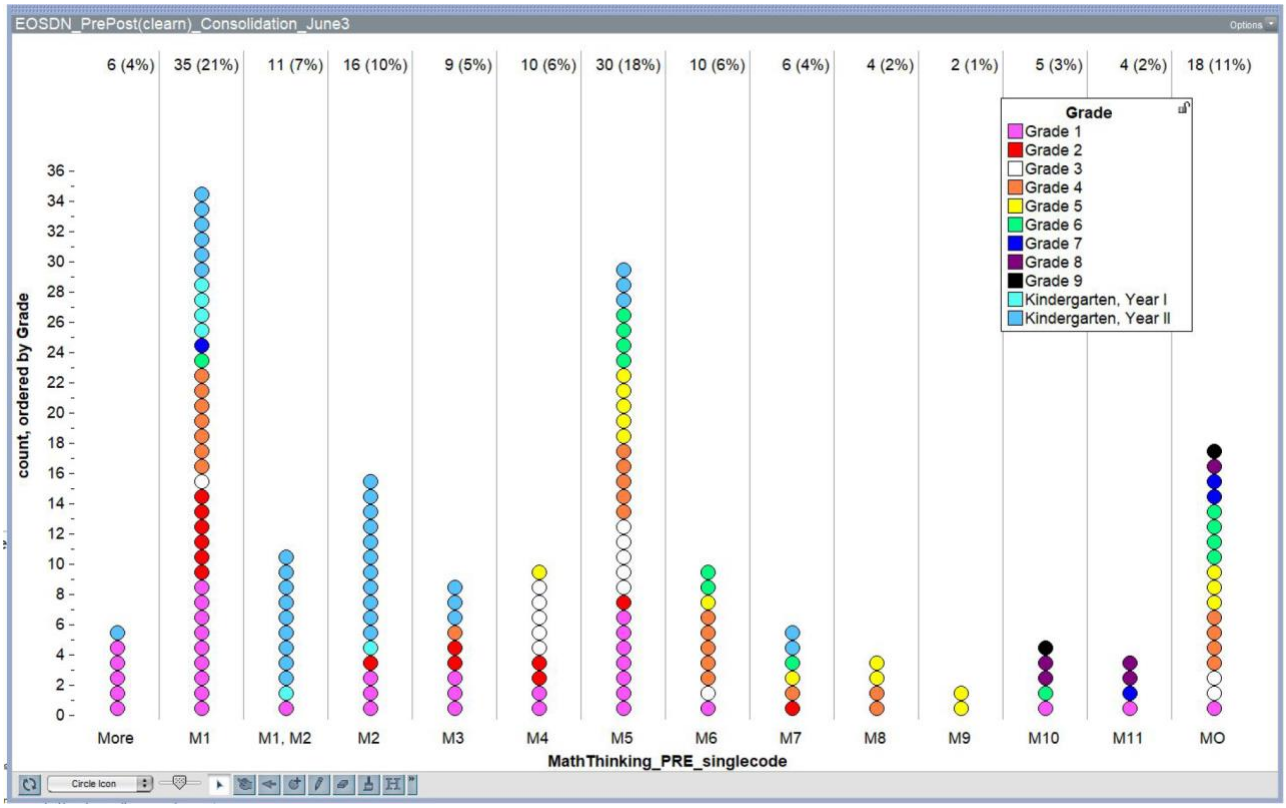

Figure 5. Frequency of phases of students' math thinking on pre-task by grade.

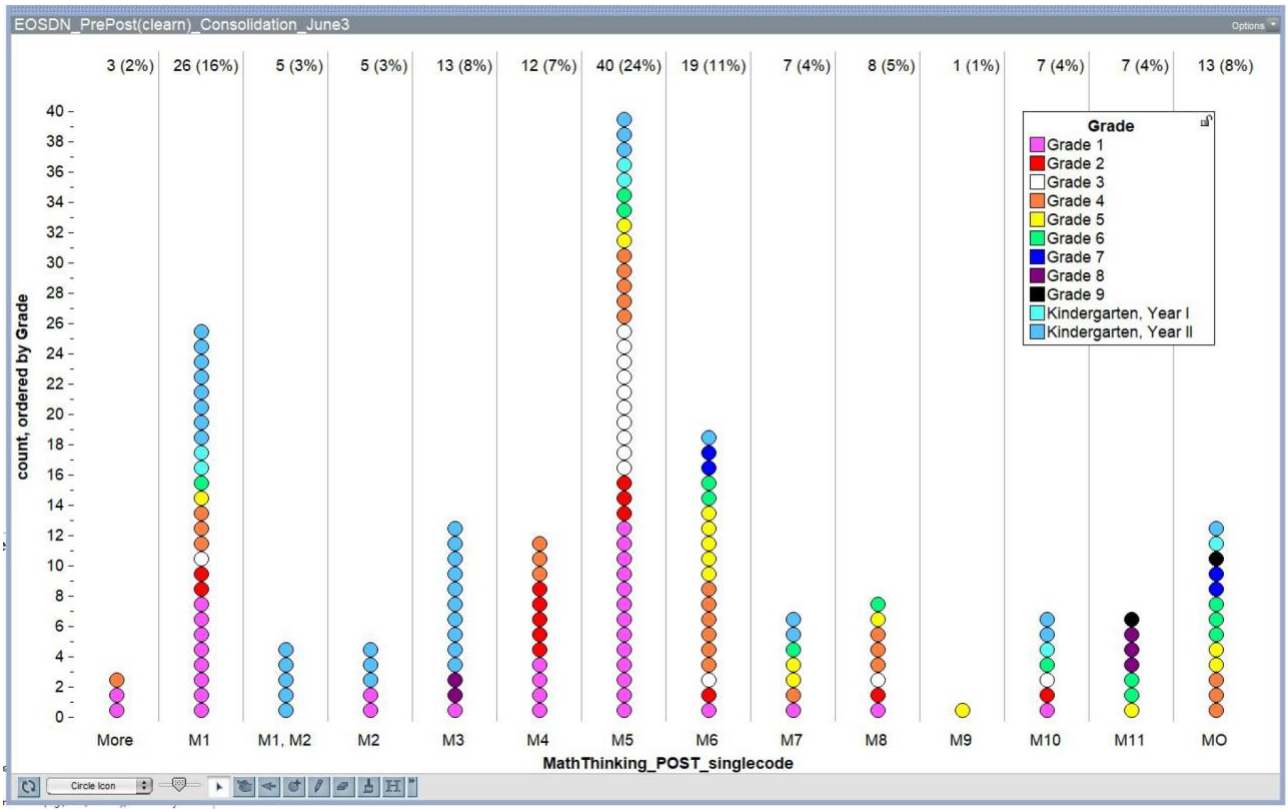

Figure 6. Frequency of phases of students' math thinking on post-task by grade.

Importantly, a majority of students of mystery (n = 69, 42%) demonstrated an increase of one or more phases of growth in their math thinking (see Figure 7). Thirty-four students of mystery (20%) showed no change in their math thinking, and 32 (19%) showed one or more phases of regression in their math thinking. Given the short timeline of the project (February-May 2019) and identified learning needs among students of mystery, these overall results are encouraging and highlight the benefits of educators using the CASMT protocol in conjunction with developmental continua of students' math thinking to precisely assess and support math learning among students of mystery. The CASMT protocol and developmental continua not only elucidated growth in 42% of students' math thinking but also helped educators better understand and pinpoint next steps for students who did not progress or regressed in their math thinking.

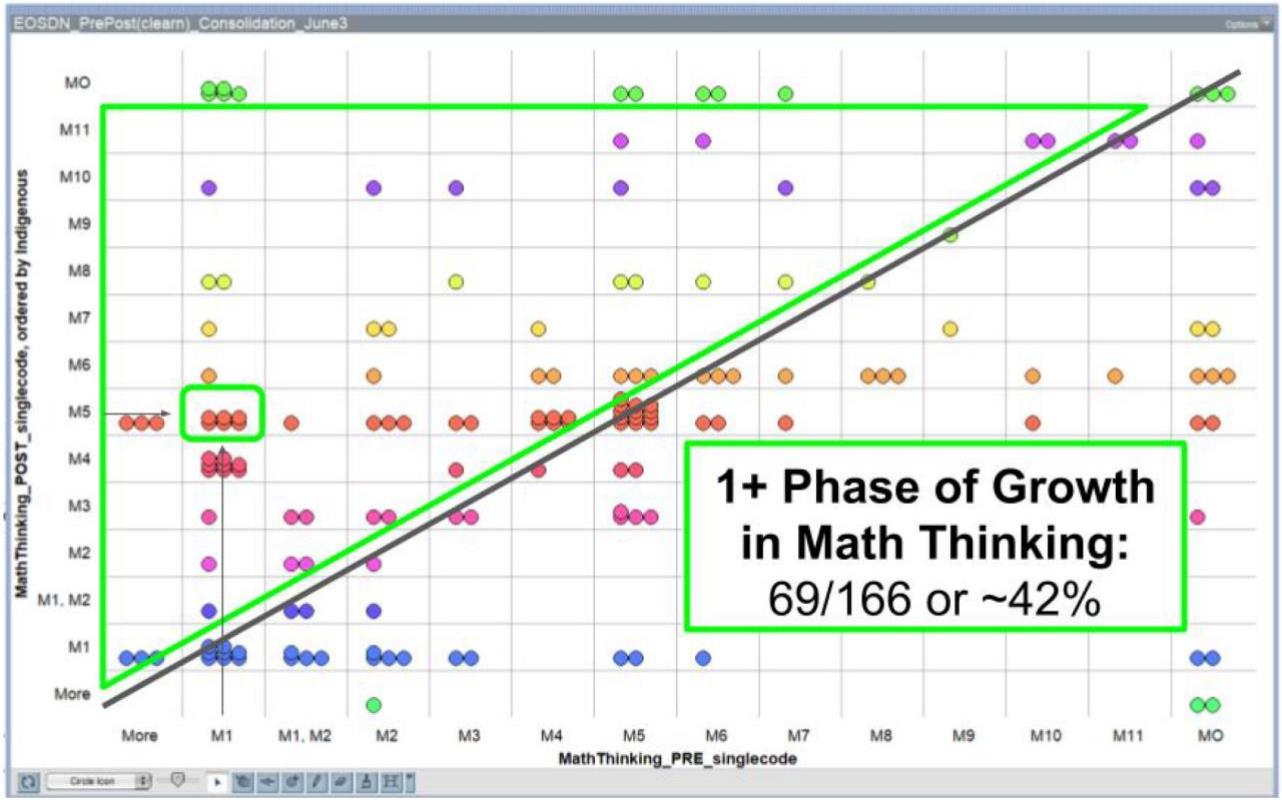

Figure 7. Phases of growth in students' math thinking from pre- to post-task.

Suggestions Moving Forward

EMP educator participants offered suggestions for future regional networked professional learning in math beyond the duration of this project. Suggestions are organized according to: (a) aspects of the project to maintain; and (b) opportunities to enhance regional learning.

Aspects of the Project to Maintain

Educator participants agreed on maintaining two key aspects of this professional learning project moving forward.

Regional focus of the EMP.
Educator participants valued the coherent regional focus on students of mystery, learner profiles, CASMT, and developmental continua and recognized the positive impacts of these approaches on math teaching and learning across DSBs, schools, and classrooms. They suggested a longer project timeline over a full school year (September-May) to:

- allow more time for educators to work with students in-between regional and school team sessions
- allow more time for students to benefit from instructional strategies and demonstrate growth in their thinking
- require less time of classroom educators during May and June

Time for school team sessions supported by district facilitators and math experts.
Educators appreciated time for school teams to collaborate and would value additional time with their school teams to:

- build trusting relationships
- engage in educator capacity-building (especially for educators new to the project)
- identify students of mystery and develop learner profiles
- explore instructional strategies
- implement the CASMT protocol with developmental continua to co-analyze student work
- reflect on and discuss their practice and students of mystery
- plan precise next steps for educators and students

Opportunities to Enhance Regional Learning

EMP participants offered suggestions in two broad areas to enhance professional learning for educators in school, DSB, and regional contexts.

Use virtual learning purposefully.
While educator participants recognized the efficiency of virtual regional learning sessions in Year 6, they offered several suggestions to enhance the effectiveness of virtual learning moving forward:

- know your learner
    - apply principles of UDL when planning virtual sessions
    - conduct a needs assessment with educator participants to inform planning
    - provide specific orientation sessions for educators new to project
    - provide differentiated and scaffolded support within virtual sessions

- build a collaborative community
    - build a virtual learning community through introductions and protocols
    - balance face time with slides during virtual sessions
    - invest in reliable technological infrastructure
    - develop a protocol to guide educators' engagement in virtual sessions

- promote region-wide ownership of the learning
    - project leads and district facilitators co-plan virtual sessions
    - clarify the purpose, expectations and timelines with all participants (in the Fall)
    - ensure reasonable length and relevant content of virtual sessions
    - provide sufficient time during virtual sessions for district facilitators to pause and discuss learning or apply strategies with school teams
    - streamline all virtual content and data collection in one digital platform
    - collect feedback from participants during and/or after each virtual session

- balance asynchronous and synchronous sessions
    - pre-record informational virtual sessions to increase flexibility of implementation for district facilitators and school teams (asynchronous)
    - continue to provide interactive, after-school virtual sessions with expert support (synchronous)
    - share recorded sessions and/or supporting slides/resources with district facilitators prior to school team sessions

Refine the blended regional networked professional learning model.

- determine whether adaptive or technical change is desired
    - leverage face-to-face learning for adaptive change and virtual sessions for technical change
- provide purposeful opportunities for regional face-to-face learning
    - allow participants to build trusting relationships, discuss strategies and ideas, share challenges, encourage each other, and celebrate successes
    - regional face-to-face sessions are particularly important for networking and collaborative learning among district facilitators
    - face-to-face sessions decrease the isolation of practice and help to mobilize thinking (vs knowledge) among educators across regional contexts
- use virtual sessions to support school-based learning in-between regional face-to-face sessions and enable math expert support

There was some great learning that happened this year and this work is important. I see opportunities and possibilities in the virtual professional learning sessions. There is an opportunity as an eastern region to rethink how we design the virtual sessions and lead the way in what this could look like across the province.
~District Facilitator

Section 5: Key Findings and Recommendations

The Year 6 evaluation report consolidates the six-year regional learning journey in the EOSDN Math Project (EMP) and contributes essential new knowledge to the growing body of literature regarding the systemic elements and structures that support evidence-informed, networked professional learning facilitated by middle leaders. Specifically, this collaborative developmental evaluation of the EMP at the end of Year 6 (Phase 7) confirms that the project was a valuable process to support math teaching and learning among educators across the nine DSBs in the Eastern Ontario region. In particular, Year 6 findings substantiate and extend previous evidence regarding the: (a) vital role of district facilitators (i.e., middle leaders) in supporting and spreading regional professional learning; (b) importance of embedded collaborative school team learning supported by district facilitators and math experts; (c) value of the student of mystery approach using learner profiles, CASMT protocol, and developmental continua to enhance math teaching and learning for all students; and (d) need for sustained educator engagement in regional evidence-informed professional learning to spread new practices across DSBs and classrooms and achieve desired student outcomes. Moreover, Year 6 findings augment previous findings by elucidating opportunities afforded by blended networked professional learning models that entail both virtual and face-to-face elements.

In Year 6, our findings provide further regional evidence regarding the critical role district facilitators play in supporting evidence-informed, networked professional learning across classrooms, schools, and systems (e.g., Fullan, 2015; Killion, 2012; LaPointe-McEwan, et al., 2017). We extend previous research by confirming the importance of providing regular opportunities for face-to-face networking and collaborative learning among district facilitators to enable them in their roles. This was particularly evident in Year 6 when district facilitators supported blended networked professional learning (i.e., virtual and face-to-face) with school teams by leveraging capacity they had developed through regional capacity-building provided by the EMP. While research suggests that face-to-face and virtual professional learning yield similar impacts on educators and students (Fishman et al., 2013; McConnell et al., 2013), our findings illustrate that the successful outcomes of Year 6 were rooted in six years of face-to-face regional networking and collaborative capacity-building among district facilitators in key areas (i.e., adult facilitation, math content and processes, data fluency, student of mystery approach). Regional capacity-building among district facilitators contributed an essential foundation for their effective facilitation of school team learning within the Year 6 blended networked professional learning model.

Consistent with Year 5 findings, we provide further evidence to augment Guskey's (2014) work by illustrating that a precise, regional focus on understanding, supporting, and monitoring the learning needs of students of mystery, facilitated by data literate district facilitators who recognize the value of both quantitative and qualitative classroom data, can accelerate intended impacts on students. Furthermore, we demonstrate additional evidence of the effectiveness of the student of mystery approach in enhancing student outcomes regionally, aligning with Kennedy's articulation of effective professional learning opportunities (i.e., a combined focus on curriculum content and processes to help educators develop strategies and insights into practice, apply new learning, and make professional judgements on behalf of students in classrooms). In particular, we reveal that implementing a common pre- and post-task with all students of mystery and using a common analysis process elucidates positive shifts in students' learning within regional professional learning. In Year 6, we also highlight the critical role of school administrators (i.e., school principals) in

creating conditions that promote collaborative capacity-building aimed at enhancing instructional practice and student outcomes in math (e.g., Hitt & Tucker, 2016). Furthermore, our findings confirm that sustained involvement of educators across roles coupled with a common regional focus, aligned with both local and systemic priorities, enables the spread of professional learning in support of students across classrooms, schools, and districts, a longstanding challenge in networked professional learning (e.g., Opfer & Pedder, 2011).

Year 6 findings make a key contribution to research and practice by illustrating the complementary nature of the research-informed professional learning (LaPointe-McEwan et al., 2018) and principal leadership frameworks (LaPointe-McEwan, 2019) (Figures 1 and 2, respectively) in the context of blended networked professional learning (i.e., Figure 4—the nested regional inquiry model). Specifically, evidence from this project illustrates that regional professional learning supported by district facilitators not only supports the achievement of provincial, regional, and system goals but also helps school principals implement leadership moves that support the attainment of school goals across classrooms in support of students' learning and achievement. In terms of the professional learning focus, the EMP endorsed common math content and strategies that were relevant to classroom practice, focused on student outcomes, and aligned with both provincial and DSB priorities (i.e., BIPSAs). This regional focus helped school principals provide capacity-building for school-based educators that focused on enhanced math pedagogy and student outcomes in order to progress toward their school math goals (i.e., SIPSAs). The enactment of professional learning within the EMP confirmed the importance of job-embedded collaboration among educators through short (i.e., 3-month) cycles of inquiry and highlighted the need to differentiate professional learning content based on educators' previous learning and experiences. Moreover, job-embedded collaboration among school teams (a) enabled school principals' active engagement in teaching and learning, and (b) helped principals and other school-based educators make evidence-informed decisions regarding precise next steps for educators and students in math through the collaborative analysis of common pre- and post-tasks (i.e., CASMT). The knowledgeable other math expert provided critical support of regional learning through virtual support of school-team learning, while district facilitators supported school teams' implementation of this knowledge in face-to-face sessions. Within the school context, principals endorsed a shared approach to leadership that leveraged the capacity of system, school. and classroom educators to support enhanced math teaching and learning.

Our overall findings for the EMP provide support for similar models of blended networked professional learning and contribute critical knowledge that serves to refine future regional and professional learning initiatives. The key findings below highlight the factors that appear to have contributed most to impacts on regional math teaching and learning in Year 6 of the EMP.

Key Findings in Year 6: What matters most to participants' learning?

1. ***Promoting Common Approaches:*** The EMP leveraged a blended networked professional learning model to promote common regional approaches to math teaching and learning, nested within provincial math priorities, enabling a common language among educators and the spread of effective approaches in classrooms, schools, and DSBs across the region.

   Building on Year 5 regional learning, the EMP continued to promote common approaches to math teaching and learning in Year 6 through a blended networked professional learning model that entailed virtual and face-to-face elements. These common approaches were aligned with provincial math priorities and included: supporting students of mystery in math using learner profiles and responsive instruction, collaboratively analyzing students' math thinking (CASMT) on common pre- and post-tasks, and using developmental continua to understand and support students' math learning with precision. Common approaches provided a focus for virtual sessions as well as school team collaboration, enabled spread of EMP learning to school-based educators not officially involved in the project, and promoted new instructional strategies that support all students' learning in math.

2. ***Regional Capacity-Building:*** Providing differentiated, role-specific opportunities for regional capacity-building supported by knowledgeable others helped educators across roles explore and apply new learning within their respective contexts of practice.

   In Year 6, the EMP confirmed the importance of regional capacity-building for educators, particularly district facilitators. Over the six-year duration of the EMP, the project provided regular opportunities for district facilitators to learn collaboratively at regional face-to-face sessions supported by knowledgeable others in key areas: adult facilitation, math content and processes, data fluency, and the student of mystery approach (i.e., developing learner profiles, implementing the CASMT protocol, and leveraging developmental continual to understand and support students' math thinking). This regional capacity-building among district facilitators was instrumental in their support of school teams' learning and implementation of the student of mystery approach during Year 6. While the math expert provided regional capacity-building for both district facilitators and school teams via Year 6 virtual sessions, the positive shifts in student outcomes attained would not have been possible without district facilitators' face-to-face, school-embedded support of learning among their school teams.

3. ***Sustained Educator Engagement:*** Sustained engagement in the project for multiple years helped educators engage with and implement virtual regional content, fostered conditions that enabled change in math teaching and learning, and led to greater impacts on students of mystery.

   In Year 6, a majority of school-based educators were new to the project. However, many district facilitators had been involved in the EMP for 4 or more years. As such, district facilitators were able to leverage previous learning and experience in the project to support school teams' engagement with and implementation of the regional content provided via virtual sessions. For district facilitators and school-based educators newer to the project, engaging with virtual sessions was more challenging as they did not have the benefit of foundational knowledge and experiences from previous years in the project and did not feel comfortable asking questions of virtual session facilitators (i.e., project leads and the math expert) due to the lecture-style nature of virtual content. Moreover, although most school-based educators were new to the project in

Year 6, school-based educators who had been involved in the project for two or more years reported greater impacts on math teaching and student outcomes, supporting previous regional findings that sustained educator engagement over multiple years is critical to achieving desired professional learning outcomes.

4. ***A Common Math Task:*** Implementing a common pre- and post-task with students of mystery provided regional evidence of growth in students' math thinking.

   Given the short timeline (February-May) and virtual regional element of Year 6, the project's focus was tighter than in previous years. This included requiring all classroom teacher participants to implement a common pre- and post-task with students of mystery at the start and end of the project. Students' solutions were collaboratively analyzed by school teams with district facilitator support using the CASMT protocol to reveal students' thinking. The math expert then analyzed regional and DSB trends in students' pre- and post-task thinking, revealing one or more phases of growth in 42% of students of mystery. Without the tight focus on a common task and analyses protocol, these positive shifts in students' thinking across DSBs would not have been evident.

5. ***Collaborative System and School Leadership:*** District facilitators and school administrators prioritized and collaboratively supported capacity-building among school-based educators in order to enhance math teaching and learning in support of BIPSA and SIPSA goals and priorities.

   Year 6 highlighted the value of district facilitators and school administrators collaboratively creating conditions to support enhanced math teaching and learning in schools. District facilitators supported school-embedded capacity-building and implementation of the student of mystery approach among school teams, helping school administrators attain their SIPSA math goals. School administrators actively participated in school team professional learning sessions and supported the implementation and spread of EMP learning among school-based educators, including those not involved in the project, to cultivate a whole-school approach to math teaching and learning.

Key Recommendations after Year 6

The following four recommendations have been identified to guide future regional professional learning initiatives and inform blended models that leverage both virtual and face-to-face elements.

1. ***Prioritize opportunities for face-to-face networking and collaborative learning among system facilitators.***

   Over its six-year duration, the EMP clearly demonstrated the value of providing regular opportunities for face-to-face regional networking and collaborative learning among system facilitators. Regional face-to-face sessions provided valued opportunities for system facilitators to build trusting relationships, discuss strategies and ideas, share challenges, encourage each other, and celebrate successes. Moreover, purposeful capacity-building opportunities for system facilitators (i.e., adult facilitation, math content and processes, data fluency, student of mystery approach) enhanced their confidence and effectiveness in supporting and spreading new math approaches to math teaching and learning in their DSBs and schools. Continuing to prioritize face-to-face networking and collaboration for system facilitators across regional DSBs is a valuable strategy that should be maintained in subsequent regional professional learning initiatives.

2. ***Continue to support and spread the student of mystery approach.***

   In Year 4 through 6 of the EMP, the effectiveness of the student of mystery approach became increasingly evident. District facilitators helped educators in school teams identify their students of mystery in math, develop and refine learner profiles that highlighted these students' strengths and needs, implement responsive instructional strategies to support students' learning, and collaboratively analyze students' math thinking on common tasks using developmental continua to understand and plan for precise next steps in teaching and learning. This process provided a focus for collaborative professional learning that enhanced and expedited desired outcomes on both educators and students across the region. Moreover, the student of mystery approach was readily spread by school administrators to school-based educators not officially involved in the project. Moving forward, the student of mystery approach should be continued in the context of math and also adapted to support students of mystery in other areas of learning.

3. ***Use a blend of virtual and face-to-face professional learning opportunities.***

   In Year 6, the EMP leveraged virtual sessions in conjunction with face-to-face sessions to support educator participants' learning. While participants appreciated that virtual sessions provided an efficient means to promote common regional content with the support of a math expert, school teams would not have been as successful in supporting shifts in math teaching and learning without the face-to-face, embedded support of district facilitators. Moving forward, it is recommended that regional professional learning opportunities implement asynchronous virtual sessions for content and messaging to enable flexible implementation, synchronous virtual sessions with recognized experts for interactive application of new learning, and face-to-face sessions for district facilitators and school teams to collaboratively learn and apply new learning in the school or classroom context. In addition, it will be

important for project leads and district facilitators to collaboratively plan virtual sessions to create regional ownership and ensure district facilitators are familiar with virtual content before supporting school teams' engagement with virtual content.

4. Ensure virtual professional learning sessions are responsive to the needs of participants.

The virtual professional learning element was new for the EMP in Year 6. Given the increasing prevalence of this mode of professional learning in the province, it will be important for future regional initiatives to incorporate key learnings from this project. First, virtual professional learning sessions need to prioritize differentiated and scaffolded support for participants based on a needs assessment of participants' previous experiences and current professional learning needs and goals. Second, virtual learning could be enhanced by applying UDL principles, building a virtual learning community among participants, and balancing face time with slide presentations during virtual sessions, whether asynchronous or synchronous. Third, it is critical that project leads are knowledgeable about teaching, learning, and leading; receptive to feedback from participants; and able to adapt to evolving challenges and opportunities. Finally, it will be important to create an infrastructure for synchronous virtual sessions that maximizes the potential of virtual platforms in order to accommodate large numbers of participants and enable real-time discussions among educators.

Key References

Avalos, B. (2011). Teacher professional development in *Teaching and Teacher Education* over ten years. *Teaching and Teacher Education, 27*, 10–20.

Bore, A., & Wright, N. (2009). The wicked and complex in education: Developing a transdisciplinary perspective for policy formulation, implementation and professional practice. *Journal of Education for Teaching*, *35*(3), 241–256.

Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher, 33*, 3–15.

Blitz, C. L. (2013). Can Online Learning Communities Achieve the Goals of Traditional Professional Learning Communities? What the Literature Says. REL 2013-003. Regional Educational Laboratory Mid-Atlantic.

Bryk, A. (2015). Accelerating how to learn to improve. *Educational Researcher, 44*(9), 467–477.

Bush, T., & Glover, D. (2014). School leadership models: What do we know? School Leadership and Management, 34(5), 553-571.

Campbell, C., & Levin, B. (2009). Using data to support educational improvement. *Educational Assessment, Evaluation and Accountability*, *21*(1), 47-65. doi: 10.1007/s11092-008-9063-x.

Campbell, C., Osmond-Johnson, P., Faubert, B., Zeichner, K., & Hobbs-Johnson, A. (with Brown, S., DaCosta, P., Hales, A., Kuehn, L., Sohn, J., & Steffensen, K.). (2017). *The state of educators' professional learning in Canada: Final research report.* Oxford, OH: Learning Forward.

Chappuis, S., Chappuis, J., & Stiggins, R. (2009). Supporting Teacher. *Educational Leadership*, 56–60.

Cochran-Smith, M., & Lytle, S. L. (2002). Teacher learning communities. In James Guthrie (Ed.), *Encyclopedia of Education*. New York, NY: Macmillan Publishing Company.

Cochran-Smith, M., & Lytle, S. L. (2009). Inquiry as stance: Practitioner research for the Next Generation. New York, NY: Teachers College Press.

Cordingley, P., Bell, M., Thomason, S., & Firth, A. (2005). *The impact of collaborative continuing professional development (CPD) on classroom teaching and learning. Review: How do collaborative and sustained CPD and sustained but not collaborative CPD affect teaching and learning?* London, UK: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London.

Darling-Hammond, L. (2010). Teacher education and the American future. *Journal of Teacher Education, 61*, 35–47.

Davis, B., & Sumara, D. J. (2006). *Complexity and education: Inquiries into learning, teaching, and research.* New York, NY: Routledge.

Dede, C., Jass Ketelhut, D., Whitehouse, P., Breit, L., & McCloskey, E. M. (2009). A research agenda for online teacher professional development. *Journal of Teacher Education, 60*(1), 8-19.

DeLuca, C., Shulha, J., Luhanga, U., Shulha, L. M., Klinger, D. A., & Christou, T. (2015). Collaborative inquiry as a professional learning structure for educators: A scoping review. *Professional Development in Education, 41*(1), 640–670.

Desimone, L. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher, 38,* 181–199.

Desimone, L. & Garet, M. (2015). Best practices in teachers' professional development in the United States. *Psychology, Society, & Education, 7*(3), 252–263.

Donohoo, J. (2013). *Collaborative Inquiry for Educators: A Facilitator's Guide to School Improvement*. Thousand Oaks, CA: Corwin.

Earl, L., & Katz, S. (2006). Leading in a Data Rich World: Harnessing Data for School Improvement. Thousand Oaks, CA: Corwin.

Elmore, R. F. (2004). *School reform from the inside out: Policy, practice, and performance.* Cambridge, MA: Harvard Education Press.

Fishman, B., Konstantopoulos, S., Kubitskey, B. W., Vath, R., Park, G., Johnson, H., & Edelson, D. C. (2013). Comparing the impact of online and face-to-face professional development in the context of curriculum implementation. *Journal of Teacher Education, 64*(5), 426-438.

Fullan, M. (2007). *The new meaning of educational change*. New York, NY: Routledge.

Fullan, M. (2009). Large-scale reform comes of age. *Journal of Educational Change, 10*, 101–113.

Fullan, M. (2015). Leadership from the middle: A system strategy. *Education Canada*, 22–26.

Fullan, M., & Knight, J. (2011). Coaches as system leaders. *Educational Leadership*, 50–53.

Guskey, T. (2014). Measuring the effectiveness of educators' professional development. In L. E. Martin, S. Kragler, D. J. Quatroche, & K. L. Bauserman (Eds.), *Handbook of professional development in education* (pp. 447-466). New York, NY: Guilford Press.

Guskey, T., & Yoon, K. (2009). What works in professional development. *Phi Delta Kappan, 90*, 495–500.

Hallinger, P. (2011). Leadership for learning: Lessons from 40 years of empirical research. *Journal of Educational Administration, 49*(2), 125-142.

Hargreaves, A., & Ainscow, M. (2015). The top and bottom of leadership and change. Phi Delta Kappan, 97(3), 42-48.

Hattie, J. (2013). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. New York, NY: Routledge.

Heck, R.H., & Hallinger, P. (2014). Modeling the longitudinal effects of school leadership on teaching and learning. *Journal of Educational Administration*, *52*(5), 653-681.

Hitt, D. & Meyers. C. (2018). Beyond turnaround: A synthesis of relevant frameworks for leaders of sustained improvement in previously low-performing schools. *School Leadership and Management, 38*(1), 4-31.

Hitt, D., & Tucker, P. (2016). Systemic review of key leader practices found to influence student achievement: A unified framework. *Review of Educational Research, 86*(2), 531-569.

Katz, S., & Earl, L. (2010). Learning about networked learning communities. School *Effectiveness and School Improvement, 21*, 27–51.

Kennedy, M. M. (2016). How does professional development improve teaching? Review of Educational Research, 86(4), 945-980. doi: 10.3102/0034654315626800

Kennedy, A., Deuel, A., Nelson, T. H., & Slavit, D. (2011). Requiring Collaboration or Distributing Leadership?. *Phi Delta Kappan, 92*(8), 20–24.

Killion, J. (2012). Coaching in the K-12 context. In S. J. Fletcher & C. A. Mullen (Eds.), *The Sage handbook of mentoring and coaching in education* (pp. 273-294). Los Angeles, CA: Sage.

LaPointe-McEwan, D., DeLuca, C., & Klinger, D. (2017). The role of the middle leader: Supporting evidence-use in networked educator professional learning. *Educational Research*, *59*(2), 136–153.

LaPointe-McEwan, D. (2019). *Literature review report: Principal leadership framework.* MISA EAST Professional Network Centre, Eastern Ontario Staff Development Network, Ontario, CA.

LaPointe-McEwan, D., Heggie, L., & Klinger, D. (2018). *Literature review report: Professional learning framework.* MISA EAST Professional Network Centre, Eastern Ontario Staff Development Network, Ontario, CA.

Leat, D., Lofthouse, R., & Tower, C. (2012). Improving coaching by and for school teachers. In S. J. Fletcher & C. A. Mullen (Eds.), *The Sage handbook of mentoring and coaching in education* (pp.43-58). Los Angeles, CA: Sage.

Leithwood, K., Aitken, R., & Jantzi, D. (2006). *Making schools smarter: Leading with evidence*. Thousand Oaks, CA: Corwin Press.

Leithwood, K., Harris, A., & Hopkins, D. (2008). Seven strong claims about successful school leadership. *School Leadership and Management*, *28*(1), 27-42.

Lieberman, A., & Miller, L. (2014). Teachers as professionals: Evolving definitions of staff development. In L. E. Martin, S. Kragler, D. J. Quatroche, & K. L. Bauserman (Eds.), *Handbook of professional development in education* (pp. 3-21). New York, NY: Guilford Press.

McConnell, T. J., Parker, J. M., Eberhardt, J., Koehler, M. J., & Lundeberg, M. A. (2013). Virtual professional learning communities: Teachers' perceptions of virtual versus face-to-face professional development. *Journal of Science Education and Technology*, *22*(3), 267-277.

Miles, M. B., and Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook.* (2nd ed.) Thousand Oaks: Calif.: Sage, 1994.

Moolenaar, N. M. (2012). A social network perspective on teacher collaboration in schools: Theory, methodology, and applications. *American Journal of Education, 119*(1), 7–39.

Muijs, D., West, M., & Ainscow, M. (2010). Why network? Theoretical perspectives on networking. *School Effectiveness and School Improvement, 21*, 5–26.

Namey, E., Guest, G., Thairu, L., & Johnson, L. (2008). Data reduction techniques for large qualitative data sets. In G. Guest & K. M. MacQueen (eds.), *Handbook for team-based qualitative research* (pp. 137-61). Lanham, MD: AltaMira Press.

Nelson, T. H., & Slavit, D. (2008). Supported teacher collaborative inquiry. *Teacher Education Quarterly, 35*, 99–116.

Neumerski, C. (2012). Rethinking instructional leadership, a review: What do we know about principal, teacher, and coach instructional leadership and where should we go from here? *Educational Administration Quarterly*, 49(2), p. 310-347.

Opfer, V., & Pedder, D. (2011). Conceptualizing teacher professional learning. *Review of Educational Research, 81*, 376–407.

Patton, M. Q. (2002). *Qualitative research and evaluation methods (3rd ed).* Thousand Oaks, CA: Sage.

Patton, M. Q. (2012). *Essentials of utilization-focused evaluation*. Los Angeles, CA: Sage Publications.

Quatroche, D. J., Bauserman, K. L., & Nellis, L. (2014). Supporting professional growth through external resources. In L. E. Martin, S. Kragler, D. J. Quatroche, & K. L. Bauserman (Eds.), *Handbook of professional development in education* (pp. 431-442). New York, NY: Guilford Press.

Robinson, M.A. (2010). *School perspectives on collaborative inquiry: Lessons learned from*

New York City, 2009–2010. Philadelphia, PA: Consortium for Policy Research in Education.

Rogers, P. (January, 2011). Program theory and logic models for systemic evaluation. Paper presented at the International Conference on Systemic Approaches in Evaluation, Eschborn, Germany.

Schildkamp, K., Poortman, C. L., & Handelzalts, A. (2016). Data teams for school improvement. *School Effectiveness and School Improvement, 27*(2), 228–254.

Timperley, H. (2011). Realizing the power of professional learning. New York, NY: McGraw-Hill.

Vangrieken, K., Meredith, C., Packer, T., & Kyndt, E. (2017). Teacher communities as a context for professional development: A systematic review. *Teaching and Teacher Education, 61*, 47-59. doi: 10.1016/j.tate.2016.10.001

Vineyard, L., 2010. *Collaborative inquiry: a strategy for assessing Response to Instruction and Intervention (RtI^2) for English learner students*. (Doctoral dissertation). Available from ProQuest Dissertations & Theses database. (UMI No. 3446801)

Wellman, B., & Lipton, L. (2004). *Data-driven dialogue: A facilitator's guide to collaborative inquiry*. Mira Via, LLC.

Youngs, P., & Lane, J. (2014). Involving teachers in their own professional development. In L. E. Martin, S. Kragler, D. J. Quatroche, & K. L. Bauserman (Eds.), *Handbook of professional development in education* (pp. 284-303). New York, NY: Guilford Press.

Appendix A: Summary of Year 1 Project Activities

EOSDN Regional Mathematics "Closing the Gap" Project
Year 1 (2013-2014)

Focus of the Project/Study

The EOSDN Math project/study is supporting teacher inquiry and professional learning in mathematics through the following:

- examining beliefs about teaching mathematics (mindset)
- developing fluency in the observation, description, and analysis of students at work and their work products (knowing what to look and listen for)
- developing fluency in posing questions, providing feedback and consolidating learning in ways that promote student thinking (shifting the role of the teacher from instructor to co-learner/coach)
- using the "power of co" through co-planning, co-observing/assessing students at work, and co-moderating student work
- networking within and beyond the DSB

All of this is being done through a regional focus on proportional reasoning and representation of student thinking in mathematics – each of which cuts across strands, topics, and courses.

Valued Components of the Project

Steering Committee Sessions

A key component of the EOSDN math project/study is the ongoing learning of math program facilitators from each DSB. This 'support of the supporters' is being recognized by participants and by the researchers as having significant impact on the depth and spread of the project. Operational items have been dealt with through teleconferences, emails, and end of session 20 minute updates. The focus of each session has been on learning.

September This session focused on local Implementation plans, and the submission of DSB plans and letter of financial commitment. Dr. Rebecca Luce-Kapler from Queen's University led a discussion about Queen's University's role as researchers and support within the project. She also spoke about assessment and monitoring, and each DSB was given the opportunity to share questions and/or concerns regarding assessment and monitoring.

October The focus was to gain further knowledge in the areas of Proportional Reasoning and EQAO (facilitated by Lorraine Giroux, School Support and Outreach Education Officer), and to continue discussions about monitoring (facilitated by Danielle LaPointe and Christopher Deluca, Queen's Researchers).

December Each DSB shared ideas from local implementation of the EOSDN Math Project. The remainder of the day was facilitated by Queen's Researchers, Danielle LaPointe and Don Klinger leading learning about Data/Evidence Collection and Analysis. Each DSB had the opportunity to work through a shared data analysis process using data from the EOSDN Regional Think Tank Sessions. DSB teams followed the data analysis process that was modelled to analyze data from their own DSB.

January Steering Committee Reps planned for facilitation of learning at the SIM Session on January 31: EOSDN Math Project - Proportional Reasoning, the Process of Representation and Teacher Fluency. The remainder of the day was facilitated by Queen's Researcher, Danielle LaPointe, the topic being Observing with Purpose: Exploring Classroom Video Analysis.

March Cathy Bruce, Trent University Researcher facilitated the learning with the focus on being an effective instructional coach - facilitation, efficacy, and how mathematics leaders support others. She also focused on student representation of their thinking using fractions as the proportional reasoning content.

April Planning Session for the May 14-15 Regional Think Tank Session with a focus on consolidating the learning of teacher participants in the project. As well, the Queen's Researchers explained how they will gather data from participants to develop a deeper understanding of the structures that support the success of collaborative professional learning initiatives (where success is defined as the impact of the professional learning program on enhanced teacher practice, improved student learning and achievement, and increased collaboration among educators).

May Finalizing the planning for the consolidation day; providing input into the report to the Board of Directors; working with Queen's researchers on data collection tools.

June Steering Committee reps consolidated their DSB data into a summary report and created a poster representing the learning journey within the district. The poster becomes part of the report to the Ministry of Education.

Access to Expertise

Having access to acknowledged experts in mathematics and in research methodology is also valued highly by DSB participants.

- Marian Small facilitated three Regional Think Tank Sessions on September 27(Kingston), October 7(Ottawa) and 8(Kemptville). The 700 teachers participating in the Math Project were invited to attend one of the sessions. The focus for the learning was on developing and/or refining an understanding of Proportional Reasoning in the Ontario Curriculum K-12; 'Doing the Math' in DSB teams; Strategies for Providing for Feedback using Asset Model stance.

- Each DSB was funded for up to 5 days of in-district mathematics expert time. In some DSBs, the math expert worked directly with teacher inquiry teams; in other DSBs she/he worked with school administrators and district facilitators. Some DSBs collaborated co-terminously and added extra days with the math expert. DSBs were able to select the math expert with whom they worked, provided the focus was related to the project.

- Math facilitators from each district are working with researchers from Queen's University Faculty of Education to become more effective in formulating an inquiry and in assessing and monitoring progress in the implementation work. The researchers and project coordinator have been spending two days within each DSB to provide support tailored to the district inquiry focus - to advise on how to assess and to document evidence of the learning of students and how to gauge the impact of strategies as they are being incorporated into classroom practice.

- In April, an inquiry team from each DSB was invited to attend the MISA/Math day where researchers from Queen's and the Student Achievement Division provided support on data analysis.

- In May, many members of the Steering Committee attended the OAME conference, funded by the Math project, where they attended workshops and plenaries by leading math educators. Exposure to different experts will be useful as we move into year two.

Consolidation of Year 1 Learning

District School Board Learning

A consolidation day was held in mid-May with 100 teacher/school administrator participants. From the table dialogue and the artifacts presented, some encouraging themes emerged:

- "Kids can do it!" – Teachers reported that students could meet high expectations in math
- "Math makes sense" – Teachers reported that *big ideas* in math help connect the different topics, strands, courses they teach – "I used to teach math compartments, now I teach connections"
- "Abandon the pie chart" – Teachers reported that student thinking is revealed in representation – they can see, hear and probe their reasoning through a variety of ways
- "Spreading the Joy of Math" - There is spread beyond the original inquiry groups – There were several examples of all grades tackling the same open problem – creating a school math community
- "Fluency instead of speed" – Teachers reported that think time, persevering time is important for deep learning
- "We can do it" – There was energy and optimism in the room – "When we have the same focus we can support each other".

As part of the consolidation process, steering committee members spent a second day analyzing the data from their own DSB with support from the Queen's researchers.

Regional Learning

Nearing the end of year 1 of the EOSDN Regional Math Project/study, the Queen's research partners gathered data from teacher participants, school administrators, math facilitators on the Steering Committee, and project leads. The combination of surveys and interviews adds to the classroom data from each district that is being analysed and studied and is presented in the developmental evaluation report and project poster.

Data Collection Year 1 (2013-2014)

Phase 2 (Year 1) of the evaluation involved collecting data on the effectiveness of EMP activities to meet the EMP's initial aim as stipulated in the program theory. The evaluation used a collaborative, developmental methodology to guide data collection and analyses. Data were collected from multiple participants including: project leads, district facilitators, teachers, school administrators, and expert learning partners (i.e., math and research experts). Data were collected in Spring 2014, at the end of Year 1 of the EMP, to provide an interim sense of the project's impact on participants' learning and practices, and to identify the structures that supported the project's success. In addition, data were obtained during project activities (i.e., Steering Committee sessions, DSB school visits, and year-end sharing sessions) to determine immediate and sustained value of project activities on professional learning and practice.

Table 1: *Data Collection by Participant Group (Year 1)*

Participant Group	Data Collection Activity	Number	Type of Data
Project Leads	Steering Committee Sessions	10	– Observation – Artifacts
	Project Lead Interview	2	– Interview
District Facilitators	Steering Committee Sessions	10	– Observation – Artifacts
	DSB Visits	9	– Observation
	Facilitator Survey	22	– Fixed-response – Open-response
	Facilitator Interview	9	– Interview
	DSB Inquiry Poster	9	– Artifact
Teachers	School Visits	6	– Observation – Artifacts
	Teacher Survey	184	– Fixed-response – Open-response
	Consolidation Day (May 14)	9	– Artifacts
School Administrators	School Visits	6	– Observation – Artifacts
	Administrator Survey	12	– Fixed-response – Open-response
Experts	Interview Questionnaire	4	– Interview

Data were primarily collected through qualitative methods including in-depth interviews and ethnographic observations (Patton, 2002). In addition, surveys were administered to district facilitators, teachers, and administrators to gain additional quantitative evidence on the impact of the EMP. These multiple data collection methods were used in order to triangulate findings and to established trustworthy results. Data tools (i.e., interview protocols, questionnaires, and surveys) are presented in Appendices B and C. Table 1 provides a summary of the data collection activities for each participant group.

Along with the two project leads, the EMP involved educators representing nine DSBs in the Eastern Ontario region: 700 teachers and 350 school administrators, and approximately 50 district facilitators from the nine DSBs in Eastern Ontario. The 22 district facilitators who regularly attended Steering Committee sessions completed surveys. Teacher surveys were distributed to five of nine the districts; this convenience sample was selected based on DSBs in which permission for external research was obtained. From these five DSBs, we received 184 surveys; however 20 of those surveys were from teachers who were not officially involved in the EMP. The response rate within these DSBs was 61.4% (see Table 2).

Key Findings in Year 1: What matters most to participants' learning?

1. ***Readiness:*** *Recognizing and addressing educators' mindsets and previous learning experiences supports their engagement in collaborative professional learning.*

   Educators began the EMP with different degrees of comfort and experience with math pedagogy, inquiry, and data practices, which differentially impacted their learning journeys within the EMP. The project leads and experts acknowledged and were responsive to different degrees of readiness in promoting educators' knowledge acquisition and fluency of application of new learning in practice. In particular, our findings identified the importance of differentiated support in the professional development of district facilitators, and this would likely extend to teachers and school administrators as well.

2. ***Ownership:*** *Educators engaged in collaborative professional learning identify their own area of inquiry so the learning is meaningful and relevant to their role, context, and needs.*

   Project leads and district facilitators spoke about the "loose-tight" structure of the project that enabled educators, within the overall "enabling constraints" of project goals, to engage in inquiry meaningful to their respective contexts and needs. Although the EMP identified three key goals (i.e., building educator fluency in the areas of proportional reasoning and the process of representation in math), there was considerable latitude for all educators involved to determine an area of inquiry that was meaningful to them. This freedom appears to have increased educators' engagement in the EMP and broadened the range of inquiries occurring under the umbrella of the project.

3. ***Alignment:*** *Strategically aligning professional learning to a meaningful focus promotes a common language and depth and spread of learning among educators within a school district and across a region.*

   The purposeful alignment connecting the focus of the EMP with various, ongoing professional learning activities helped to create a project that was responsive to the needs of students, teachers, schools, districts, and the province. Such alignment also helped to ensure the EMP would be viewed as an integrated project within the larger school, district, and regional goals, rather than as a separate disconnected initiative.

4. ***Relationships:*** *Building trusting, supportive relationships among all participants involved promotes a culture in which educators can take risks in professional learning and practice.*

   Much of the success of the EMP was grounded in the professional relationships that developed throughout the first year of implementation. All of the participants reported the importance of trusting relationships as a support of collaborative professional learning and change in professional practice. As trusting relationships developed over the year, educators began to take more risks in their learning and practices. They also became more comfortable talking about challenges, barriers, and opportunities with colleagues and more willing to ask for support from experts and each other. As a result of these relationships, the regional learning and dialogue created a momentum that allowed educators to explore their thinking and learning more deeply around the goals of the EMP in their respective districts.

5. ***Intentionality:*** *Devoting time and personal resources to build fluency, support practice, monitor learning, and develop relationships contributes to meeting professional learning goals.*

Building professional fluency and changing professional practice occurs through intentional design and actions. It requires professional commitment supported with resources and opportunities to engage in learning, reflection, and dialogue. Educators in the EMP reported that having designated times to engage in learning, reflection, and dialogue with colleagues, supported by expert learning partners as appropriate, impacted their learning and practice. Educators also reported the need for flexible support in their own contexts as they explored and practiced implementing new learning in-between group sessions. There was general agreement that this support should be regular and ongoing, include feedback from colleagues and experts, and be individualized to the role and readiness of each educator.

Key Recommendations after Year 1

The following four recommendations were made to guide next steps for the EMP in Year 2 (2014-2015).

1. ***Cultivate depth and spread***

   Continue to focus on the EMP's goals, informed by emerging understandings about what matters most in building educators' fluency, to promote depth and spread of the learning. The direct involvement of fewer schools with more educators per school may support deeper implementation and precise monitoring of learning in schools and classrooms. An intentional focus on meeting the professional learning needs of secondary teachers and school administrators may increase the EMP's impact on these educators. All those involved in the EMP are encouraged to be cognizant of authentic opportunities to align the learning of this project with other district and school goals and professional learning initiatives to maximize the spread of learning.

2. ***Focus on assessment and monitoring***

   Continue to develop educators' assessment and monitoring strategies that are purposeful and responsive to learners' needs. Expert modelling and support of these practices is essential in all phases of learning and implementation and as new educators become involved in the EMP. Provide opportunities for facilitators to explore and practice these strategies in ways that minimize stress and concerns with trying "something new." This includes the extensive use of formative methods of assessment and developmental methods of monitoring. Further, work to develop common monitoring procedures and tools that not only meet quality requirements but also those of district facilitators and school educators.

3. ***Contribute to professional learning***

   Continue to find the balance that provides opportunities for professional judgment and ownership within a structure that allows the learning to be meaningful to participants and the broader educational community within the region and the goals of the EMP. Educators' learning must address individual goals as well as the goals of the project.

4. ***Rethink leadership***

   Explore important questions about leadership. Facilitators, school administrators, and teacher leaders all fulfill leadership roles. How do we develop and support leadership capacity among educators in each of these roles? How does building leadership capacity in facilitators, administrators, and teacher leaders contribute to spread of professional learning in schools and systems? Year 1 provided important opportunities to further develop the leadership skills of district facilitators. It will be important to continue to develop these skills while also helping teachers involved in the EMP to develop their own leadership skills related to the goals of the EMP and their inquiries. Such leadership models will further help to cultivate depth and spread.

Appendix B: Summary of Year 2 Project Activities

EOSDN Regional Mathematics "Closing the Gap" Project
Year 2 Activities (2014-2015)

During Year 2, the Steering Committee continued to use its monthly meetings for their own continued learning in the facilitation of adult learning of mathematics content and pedagogy and the systematic collection and analysis of evidence of adult and student learning. Over the first four meetings, DSB facilitators formally shared the DSB Year 1 Research Posters; the DSB Year 2 Inquiry Questions and/or Theories of Action; and the DSB Year 2 Data Collection Processes.

September: The group reviewed and reflected on the EOSDN Math Project Report from Year 1 to determine the Steering Committee research focus for learning in Year 2. As well, the proposal for the Secondary Mathematics Focus was explained which included the goal, structure and costs.

October: Christine Suurtamm facilitated learning and discussions around the area of Mathematics teaching and learning: dilemmas, challenges and solutions through the lens of her research in this area. This learning was intended to further develop Math facilitator knowledge in the area of Mathematics teaching and learning.

November: Queen's University researchers shared their process for data collection for the Year 2 Evaluation Report which will explore the tensions identified in the Collaborative Inquiry in Ontario monograph. They provided a review of purposeful data collection process, and in DSB teams the Steering Committee reps discussed and planned strategies for Year 2 data collection.

January: With a focus on Assessment, Lorraine Giroux, EQAO School Support and Outreach, facilitated learning about EQAO Math Assessments and Proportional Reasoning. EQOA data from Eastern Ontario 2013-14 results was shared. The Steering Committee reps reflected on Years 1 and 2 to develop a potential focus for learning in Year 3, if funds were made available by the Ministry.

February: Facilitated by Queen's Researchers, Danielle LaPointe and Don Klinger, the February Steering Committee meeting provided Steering Committee reps the opportunity to analyze data that had been collected thus far in Year 2 of the EOSDN Math Project within their DSB.

March: The learning, sharing and discussions focused on Pedagogical Documentation facilitated by Sharon McNamara-Trevison, Colleen DeMille, Danielle LaPointe and Tammy Billen. The group reviewed the Pedagogical Documentation Revisited monograph in the context of their own DSBs. Student Work Study Teachers: Nikki Roy, Erik Lemke, Alison MacDougall, and Katie Williamson shared their experiences with regards to Pedagogical Documentation. Susan Davidson, Helene Coulombe and Kim Lacelle from OCSB then shared their DSB Pedagogical Documentation Learning journey. EOSDN Secondary Math Project representatives shared their learning journey thus far.

April: The Steering Committee planned for the EOSDN Math Project Consolidation Day on April 28. After reviewing 2014 Consolidation Day agenda, Steering Committee reps reflected on components of the day that would be maintained and provided suggestions for changes to enable rich sharing from Year 2 of the project.

Consolidation of Year 2 Learning

District School Board Learning

A consolidation day was held in late-April with approximately 100 teacher/school administrator participants. From the table dialogue and the artifacts presented, some encouraging themes emerged:

- "Planning a math task is planning for consolidation."—Teachers were increasingly focused on highlighting *big ideas* in math lessons through consolidation during instruction.
- "What is this student work telling me?"—Teachers engaged in pedagogical documentation, observing and listening to their students' current understandings to enable responsive instruction.
- "How do we move from presentations to conversations?"—Teachers fostered accountable talk among students in their math classrooms.
- "We need to engage in productive floundering!"—Teachers and students explored multiple ways of thinking about and solving math problems.
- "All students have an entry point."—Rich, open problems allowed all students to engage in problem solving tasks.
- "Get your toolbox!"—Manipulatives supported students' learning across K-12 classrooms.

As part of the consolidation process, steering committee members spent a second day analyzing the data from their own DSB with support from the Queen's researchers.

Regional Learning

Nearing the end of year 2 of the EOSDN Regional Math Project/study, the Queen's research partners gathered data from teacher participants, school administrators, math facilitators on the Steering Committee, and project leads. The combination of surveys and interviews adds to the classroom data from each district that is being analyzed and studied and is presented in the developmental evaluation report and project poster.

Data Collection Year 2 (2014-2015)

Phase 3 (Year 2) of the evaluation involved collecting data on the effectiveness of EMP activities to meet the EMP's initial aim as stipulated in the program theory. The evaluation used a collaborative, developmental methodology to guide data collection and analyses. Data was collected from project leads, district facilitators, teachers, school administrators, student achievement officers (SAOs), and expert learning partners at regular intervals throughout Phase 3 of the evaluation. Data were primarily collected through qualitative methods including in-depth interviews, open-response questionnaires, and ethnographic observations (Patton, 2002). In addition, surveys were administered to district facilitators, teachers, and school administrators to gain additional quantitative evidence on the impact of the EMP. These multiple data collection methods were used in order to triangulate findings and to establish trustworthy results. Data tools (i.e., interview protocols, questionnaires, and surveys) are presented in Appendices C and D. Table 1 provides a summary of the data collection activities for each participant group. [Note: The job action initiated in May 2015 precluded affiliated educators from participating in subsequent data collection activities.]

Table 1: *Data Collection by Participant Group (Year 2)*

Participant Group	Data Collection Activity	Number	Type of Data
Project Leads	Steering Committee Sessions	8	– Observation/Artifacts
	Project Lead Questionnaire	2	– Open-response
	Project Lead Interview	2	– Interview
	Consolidation Day (April 29)	9	– Artifacts
District Facilitators	Steering Committee Sessions	8	– Observation/Artifacts
	DSB Visits	7	– Observation/Artifacts
	Facilitator Survey	12	– Fixed-response – Open-response
	Facilitator Questionnaire	9	– Open-response
	DSB Inquiry Poster	5	– Artifact
Teachers	School Visits	7	– Observation/Artifacts
	Teacher Survey	113	– Fixed-response – Open-response
	Teacher Questionnaire	21	– Open-response
	Teacher Focus Group	6 (n=29)	– Interview
	Consolidation Day (April 28)	9	– Artifacts
School Administrators	School Visits	7	– Observation/Artifacts
	Administrator Survey	23	– Fixed-response – Open-response
	Administrator Questionnaire	2	– Open-response
	Administrator Interview	6	– Interview
Experts	Expert Questionnaire	4	– Open-response

Along with the two project leads, the EMP involved educators representing nine DSBs in the Eastern Ontario region: 400 teachers from 220 schools, and approximately 45 district facilitators from the nine DSBs in Eastern Ontario. Twelve of 45 district facilitators who regularly attended Steering Committee sessions completed surveys (response rate of 26.7%). We received 113 teacher surveys (response rate of 28.3%), and 23 administrator surveys (response rate of 10.5%; see Table 2).

Key Findings in Year 2: What matters most to participants' learning?

1. ***Loose-Tight Structure:*** A focus on common project goals while supporting related, nested district, school, and classroom inquires responsive to local needs and priorities fosters educator engagement.

   In our Year 1 evaluation report, both project leads and district facilitators spoke about the "loose-tight" structure of the project that enabled educators, within the overall "enabling constraints" of the EMP, to engage in inquiry meaningful to their respective contexts and needs. Despite this latitude, Year 1 specific inquiries were closely related to the regional EMP goals. In Year 2, the value of the "loose tight" structure became increasingly apparent in three primary ways. First, at the start of Year 2, district facilitators, along with research experts, project leads, and SAOs, co-developed four precise regional guiding questions. These questions were grounded in the Year 1 EMP evaluation findings, and were nested within, but distinct from, the three overarching project goals. Second, district facilitators pursued selected regional guiding questions in their districts and developed related DSB inquiry foci that were precise and relevant to the needs of educators in their district's schools and classrooms (Table 2). Third, district facilitators provided opportunities for educators in schools and classrooms to pursue meaningful areas of inquiry nested within their identified DSB inquiries. These nested regional inquires across regional contexts (see Figure 1) supported the dual professional learning purposes of: (a) attaining systemic instructive professional learning goals (i.e., developing new knowledge and instructional practices in math grounded in theory and aligned with curriculum); and (b) fostering active engagement of educators in personal professional learning goals relevant and meaningful in their current contexts of practice. Further, the sharing of these connected but distinct inquiries enabled those across the region to learn from the experiences of others.

2. ***Sustained Focus:*** A continued regional focus on project goals and research-based strategies cultivates depth and spread.

   The EMP's sustained focus on the three overarching goals in Year 2 supported depth of professional learning and the development of a common knowledge and understanding of math teaching and learning through the big idea of proportional reasoning among participants. Among other benefits, the result has been an emerging common math language across the region—facilitating rich professional dialogue among educators and contributing to shifts in district, school, and classroom math culture. Moreover, the EMP provided recurring opportunities for educators to engage in reflective, collaborative professional learning and dialogue within and across regional contexts. Professional learning and dialogue was most commonly supported by district facilitators, however in some cases, school-based educators involved in the project for the second year took on informal leadership roles, fostering the spread of learning to educator colleagues within and outside the EMP. It was apparent throughout the EMP, that changes in the "math culture" within participating schools and teachers' instructional practices require time, resources and sustained effort.

3. ***Increased Precision:*** As educator fluency and understanding of systematic inquiry develops, the focus of learning and implementation becomes increasingly precise.

   Building on the collective learning experiences and emerging fluency during Year 1, EMP participants pursued more precise professional learning goals in Year 2, with an increased focus on implementation of professional learning in the context of practice. Specifically, educators focused their learning on more precise content areas (e.g., understanding fractions through the linear model, developing multiplicative thinking in primary grades), linked to more explicit pedagogical practices (e.g., questioning, diagnostic assessment, pedagogical documentation, consolidation, use of manipulatives), and supported by triangulation of purposefully collected evidence (products, conversations, and observations) to demonstrate educator and student learning within and across contexts.

4. ***Supported Implementation:*** The provision of responsive, context-embedded support for educators promotes transfer of learning into practice**.**

   Grounded in Year 1 collaborative evaluation findings and acknowledging the importance of opportunities to apply professional learning in the context of practice, the EMP prioritized organizational support for increased context-embedded support throughout Year 2. This support was differentiated and responsive to local educators' needs and manifested in two primary ways. First, the EMP provided regular opportunities for knowledgeable others (district facilitators, math and research experts) to support the implementation of new math pedagogy and inquiry processes. These knowledgeable others enriched educators' learning and supported educators' risk taking within their own professional practice. Second, educators worked with colleagues, who had shared interests, to explore professional learning goals and support each other's implementation of learning and resulting pedagogy within their own practice. Educators valued these critical opportunities to work with such colleagues as they collectively developed fluency with math pedagogy and inquiry processes.

5. ***Collaborative Leadership:*** Processes that enable educators to work together within and across regional contexts provide valuable supports that enhance the development and attainment of: (1) professional learning goals; (2) shifts in learning culture; and (3) educational leadership.

   Rooted in professional relationships that developed during Year 1, collaborative leadership among educators emerged within and across contexts in Year 2. This collaborative leadership was central to the success of the EMP and evident in multiple ways including: (1) the project leads and research experts facilitating regional learning at Steering Committee sessions; (2) district facilitators working collaboratively to support regional, district, and school learning; (3) district facilitators, school administrators, and teachers collectively leading learning in schools; and (4) teacher teams in schools supporting the learning of administrators, peers, and students. We recognized the value of collaborative leadership among educators to foster the spread of EMP learning across the region and shifting the regional math culture, specifically cultivating growth and inquiry mindsets among educators and students. Furthermore, collaborative leadership contributed to meaningful learning within and across regional contexts that provided educators with opportunities to move beyond sharing professional ideas and experiences to collaboratively generating new professional knowledge.

Key Recommendations after Year 2

The following four recommendations were identified to guide next steps for the EMP in Year 3 (2015-2016).

1. ***Promote spread and sustainability***

   Continue to focus on regional project goals and "loose-tight" nested inquiry structure, but adopt common professional learning models (e.g., Lesson Study) and focus on key practices (e.g., pedagogical documentation) that have the potential to support regional math learning and instructional practice throughout Year 3 and beyond. Common models and key practices should be collaboratively determined by Steering Committee members at the outset of Year 3.

2. ***Cultivate further collaborative leadership.***

   Leverage district facilitators and math experts, in conjunction with common professional learning models and foci, to develop school-based collaborative leadership teams among teachers and school administrators. These teams may play a central role in adapting, sustaining, and spreading new math pedagogical practices and shifting math culture in schools and classrooms across the region in Year 3 and beyond the EMP's funding.

3. ***Focus precise support on assessment and monitoring.***

   Provide differentiated, responsive support for educators in all regional contexts to further develop educators' fluency with assessment and monitoring. Ensure that these strategies are purposeful and responsive to learners' needs and leverage expert modelling and support of learning and implementation as appropriate in districts, schools, and classrooms. Further, work to develop common monitoring procedures and tools that not only meet quality requirements but also those of district facilitators and school educators.

4. ***Identify models and methods to examine the impact of inquiry efforts to impact students' learning.***

   Along with a focus on assessment and monitoring for the purposes of teaching and learning in the classroom context, it will also be critical to expand these assessment and monitoring efforts to provide links between professional inquiry efforts and subsequent student learning. As one example, educators involved in the project may now have the skills to develop a "theory in action" for their specific inquiries. These theories in action can enable those in involved in systematic inquiry to more explicitly identify the intended impacts of their efforts on students' educational outcomes.

Appendix C: Summary of Year 3 Project Activities

EOSDN Regional Mathematics "Closing the Gap" Project
Year 3 Activities (2015-2016)

Project activities for Year 3 of the EOSDN Math Project followed a similar structure as Year 1 and 2, in that regional Math leads attended monthly Steering Committee meetings. The learning at these sessions shifted from facilitation of educator learning of mathematics content and pedagogy to developing 'collaborative leadership' within district school boards to promote sustainability and spread. As in the first two years of the project, Queen's Researchers continued to support and/or refine the systematic collection and analysis of evidence of educator and student learning. All Steering Committee meetings were co-planned and co-facilitated by Tammy Billen (Project Coordinator) and Danielle LaPointe-McEwan (Queen's researcher).

September: Steering Committee reps reviewed and reflected on the EOSDN Math Project Developmental Report from Year Two, with a focus on the Key Findings and Recommendations for the purpose of DSBs developing their EOSDN Math plans for year three. DSB teams were also completed a Needs Assessment Survey for the purpose of determining next steps for Steering Committee meeting learning.

October: The objective of this meeting was to give regional Math reps the opportunity to think, discuss and reflect on personal and DSBs ideas of 'Developing Collaborative Leadership'. Discussions were facilitated through questions pertaining to educator leadership; learning structures; mathematical fluency; and data collection and analysis. The Ontario Leadership Framework was used as a framework for reflecting and planning forward.

Shelley Yearley, Provincial Math Lead, shared experiences with modified Lesson Study and ideas for implementing this learning structure in the EOSDN project. The intent of this sharing was to give reps the opportunity to think about a learning structure that would meet the needs of the learners involved in the EOSDN Math Project.

November: Reviewing and reflecting on the EOSDN Math Project Regional learning from Year 2, reps determined regional and DSB guiding questions for Year 3. Reps planned and/or reflected on their year 3 DSB plan, revisiting the Key Recommendations from the Year 2 report to ensure plans aligned with these recommendations. The Steering Committee collectively worked through a process of determining the guiding questions for learning regionally that would be addressed at subsequent monthly Steering Committee meetings. Don Klinger and Danielle LaPointe-McEwan, Queen's Researchers supported team in developing DSB inquiries and guiding questions.

January: The learning focused on mathematics content for teaching, and instructional strategies to meet teacher and student need. Sharon McNamara-Trevisan and Ruth McNulty (Student Achievement Officers) shared an overview of the big ideas from the MISA "Celebration of Thinking through Collaboration" with Peter Liljedahl. Shelley Yearley (Provincial Math Lead) and Ross Isenegger (Provincial Math Lead, Digital Resources) facilitated learning in the area of fractions referencing resources (e.g. Fractions Learning Pathways and Math digital resources) to support educator learning. DSB teams were provided time to reflect and plan next steps when considering the learning from the day and the EOSDN Math project regional inquiry and guiding questions.

March 30 and 31:
March 30: Reps reflected on their EOSDN Math plans and learning from the 2015-16 year. DSBs shared a three-minute 'Public Service Announcement' that captured their DSB Inquiry Question(s), Celebrations and Tensions. The professional learning cycle was used as the framework by which DSBs reflected, shared and planned forward.
March 31: This regional networking session included representation from the MISA and EOSDN Math groups. Rachel Ryerson (Ministry of Education) facilitated the learning of 'Ethical Use of Pedagogical Documentation'.

April: The Steering Committee planned for the EOSDN Math Project Consolidation Day scheduled for May 10, 2016. After reviewing 2015 Consolidation Day agenda, Steering Committee reps reflected on components of the day that would be maintained, provided suggestions for changes to enable rich sharing from Year 3 of the project, and in teams planned the consolidation day. The teams were cognizant of framing the day in a manner that would encourage discussions about 'collaborative leadership' within their DSB.

May: Meeting the day following the Regional Consolidation, reps shared the reflections from the teachers and administrators who participated in the EOSDN Math this year. Reps began analyzing DSB data using Year 3 guiding questions as a framework.

In May, some Steering Committee members also presented their learning from the project at the OAME and/or CAfLN Conferences and attended relevant workshops conducted by math and assessment experts in the field.

June: Steering Committee reps consolidated their DSB data into a summary report and created a poster representing the learning journey within their district. The poster becomes part of the report to the Ministry of Education.

Consolidation of Year 3 Learning

District School Board Learning

A consolidation day was held in May with 100 teacher/school administrator participants. From the table dialogue and the artifacts presented, some encouraging themes emerged:

- "Don't over-structure the learning."—Many school teams focused on cultivating students' understanding through spiraling of *big ideas* in the math curriculum.
- "What does evidence of success look like?"—District- and school-based educators collected multiple sources of classroom evidence to demonstrate impacts on students' learning.
- "Teachers need to collectively own the learning."—School-based inquiry teams identified and explored local needs and goals within the project.
- "Assessment build relationships."— Students valued personalized, targeted oral feedback from teachers.
- "Spread is happening."—District facilitators and school-based inquiry teams shared new learning and strategies with colleagues not officially involved in the project.

As part of the consolidation process, steering committee members spent a second day analyzing the data from their own DSB with support from the Queen's researchers.

Regional Learning

Nearing the end of Year 3 of the EOSDN Regional Math Project/study, the Queen's research partners gathered data from teacher participants, school administrators, district math facilitators on the Steering Committee, and project leads. The combination of surveys and interviews adds to the classroom data from each district that is being analyzed and studied and is presented in the developmental evaluation report and project poster.

Data Collection Year 3 (2015-2016)

Phase 4 (Year 3) of the evaluation involved collecting data on the effectiveness of EMP activities to meet the EMP's initial aim as stipulated in the program theory. The evaluation used a collaborative, developmental methodology to guide data collection and analyses. Data was collected from project leads, district facilitators, teachers, school administrators, student achievement officers (SAOs), and expert learning partners at regular intervals throughout Phase 4 of the evaluation. Data were primarily collected through qualitative methods including in-depth interviews, open-response questionnaires, and ethnographic observations (Patton, 2002). In addition, surveys were administered to district facilitators, teachers, and school administrators to gain additional quantitative evidence on the impact of the EMP. These multiple data collection methods were used in order to triangulate findings and to establish trustworthy results. Table 1 provides a summary of the data collection activities for each participant group.

Table 1: *Data Collection by Participant Group (Year 3)*

Participant Group	Data Collection Activity	Number	Type of Data
Project Leads	Steering Committee Sessions	10	– Observation – Artifacts
	Project Lead Interview	2	– Interview
District Facilitators	Steering Committee Sessions	10	– Observation – Artifacts
	DSB Visits	9	– Observation
	Facilitator Survey	22	– Fixed-response – Open-response
	Facilitator Interview	9	– Interview
	DSB Inquiry Poster	9	– Artifact
Teachers	School Visits	6	– Observation – Artifacts
	Teacher Survey	184	– Fixed-response – Open-response
	Consolidation Day (May 14)	9	– Artifacts
School Administrators	School Visits	6	– Observation – Artifacts
	Administrator Survey	12	– Fixed-response – Open-response
Experts	Interview Questionnaire	4	– Interview

Along with the two project leads, the EMP involved educators representing nine DSBs in the Eastern Ontario region: 700 teachers and 350 school administrators, and approximately 50 district facilitators from the nine DSBs in Eastern Ontario. The 22 district facilitators who regularly attended Steering Committee sessions completed surveys. Teacher surveys were distributed to five of nine the districts; this convenience sample was selected based on DSBs in which permission for external research was obtained. From these five DSBs, we received 184 surveys; however 20 of those surveys were from teachers who were not officially involved in the EMP. The response rate within these DSBs was 61.4% (see Table 2).

Key Findings in Year 3: What matters most to participants' learning?

1. ***Educator Fluency:*** Educators leverage previous learning and experiences within the project, exercising sound professional judgment, based on knowledge of math content and processes as well as evidence-use.

   Educators' fluency continued to develop in Years 1 and 2 of the EMP, providing a foundation for multifaceted inquiries and professional learning goals in Year 3. Specifically, district facilitators leveraged previously developed capacity in inquiry processes and evidence-use to more independently identify meaningful areas of inquiry, prioritize and plan for purposeful data collection, and analyze and use evidence to inform math teaching and learning in their DSBs. These processes continued to be supported by research experts in Year 3, however this support became more precise and responsive to the current fluency and goals of district facilitators. In addition, school-based educator teams (i.e., classroom teachers, student support teachers, and school administrators) involved in the project for multiple years pursued precise professional learning and practice goals, rooted in previous learning and related to specific instructional practices and approaches to classroom assessment. These teams leveraged their developing fluency to determine how more knowledgeable-others (i.e., district facilitators, learning partners, and math experts) and research-based resources would be used to support their collective learning.

2. ***Embedded Learning:*** As educators develop fluency, they prioritize personalized learning opportunities, embedded within their respective contexts of practice and rooted in local educator and student needs.

   While regional learning sessions were necessary in EMP Years 1 and 2 to build educators' foundational knowledge specific to the project's goals, these sessions were less important for educators in Year 3. In particular, educators involved in the project for multiple years preferred opportunities to more deeply explore their beliefs and practices, and implement new strategies within their respective contexts of practice. For example, embedded learning opportunities allowed DSB-based teams (i.e., district facilitators) to plan for purposeful inquiry and data collection, adapt professional learning models, and determine math content foci in alignment with their BIPSAs. Likewise, embedded learning opportunities allowed school-based educator teams to collectively explore classroom implementation and analyze evidence of math teaching and learning from students in their own schools.

3. ***Evidence-informed Practice:*** Collecting, analyzing, and using multiple sources of data over time enhances and demonstrates the project's impacts on math teaching and learning in the region, DSBs, schools, and classrooms.

   Educators in DSBs, schools, and classrooms focused their efforts in Year 3 on evidence-informed practice, supported by the language and processes of AfL In particular, district facilitators engaged in systemic AfL—they developed DSB inquires and associated professional learning goals; developed success criteria for professional learning outcomes; identified potential data sources that could provide evidence of professional learning outcomes—including products, observations, and conversations; collected these data from multiple stakeholders over time; and analyzed sources to inform subsequent learning and practice. School-based educators engaged in

similar processes, prioritizing classroom data obtained through pedagogical documentation and diagnostic assessments to inform local professional learning and practice. In these ways, educators leveraged evidence to inform and demonstrate impacts of the project within and across regional contexts.

4. ***Collaborative Leadership:*** Educator fluency, coupled with embedded learning opportunities and trusting professional relationships, contributes to collaborative leadership among educators in the region, DSBs, and schools.

Educators involved in the project for multiple years emerged as collaborative leadership teams in Year 3. District facilitators contributed knowledge constructed within the EMP (e.g., math pedagogy, facilitation, inquiry processes) to educators involved in concurrent provincial and DSB-based initiatives. Furthermore, these district facilitators shared important insights from their EMP experiences during provincial and DSB planning sessions regarding the Renewed Math Strategy to be enacted in Year 4. School-based educators involved in the project for multiple years shared excitement about their EMP learning with colleagues not officially involved in the project, modelling new instructional strategies and assessment approaches and distributing research-based resources to spread learning within their schools.

5. ***Collective Ownership:*** As educators' fluency and collaborative leadership emerge, collective ownership of shared professional learning goals, reflective of local educator and student needs, is increasingly important.

In Year 3, professional learning goals were less focused on individual needs and interests and more focused on collective needs and interests. District facilitators across the nine DSBs readily developed and agreed upon regional guiding questions for Year 3, based on evidence of educator and student learning from Year 2 regional and DSB inquires. Moreover, Year 3 guiding questions were more interrelated than those developed in Year 2, reflecting cohesive regional learning priorities. Similarly, school-based educator teams pursued professional learning goals that targeted educator and student needs across classrooms within their schools. In previous years, individual educators generally set goals specific to their practice in their own classrooms. However, in Year 3 teams of school-based educators who had been involved in the EMP for multiple years moved toward setting common goals for students across their collective classrooms and, in some cases, across the entire school. This accelerated the learning and engagement of those teachers newly entering the project. Accordingly, regional, DSB, and school-based educators began to take collective ownership of educator and student learning within and across regional contexts—moving away from thinking about 'my students' and 'your students', toward thinking about 'our students'.

Key Recommendations after Year 3

The following four recommendations were identified to guide next steps for the EMP in Year 4 (2016-2017).

1. ***Sustain the "loose-tight" focus.***

   Continue to focus on the overarching project goals but allow DSB- and school-based teams to adapt various professional learning models (e.g., collaborative inquiry, lesson study) and explore meaningful areas of inquiry that target local educator and student needs in math. This is particularly important for educators who have been involved in the project for multiple years—these educators require latitude to explore precise areas of inquiry in more depth than educators who are new to the project. Such initiatives should be supported by relevant experts internal or external to the school district and the region.

2. ***Cultivate and refine approaches to collaborative leadership through regional learning sessions.***

   Devote regional learning time (i.e., selected Steering Committee sessions) to cultivating and refining approaches to collaborative leadership among DSB teams of school-based educators. Moreover, recognize that these school-based educators will likely require explicit opportunities to build foundational knowledge in math teaching and learning, facilitation, and evidence-use, thus enhancing their capacity to foster and spread changes in practice and culture among colleagues within their schools.

3. ***Prioritize personalized, embedded learning opportunities for educators, supported by more knowledgeable-others and/or research-based resources.***

   Provide educators with personalized learning opportunities embedded within their respective contexts of practice in order to attain desired EMP impacts. While central sessions are valuable for foundational knowledge building and networking, embedded learning supported by more knowledgeable-others enables professional learning and dialogue that is meaningful and relevant to local educators' and students' needs. In addition, develop internal capacity among district- and school-based educators in order to sustain this embedded learning beyond the project's funding.

4. ***Collect evidence of impact on students' learning in alignment with the Renewed Math Strategy in order to inform provincial math goals.***

   Continue to collect, analyze, and use evidence of the project's impact on students' math learning through various methods (e.g., pedagogical documentation, diagnostic assessment, formative assessments, large-scale assessments). However, as appropriate, align these efforts with the Renewed Math Strategy in order to explicitly inform provincial needs and goals for students in math. Continue to prioritize building district- and school-based educators' capacity to leverage quantitative and qualitative evidence to inform and monitor instructional practices and student learning outcomes.

Appendix D: Summary of Year 4 Project Activities

EOSDN Regional Mathematics "Closing the Gap" Project
Year 4 Activities (2016-2017)

Project activities for Year 4 of the EOSDN Math Project followed a revised structure that enabled collaborative leadership within and across regional, district, and school contexts. As in the first three years of the project, Queen's Researchers continued to support and/or refine the systematic collection and analysis of evidence of educator and student learning. All Steering Committee meetings were co-planned and co-facilitated by Eleanor Newman (Project Director), Tammy Billen (Project Coordinator), and Danielle LaPointe-McEwan (Queen's researcher) and attended by Ministry of Education personnel (i.e., Senior Education Specialist, Regional Student Success Lead, and Student Achievement Officers).

Month	**Steering Committee Participants**
September	district facilitators (math and special education leads)
October	district facilitators (math and special education leads), EMP school administrators
November	district facilitators (math and special education leads), EMP school teams (school administrators, support teachers, classroom teachers)
December	district facilitators (math, special education, and TELT leads)
January	district facilitators (math, special education, and TELT leads), EMP school administrators
February	district facilitators (math, special education, and TELT leads), EMP school teams (school administrators, support teachers, classroom teachers)
March	district facilitators (math and special education leads)
April	district facilitators (math and special education leads)
May	Day 1: district facilitators (math, special education, and TELT leads), EMP school teams (school administrators, support teachers, classroom teachers) Day 2: district facilitators (math, special education, and TELT leads), school administrators
June	district facilitators (math and special education leads)

Note. TELT = Technology Enabled Learning and Teaching.

July: - Regional superintendents and district math facilitators from the nine DSBs attended a special EOSDN Learning Session with a focus on the Renewed Mathematics Learning Strategy (RMS). EOSDN Math Project leads shared an overview of the RMS, and specifically the advice and direction pertaining to Teaching and Learning, Goals for Students, Classroom Pedagogy, Special Education and Curriculum. The EOSDN Math Project leads also summarized the 'Five Key Areas for Professional Thinking' from the EOSDN project and described how these areas support and align with the RMS.

September: District facilitators (math and special education leads) reviewed the Ontario Ministry of Education Renewed Math Strategy, and how the learning gleaned from the EOSDN Math Project would support RMS work in DSBs. The group also reviewed the whole-school approach of the 2016-17 EOSDN Math Project, which brings the project into tighter alignment with the RMS. Danielle LaPointe-McEwan (Queen's Researcher) summarized the findings and recommendations from the

Year 3 developmental evaluation report. The group considered the perspectives of policy, practice and research for the purpose of refining and/or developing new regional guiding questions for the current year.

October: School administrators engaged in the regional project joined the district facilitators for this learning session. Tammy Billen and Danielle LaPointe-McEwan shared an overview of the EOSDN Math Project regional inquiry questions and guiding questions for 2016-17. Participants reviewed the Ontario Ministry of Education Renewed Math Strategy, and its alignment with the EOSDN Math Project, as well as an overview of the structure and goals of the 2016-17 EOSDN Math Project. DSB teams reviewed the template for "Designing Effective Professional Collaborative Inquiry for Student Learning" and how this model aligns with learning within their DSB and school contexts. Administrators shared school strengths, needs and plans for addressing Mathematics within each of their schools with their DSB team. The group determined that the learner profiles of *students of mystery* would form a basis for planning and collaboration at each school.

November: School administrators and teachers involved in the regional Math Project joined with the district facilitators (math and special education leads). The group reviewed the overview of the EOSDN Math Project regional inquiry question and guiding questions for 2016-17 to provide a context for those who had not participated in the EOSDN Math Project to date. Danielle LaPointe-McEwan then shared the 'Revised Nested Regional Inquiry Model', explaining how this model aligns with the EOSDN Math Project and with the RMS. When considering the RMS renewed emphasis on Balanced Mathematics, DSB teams reflected on their current thinking about practices related to 'Balanced Mathematics' and created a mind map. Using a SWST-like stance, participants focused on school-identified *students of mystery* and used the 'Designing Effective Professional CI for Student Learning' framework for DSB teams (district facilitators, school administrators, support teachers, and classroom teachers) to develop DSB plans. Colleen DeMille and Tammy Billen sharing a possible process of utilizing Connie Quadrini and YCDSB's resource, *Supporting Students with Learning Disabilities in Mathematics* to address student needs.

December: Technology Enabled Learning and Teaching (TELT) leads from each DSB joined the district facilitators (math and special education leads). The focus for learning was 'Enhancing Precision in our Work' when considering the goals of the EOSDN Math Project, RMS, and DSB goals. Teams reviewed their EOSDN Math Project data collection plans, with a focus on the *students of mystery* and a whole school approach to meeting student needs. TELT leads contributed to DSB discussions as to how they could collaboratively support DSBs with a focus on the context of the EOSDN Math Project. Tracy Joyce and Heidi Ferguson (math facilitators, RCCDSB) shared a process for utilizing the YCDSB's *Supporting Students with Learning Disabilities in Mathematics* document to support teacher and student learning. DSBs discussed how this document could support teachers involved in the EOSDN Math Project to address student needs with focused intention and precision.

January: District facilitators (math and special education leads), school administrators, and Technology Enabled Learning and Teaching (TELT) leads were present. The objective for this meeting was to provide the opportunity to learn from each other about the use of assessment strategies, learner profiles, and pedagogical approaches in DSBs. District facilitators and school administrators reflected on their current processes and strategies, planning forward to meet the needs of both educators and students involved in the EOSDN Math Project. Participants shared artifacts, processes and strategies in a gallery walk. School administrators shared specific school needs with

TELT contacts in the area of Mathematics, the LD learner, and technology. Collectively, regional needs were identified. District facilitators shared processes for utilizing math resources provided by EOSDN with the purpose of supporting educator learning as a district and within schools.

February - School administrators and teachers (classroom and support) involved in the regional Math Project joined with the district facilitators (math, student support, and TELT leads). The group revisited the 'Revised Nested Regional Inquiry Model' – starting with the 'student' - explaining how this model aligns with the EOSDN Math Project and the RMS goals. DSB teams further refined their thinking about learner profiles using the *Learning for All* document for the purpose of developing profiles for each of their identified *students of mystery*. RCCDSB Steering Committee reps shared their process for meeting the LD learner needs utilizing Connie Quadrini and YCDSB's resource, *Supporting Students with Learning Disabilities in Mathematics*. The afternoon was facilitated by regional TELT leads, addressing technology needs identified at the January meeting.

March: District facilitators (math and special education leads) participated in the Ministry of Education's Virtual Learning Session facilitated by Connie Quadrini in the morning, with a focus the LD learner in Mathematics. In the afternoon, district facilitator shared processes for data collection with regards to DSB and EOSDN goals, and monitoring and documentation processes used for *students of mystery*.

April: The agenda for the day was to plan for the EOSDN Math Project Consolidation Day in May. After reviewing 2016 Consolidation Day agenda, district facilitators (math and special education leads) reflected on components of the day that would be maintained and provided suggestions for changes to enable rich sharing from Year 4 of the project. District facilitators then divided into three teams, to plan the Minds On, Regional Sharing Time, and Professional Learning for the day. Administrators involved in the project were invited to participate in a teleconference during this planning day for the purpose of district facilitators sharing plans and seeking feedback concerning the Consolidation Day.

May: Meeting the day following the Regional Consolidation, district facilitators analyzed DSB data using exit card responses from the Regional Consolidation day. District facilitators then shared the reflections from their teachers and administrators who participated in the EOSDN Math this year.

June: District facilitators (math and special education leads) further analyzed the exit cards from the Regional Consolidation day from a regional perspective using the 2016-17 guiding questions as a framework for analysis. Facilitators then consolidated their DSB data and created a poster representing the learning journey within their district. The DSB posters are included in the Appendix of this evaluation report to the Ministry of Education.

Consolidation of Year 4 Learning

District School Board Learning

A consolidation day was held in May with 137 participants. These participants included district facilitators (math, student support, and TELT leads), school administrators, teachers (classroom and support), and Student Achievement Officers. From the professional dialogue and the artifacts constructed by DSB teams, some encouraging themes emerged:

- "What can they do? How can I build on that?"—Developing asset-based learner profiles for *students of mystery* enhances precision in professional learning and practice.
- "Necessary for some, good for all…"—Focusing on supporting *students of mystery* helps educators support the learning of all students.
- "Assessment practices are changing."—School teams are relying less on products and assessing more through observations and conversations.
- "A whole-school approach is emerging."—School administrators and support teachers are supporting in-between work with classroom teachers.
- "Spread is happening."—District facilitators (math, student support, and TELT leads) are collaborating and spreading EMP learning within DSBs.

As part of the consolidation process, steering committee members spent a second day analyzing the data from their own DSB with support from the Queen's researchers.

Regional Learning

Toward the end of Year 4 of the EOSDN Regional Math Project/study, the Queen's research partners gathered data from teacher participants, school administrators, district facilitators on the Steering Committee, and project leads. The combination of surveys and interviews adds to the classroom data from each district that is being analyzed and studied and is presented in the developmental evaluation report and project poster.

Key Findings in Year 4: What matters most to participants' learning?

1. ***Purposeful Alignment:*** The purposeful alignment of regional project goals with provincial, DSB, and school priorities supports educators' ownership and engagement in networked regional professional learning.

   Over the past four years, the regional project inquiry and professional learning foci have been rooted in the province's commitment to enhancing math teaching and learning. However, in Year 4, the EMP's alignment with provincial priorities became more explicit with the introduction of the Renewed Math Strategy (RMS). In accordance with the provincial RMS document, the EMP maintained its ongoing focus on developing students' conceptual understanding of *big ideas* in math, implementing a balanced approach to instruction (i.e., building skills and understanding), cultivating growth mindsets in math among educators and students, monitoring evidence of impact on students (e.g., assessment *for* learning cycles and pedagogical documentation), and fostering collaborative leadership in schools among educators. In addition to these foci, the EMP adopted the RMS focus on students struggling in math (i.e., *students of mystery*), especially students with identified learning disabilities, through a whole-school approach that leveraged asset-based learner profiles, responsive instruction, targeted accommodations, and assistive technology. These RMS priorities were also reflected in the BIPSAs and SIPSAs of educators involved in Year 4, allowing these educators to engage in the regional project while concurrently addressing their DSB- and school-specific goals.

2. ***Precise Focus:*** Articulating a precise regional focus on supporting *students of mystery* enables targeted professional learning and responsive implementation among educators within classrooms, schools, and across regional contexts.

   In previous EMP years, educators focused their support on math learning for all students in a division or grade by addressing their own learning needs as educators. In Year 4, the RMS contributed a slightly revised focus. While maintaining the goal to support all students, a precise regional focus on understanding and supporting *students of mystery* in math was initiated, rooted in more explicitly considering individual student's needs. Consequently, all educators involved in Year 4 of the project co-developed asset-based learner profiles and monitoring plans for two *students of mystery* in each EMP classroom. These learner profiles and monitoring plans enabled targeted professional learning and responsive implementation at both regional and school-based sessions. Moreover, the focus on *students of mystery* and learner profiles promoted a common language which helped both educators and students name and notice math thinking and strategies. At the regional Consolidation Day in May, artifacts constructed by participating educators clearly illustrated student voice and highlighted the impacts on students' learning to a greater extent than in previous EMP years. Overall, the precise regional focus on supporting *students of mystery* throughout Year 4 elucidated the importance of leveraging students' learning needs to drive professional learning.

3. ***Whole-School Approach:*** Engaging school administrators, support teachers, and classroom teachers in regional and school-based professional learning sessions cultivates a whole-school approach and promotes spread throughout schools.

   Previous EMP years prioritized cultivating collaborative leadership in schools; however, Year 4 marked an important shift toward achieving this goal through changes to the structure of regional Steering Committee meetings. By including school administrators, support teachers, and classroom teachers at designated regional meetings throughout Year 4, school teams had critical opportunities to learn and plan with their district facilitators (math, student support, and TELT leads). In-between regional meetings, with support from district math facilitators where possible, enabled school teams to implement new practices and shared regional learning with their colleagues—most notably school administrators through staff meetings and support teachers through their ongoing work across classrooms. This contributed to a whole-school approach to supporting *students of mystery* through asset-based learner profiles and responsive instruction.

4. ***Conceptual Assessment:*** Monitoring the conceptual understanding of *students of mystery* through multiple forms of assessment (observations, conversation, and products) over time supports learning and informs instruction for all students.

   Stemming from the Year 4 focus on supporting *students of mystery* in math, educators began to assess these students' understandings of math concepts across continua of learning, as well as in relation to their achievement of grade-specific curriculum expectations. This helped educators better understand the needs of their *students of mystery* from a developmental perspective and provide instructional accommodations to enable these students' success in math. Moreover, educators recognized the importance of leveraging multiple forms of assessment (observations, conversations, and products) to understand and support their *students of mystery*—relying more on student voice in assessment (e.g., interviews, videos, observational notes) and less on paper-pencil products to guide instructional next steps. As the school year progressed, educators acknowledged that this approach to assessment supported learning and instruction with not only *students of mystery*, but all students.

5. ***School-based Support:*** Formal time for facilitated, school-based support of planning, implementation, and reflection helps administrators, support teachers, and classroom teachers apply new learning in their own contexts of practice.

   Year 4 prioritized the cultivation of a whole-school approach by including school administrators, support teachers, and selected classroom teachers at regional Steering Committee meetings. While the inclusion of these educators at regional sessions provided valued opportunities for collaboration and co-learning with their district facilitators (math, student support, and TELT leads), school teams advocated the importance of formal release time for facilitated support in their schools. In particular, district math facilitators: (a) provided important support to administrators leading learning at staff meetings; and (b) supported teachers' working with *students of mystery* across classrooms, and classroom teachers' implementing new instructional strategies. This facilitated support in schools was especially important for educators new to the project, as was the case for many administrators and teachers in Year 4.

Key Recommendations after Year 4

The following four recommendations have been identified to guide next steps for the EMP in Year 5 (2017-2018).

1. ***Maintain alignment with Renewed Math Strategy (RMS) and focus on students of mystery.***

   Continue to align regional project goals with the provincial Math Strategy (RMS). This alignment helps participating educators across contexts engage in cohesive professional learning and construct knowledge that informs instructional practice and students' learning in the province, region, districts, and schools. Furthermore, the RMS provides an enabling framework that supports precision in educators' learning and practice while allowing latitude to build on regional learning and momentum from Years 1 through 4.

2. ***Collectively identify precise regional objectives and develop monitoring plans.***

   Devote regional learning time at the start of Year 5 to identifying precise regional objectives for each guiding question, following the process of co-constructing success criteria. These objectives, or criteria, will inform the subsequent development of monitoring plans that can be used to guide data collection in the region, districts, schools, and classrooms throughout Year 5.

3. ***Increase depth of professional learning at regional Steering Committee meetings.***

   Provide consistent opportunities for deep professional learning at regional Steering Committee meetings, supported by external and district experts as appropriate. Ensure that these opportunities allow educators sufficient time to apply new learning (e.g., solving math problems, mapping developmental/conceptual continua onto math curriculum, developing and refining learner profiles, using the CASL method to analyze student work, exploring technology to support *students of mystery*).

4. ***Provide additional opportunities for facilitated learning in schools.***

   School-based educators require facilitated support of their learning and implementation within their own contexts of practice. This is especially important for educators who are new to the project and/or to collaborative inquiry in math. While facilitator support may be released gradually over time, it is critical in the initial stages when educators are planning, implementing, and reflecting on new practices. This support pertains not only to teachers in classrooms, but also to school support teachers who are fostering spread through their work across classrooms and school administrators who are beginning to lead learning in staff meetings and other school-based initiatives.

Appendix E: Summary of Year 5 Project Activities

EOSDN Regional Mathematics "Closing the Gap" Project
Year 5 Activities (2017-2018)

Project activities for Year 5 of the EOSDN Math Project followed a structure of going deeper in the learning and applying the learning more broadly through collaborative leadership within and across regional, district, and school contexts. As in the previous four years of the project, Queen's Researchers continued to support and/or refine the systematic collection and analysis of evidence of educator and student learning. All Steering Committee and Regional Learning meetings were co-planned and co-facilitated by project leads—Tammy Billen (Project Coordinator), Danielle LaPointe-McEwan (Queen's researcher), and Eleanor Newman (Project Director)—in collaboration with Connie Quadrini (Student Achievement Officer) and Math Experts (Christine Suurtamm and Heather Wark). Regional Ministry of Education personnel (i.e., Senior Education Specialist, Regional Student Success Lead, and Student Achievement Officers) also supported the learning.

2017-18 EOSDN Regional Mathematics Project Design		
Month	**Participants**	**Agenda**
September 7, 2017	Supervisory Officers; System Principals; Steering Committee Rep; Math Lead; Special Ed. Lead	Leveraging the Learning: Building upon the Regional Mathematics Project in DSBs
October 12, 2017	Administrators from DSB selected schools; Steering Committee Rep; Math Lead; Special Ed. Lead	Supporting School Leaders: 5 Key Areas of Practice-based Learning – Regional Mathematics Project Monograph
November 23, 2017	Administrators from DSB selected schools; School Math Leads; School Spec. Ed. Lead; Classroom Teachers; Steering Committee Rep; Math Lead; Special Ed. Lead	Supporting School Teams: Students of Mystery, Learning Profiles, LD in Mathematics External Expert: Connie Quadrini
December 14, 2017	Steering Committee Rep; Math Lead; Special Ed. Lead	Sharing/Consolidating the Learning in DSBS: Internal Experts: Steering Committee Math Leads, Ministry SAOs
January 11, 2018	Steering Committee Rep; Math Lead Special Ed. Lead	Grade 9 Mathematics Study Group External Expert: Christine Suurtamm
February 8, 2018	Administrators from DSB selected schools; School Math Leads; School Spec. Ed. Lead; Classroom Teachers; Steering Committee Rep; Math Lead; Special Ed. Lead	Supporting School Teams: Resources and Strategies for Students of Mystery in Mathematics External Expert: Connie Quadrini
March 7 & 8, 2018	Steering Committee Rep; Math Lead; Special Ed. Lead	K-3 Continuum of Learning in Mathematics External Expert: Heather Wark (Alex Lawson – What to Look For)
April 5, 2018	Steering Committee Rep; Math Lead Special Ed. Lead	Sharing the Learning: Internal Experts, Ministry SAOs Planning for May Consolidation

May 9-10, 2018 (Consolidation Days)	All participants in EOSDN Math Project 2017-18	Consolidating the Learning with School Teams; Analysis of Data, Initial Preparation of DSB Research Posters External Expert: Connie Quadrini
June 14-15, 2018	Steering Committee Rep; Math Lead; Special Ed. Lead	K-3 Continuum of Learning in Mathematics, Part 2 External Expert: Heather Wark (Alex Lawson – What to Look For)

September: Informing RMS Work in DSBs – Applying the Learning
Directors, Superintendents, System Principals and Steering Committee leads gathered to consolidate and share the learning from district and regional RMS work and to consider how to leverage this learning in the 2017-18 year. During the day, Board teams were engaged in:

- Identifying key elements of the EOSDN regional mathematics project found to be effective for student mathematical learning, and specifically for students who struggle in mathematics using the Development Evaluation Report and the monograph developed to assist the work of spread and sustainability of the learning.
- Identifying and sharing District School Board strategies for supporting implementation and monitoring of mathematics teaching and learning. Copies of the DSB research posters from the regional project were provided.
- Determining how to align supports for senior leaders, middle leaders and school leaders of mathematics by leveraging the learning from the EOSDN mathematics project and the work of DSB math leads and SAOs

October: Developing School Leadership – Applying the Learning
School administrators from the schools in the project joined the lead teachers from the DSBs and reviewed the regional monograph highlighting key elements of the EOSDN regional mathematics project found to be effective for student mathematical learning, and specifically for students who struggle in mathematics. Following an overview of the EOSDN Math Project Regional Inquiry guiding questions for 2017-18, DBS teams began developing plans for 'Paying Attention to Learning' in DSBs and participating schools through identified guiding question(s) in relation to BIPSAW, SIPSAW, RMS and EOSDN goals.

November: School Teams – Applying the Learning
School administrators and teachers involved in the regional Math Project joined with the DSB lead teachers in mathematics and special education for this day of learning. Participants studied key components of the EOSDN monograph, 'Making a Difference for Educators, Making a Difference for Students'. Connie Quadrini, Ontario Ministry of Education SAO, facilitated the learning: knowing and understanding 'students of mystery'/learning disabilities; deepening understanding of learner profiles; building content knowledge by 'doing the math'; and collaborative analysis of student math thinking. Administrators had the opportunity to participate in discussion with Connie and other administrators with a focus on structures, process and conditions for a whole school approach of learning.

December: Going Deeper and Applying the Learning
Teacher leaders in mathematics and special education from each DSB came together to go deeper into their own learning about the facilitation of adult learning of mathematics content and pedagogy, inquiry design, the systematic collection and analysis of evidence of adult and student learning, and

addressing the specific adult learning goals related to serving students with learning disabilities. Each DSB team shared their DSB guiding question and associated enabling questions and described how each role (i.e., DSB math leads and Special Ed leads) was supporting learning in their EOSDN schools, how a whole school approach is being cultivated in EOSDN schools, and how the EOSDN Math Project is contributing to system leading and learning in their DSB.

January: Grade 9 Applied Regional Study Group
The study focus was the learning of grade nine students enrolled in applied mathematics courses: recognizing the development stages of adolescent mathematical learning in grades 7-9, understanding strategies for applied mathematics learning, designing the learning environment, and describing strategies for noticing, naming and advancing the learning of students. Christine Suurtamm, University of Ottawa shared findings from her Grade 9 Applied Math Research (2014) to increase teacher knowledge of the curriculum and ways to implement the curriculum to address student need.

February: School Teams – Applying the Learning
School administrators and teachers involved in the regional Math Project joined with the DSB lead teachers in mathematics and special education. Connie Quadrini, Ontario Ministry of Education SAO, facilitated with the goal of knowing and understanding 'students of mystery' by further deepening participants understanding of learner profiles, content knowledge by 'doing the math', and collaborative analysis of student math thinking. A significant part of the day involved educators participating in simulations focusing on supporting students strengths and needs by deepening understanding of the cognitive domains. Educators directly referenced to the YCDSD document, Supporting Students with Learning Disabilities in Mathematics to determine next steps for the identified 'students of mystery'.

March: K-3 Regional Study Group
The focus was to develop greater fluency in supporting the learning of K-3 students. Components of the work include understanding the K-3 math curriculum, recognizing the development stages of mathematics learning, designing the learning environment, and describing strategies for noticing, naming and advancing the learning of students. Heather Wark (Lakehead University) facilitated two days of learning using the research of Alex Lawson and her resource: What to Look For.

April: Going Deeper and Applying the Learning
Teacher leaders in mathematics and special education from each DSB came together for the purpose of sharing and learning about effective supports for spreading the learning from the participating teams to other educators in the participating school and beyond. The teams participating in reviewing and refining a plan for the consolidation of learning with school teams in May.

May: Consolidation of Learning from Participating Schools
School administrators and teachers involved in the regional Math Project joined with the DSB lead teachers in mathematics and special education to share and analyze student learning. For each student of mystery, participating teachers brought the annotated learner profile, samples of student work including work on the math questions provided by Connie Quadrini at the November and February sessions, and reflections by the students on their learning and by the teachers on the impact on their practice from participation in the study of strategies for addressing the learning strengths and needs of student with difficulties/disabilities in mathematics.

On day two, the core DSB teams analyzed the posted artefacts with guidance from Queen's researcher. The results of the analysis will form the basis of DSB research posters and the Developmental Evaluation Report.

June: K-3 Regional Study Group
Following the March session on the continuum of Mathematical learning of young students (kindergarten, grade one) , it was determined that Heather Wark (Lakehead University) would return for two more days of learning using the research of Alex Lawson and her resource: What to Look For to continue study of the continuum through the primary grades.

Consolidation of Year 5 Learning

District School Board Learning
A consolidation day was held in May with approximately 145 participants. These participants included district facilitators (math and special education), school administrators, teachers (support and classroom), and Student Achievement Officers. From the professional dialogue and the artifacts constructed by DSB teams, some encouraging themes emerged:

- Common approaches across grades and contexts—Educators are developing and using learner profiles to support *students of mystery* in math, using diagnostics and ongoing formative assessments to monitor students' progress and inform instruction, using tools to support students' learning and representation of thinking, implementing differentiated group instruction, and collaboratively analyzing students' thinking (e.g., CASMT).
- Prioritizing conceptual understanding—Educators are emphasizing conceptual understanding in instruction and assessment, prioritizing students' progression along conceptual continua over achievement of isolated, grade-level curriculum expectations.
- Supporting all learners—Educators are recognizing that strategies that support *students of mystery* support all students.
- Collaborative leadership is supporting spread—Educators involved in the project are spreading learning to colleagues within and across schools in their districts.

As part of the consolidation process, steering committee members spent a second day analyzing the data from Consolidation Day 1 with support from the Queen's researchers.

Regional Learning

Toward the end of Year 5 of the EOSDN Regional Math Project/study, the Queen's research partners gathered data from teacher participants, school administrators, district facilitators on the Steering Committee, and project leads. The combination of surveys and interviews adds to the classroom data from each district that is being analyzed and studied and is presented in the developmental evaluation report and project poster.

Key Findings in Year 5: What matters most to participants' learning?

1. ***Promoting Common Approaches:*** The regional project promoted common approaches to math teaching and learning, nested within provincial RMS priorities, enabling a common language among educators and the spread of approaches in classrooms, schools, and DSBs across the region.

   Building on Year 4 regional learning, the EMP continued to promote common approaches to math teaching and learning in Year 5. These approaches were aligned with provincial RMS priorities and included: developing and using learner profiles to support students struggling in math (i.e., *students of mystery*), using diagnostics and ongoing formative assessments to monitor students' progress and inform instruction, using tools (i.e., manipulatives, visual representations, and technology) to support students' learning and representation of thinking, implementing differentiated group instruction, and collaboratively analyzing students' thinking (e.g., CASMT). Common regional approaches provided a unified focus for regional sessions and tangible strategies that could be spread by EMP participants to other educators in their schools and DSBs.

2. ***Regional Capacity Building:*** Providing differentiated opportunities for regional capacity building supported by knowledgeable others helped educators across roles explore and apply new learning during regional sessions and within their respective contexts of practice.

   In Year 5, the EMP responded to Year 4 participants' desires for regional capacity building sessions focused on supporting *students of mystery* in math. Relevant knowledgeable others led purposefully planned regional sessions, differentiated according to educators' roles as well as their articulated needs and interests. Some regional sessions involved all EMP participants (e.g., November and February with Connie Quadrini regarding supporting *students of mystery* in math). Other regional sessions involved only district facilitators (e.g., January with Christine Suurtamm regarding supporting students in Grade 9 Applied Math; March and June with Heather Wark to explore Alex Lawon's *What to Look For*). These regional capacity building sessions supported by knowledgeable others provided valued opportunities for DSB teams involved in the project to collaboratively explore and apply new learning. Moreover, knowledgeable others scaffolded math content and pedagogical knowledge to enable EMP participants' implementation of new learning in-between regional sessions.

3. ***Sustained Educator Engagement:*** Continuing to involve Year 4 educators and schools in the project enabled depth and spread of learning and promoted collaborative leadership among educators within and across schools in DSBs.

   Year 5 built on the learning momentum of the previous year by continuing to engage Year 4 educators and schools, while doubling the overall number of educators and schools involved in the project (i.e., from 21 to 42 schools in Year 5). As in Year 4, district facilitator teams included math and special education leads from each DSB, while school teams involved one school administrator, one school support teacher, and two classroom teachers. The continued involvement of Year 4 educators in Year 5 allowed them to go deeper with their learning and further explore implementation of new strategies with students. In addition, Year 4 participants collaboratively supported the learning of new EMP participants at Year 5 regional sessions and began to more actively spread EMP learning and approaches in schools across their DSBs. This included district facilitators spreading EMP learning via DSB-based professional learning

sessions and their ongoing work with educators in schools. In addition, Year 4 school-based educators spread project learning to their colleagues not officially involved in the project via staff meetings or other school- and classroom-embedded professional learning activities. In these ways, educator participants in their second year of the project demonstrated collaborative leadership in Year 5 that promoted spread of EMP learning and approaches within and across schools in DSBs.

4. ***Focus on Conceptual Understanding:*** Focusing on students' development of conceptual understanding in math enabled related shifts in instructional practice, assessment approaches, and classroom culture.

   Stemming from Year 4 learning, EMP participants continued to explore and support students' development of conceptual understanding in math. The focus on students' conceptual understanding promoted related shifts in instructional practice and assessment approaches that went beyond teaching isolated, grade-level curriculum expectations to supporting and monitoring students' progression along conceptual continua. While educators initially focused on conceptual understanding among *students of mystery*, they began to extend this focus to all students in their classrooms. Educators implemented a variety of strategies and assessments to support students' conceptual understanding in math, providing students with multiple opportunities to demonstrate understandings and misconceptions through observations, conversations, and products. Educators also modelled and promoted the use of tools (e.g., manipulatives, visual representations, and/or technology), promoting a shift in classroom culture toward all students using tools to solve problems and represent their thinking.

5. ***School-embedded Support:*** District facilitators, school administrators, school support teachers, and classroom teachers involved in the project supported each other's implementation of new strategies in classrooms and collaboratively spread strategies to colleagues within schools.

   Year 5 built on the whole-school approach endorsed during Year 4 of the project by including school administrators, support teachers, and selected classroom teachers from each school at regional sessions. Regional sessions provided valued opportunities for school-based educators to learn and plan collaboratively with district facilitators. However, as in past years, school-based educators valued embedded support from district facilitators to help them implement new strategies with students in their classrooms. This was particularly important for school teams new to the project in Year 5. In addition, district facilitators helped school teams plan and conduct staff meetings and other school-based professional learning activities to spread EMP learning to their colleagues. District facilitators also provided differentiated support to school administrators and school support teachers within the school context; these educators played pivotal roles in fostering the spread of EMP learning.

Key Recommendations after Year 5

The following four recommendations have been identified to guide next steps for the EMP in Year 6 (2018-2019).

1. ***Build on and refine regional capacity building opportunities.***

   EMP educators benefit from regional capacity building, rooted in provincial priorities (i.e., the RMS) and supported by relevant knowledgeable others. In Year 6, EMP educators would likely benefit from deeper exploration of: *What to Look For* and related practical resources, using tools to support teaching and learning, applying the *Waterfall Chart* to enhance instruction and assessment, and extending the *student of mystery* approach to inform Universal Design for Learning (UDL) to support all students' learning. In addition, it would be useful to revisit the key capacities of effective middle leaders facilitators, to reflect on how facilitators' practice has evolved and to describe clearly the factors that contribute to success in supporting the learning of educator colleagues.

2. ***Maintain current educator participants and schools.***

   In Year 5 of the EMP, participants reported emerging spread of EMP approaches within and across schools and DSBs in the region. It will be important to sustain this momentum by maintaining the involvement of current educator participants and schools in Year 6. This will allow EMP participants across roles to continue to spread project learning to colleagues in their DSBs and schools through collaborative leadership and local professional learning sessions.

3. ***Leverage technology to support regional educator learning as appropriate.***

   In Year 6, the EMP should consider leveraging virtual sessions in conjunction with face-to-face sessions to support educator participants' learning. Face-to-face regional sessions are valued by both regional and school participants and monthly regional learning continues to be feasible for district facilitators. Smaller more locally based face-to-face sessions coupled with the strategic use of virtual learning resources may be appropriate support for school-based educators (i.e., school administrators, school support teachers, and classroom teachers), particularly given the challenges of releasing classroom teachers for professional learning.

4. ***Provide additional opportunities for facilitated learning in schools.***

   Shifting to more locally situated sessions for school-based participants means that it will be increasingly important for district facilitators to provide embedded support of school-based educators' implementation of project learning. School-based support may include: helping teachers create and use learner profiles to support *students of mystery*, using tools to support teaching and learning, and implementing new approaches to assessment. This support pertains not only to teachers in classrooms, but also to school support teachers who are fostering spread through their work across classrooms and school administrators who are leading learning in staff meetings and other school-based initiatives.

Appendix F: Data Collection Protocols

EOSDN Math Project Educator Participant Survey 2018-2019

Letter of Information/Consent Form

This research is being conducted by Drs. Danielle LaPointe-McEwan and Don A. Klinger of the Faculty of Education at Queen's University in Kingston, Ontario. This study has been granted clearance according to the recommended principles of Canadian ethics guidelines and Queen's policies and approved by the Eastern Ontario Staff Development Network (EOSDN) and your district school board.

What is this study about? Effective professional learning is critical to building educator knowledge and experience that supports enhanced pedagogy and improved student learning and achievement. Many current professional learning initiatives utilize sustained, school- or classroom-embedded models that encourage reflection and collaboration among educators. Collaborative learning models provide critical opportunities affecting change within local contexts through reflection, exploration, developing inquiry habits of mind, and collaboration among teachers, school administrators, and program facilitators. Increasingly, virtual professional learning opportunities have been incorporated to support collaborative, embedded models.

The purpose of this research is to develop a deeper understanding of the structures that support the success of collaborative educator learning initiatives in mathematics, where success is defined as the impact of the professional learning program on teacher practice, student learning and achievement, and collaboration among educators.

What will this study require? In your role as an educator, you have important insights and beliefs regarding the EOSDN Closing the Gaps in Mathematics collaborative professional learning initiative. We would like to invite you to complete a 15-minute survey regarding your experiences in this professional learning initiative. The results will be used to support our research. There are no known physical, psychological, economic, or social risks associated with this study.

Is participation voluntary? Your participation is completely voluntary, and you may withdraw from this survey at any time without adverse consequences by closing the browser. Further, you are free to choose, without reason or consequence, to refuse to answer any survey questions.

What will happen to my responses? Your responses will be incorporated into a regional report that will be shared with all respondents, EOSDN district school boards, and others in the province to help further professional learning. Your responses will be anonymous. At no time will individual educators, schools, or boards be named or evaluated. All survey responses will be amalgamated across EOSDN district school boards to inform our regional research. All electronic files will be password protected. Paper data will be secured in a locked cabinet. Only the researchers and research assistants attached to the project will have access to the data. We may also publish or present our findings in professional or academic journals and conferences. In accordance with the Queen's University policy, we will maintain data for a minimum of 5 years. The Queen's University General Research Ethics Board (GREB) may access your data for quality assurance purposes.

What if I have concerns? Any questions about study participation may be directed to Dr. Danielle LaPointe-McEwan at d.lapointemcewan@queensu.ca. If you have any ethics concerns, please contact

the General Research Ethics Board (GREB) at 1-844-535-2988 (Toll free in North America) or chair.GREB@queensu.ca. Call 1-613-533-2988 if outside North America. Please note that GREB communicates in English only.

Again, thank you. Your interest in participating in this research study is greatly appreciated. **Access to this survey closes June 7, 2019.**

If you agree to participate in this survey, please select 'YES' below to proceed to the survey. By completing the survey, you are verifying that you have read the Letter of Information and all of your questions have been answered. You are not waiving any legal rights by consenting to participate in this study. If you choose not to proceed, please close your browser to exit the survey.

Do you agree to participate in this survey?

- Yes
- No

1. Please indicate your current role. [check all that apply]

- Classroom teacher
- School support teacher (e.g., special education teacher, ISRT)
- School administrator
- System math leader (e.g., facilitator, consultant, coach, coordinator)
- System special education leader (e.g., coordinator, SAT)
- System administrator
- Other (please specify) _____

2. Please indicate your school board.

- ALCDSB
- CDSBEO
- HPEDSB
- LDSB
- OCDSB
- OCSB
- RCCDSB
- RCDSB
- UCDSB
- N/A

3. In total, how many years have you been involved in the EOSDN Math Project?

- Less than one
- 1-2
- 2-3
- 3-4
- 4-5
- 5 or more

4. Thinking about the EOSDN Math Project, please indicate the extent to which each of the following factors has supported your instructional practice in math:

[5 = a great deal, 4 = a lot, 3 = a moderate amount, 2 = a little, 1 = none at all, N/A]

a. Focusing on 2-3 *students of mystery* per classroom
b. Developing/refining learner profiles for each *student of mystery*
c. Using responsive pedagogy (e.g., universal design for learning-UDL, differentiated instruction-DI, YCDSB strategies) to support students' identified strengths and needs
d. Using a developmental continuum (e.g., Alex Lawson) to support students' conceptual understanding of math fundamentals
e. Using common math tasks across classrooms (from Connie Quadrini)
f. Analyzing student work purposefully (e.g., Collaborative Analysis of Student Math Thinking-CASMT approach)
g. Using evidence from analysis of student work to inform next steps in instruction

5. Thinking about the EOSDN Math Project, please indicate the extent to which each of the following factors has cultivated conditions that support math teaching and learning in your context of practice:

[for non-classroom teachers only; i.e., all roles *except* classroom teachers]

[5 = a great deal, 4 = a lot, 3 = a moderate amount, 2 = a little, 1 = none at all, N/A]

a. Defining clear goals for instructional practice and student learning outcomes
b. Prioritizing opportunities for collective capacity-building among school teams
c. Focusing goals and capacity-building on responsive pedagogy and valued student outcomes
d. Using classroom, school, and district evidence to inform goals and collective capacity-building
e. Providing organizational supports for collective capacity-building
f. Allocating resources strategically
g. Engaging in teaching and learning activities through collective capacity-building opportunities
h. Promoting shared leadership among school teams
i. Establishing trust and open communication among school teams

6. Thinking about your *students of mystery* in math, please indicate the extent to which your participation in the EOSDN Math Project has enhanced these students':

[5 = a great deal, 4 = a lot, 3 = a moderate amount, 2 = a little, 1 = none at all, N/A]

a. Confidence and risk-taking with math tasks
b. Engagement during math class
c. Ability to identify their personal strengths and needs in math
d. Ability to work with numbers
e. Ability to recognize and apply their understanding of number properties
f. Mastery of math facts
g. Development of mental math skills
h. Development of proficiency with operations
a. Ability to represent math thinking in diverse ways (e.g., use of concrete materials, pictures, diagrams, numbers, words, and/or symbols)

7. a) Does your approach to assessment differ for *students of mystery* in your class? If so, please describe how. [classroom teachers only]

7. b) How do different forms of assessment (e.g., diagnostic, formative, summative) support the learning of your *students of mystery*? [classroom teachers only]

8. a) Please describe the most notable change you have observed in students' learning as a result of your involvement in the EOSDN Math Project.

8. b) How do you know this change in students' learning has occurred? (i.e., What is your evidence?)

9. a) Please describe the most notable change you have observed in educators' practice as a result of your involvement in the EOSDN Math Project. [non-classroom teachers only]

9. b) How do you know this change in educators' practice has occurred? (i.e., What is your evidence?) [non-classroom teachers only]

10. a) Describe how the virtual professional learning sessions supported your learning in this project.

10. b) Describe 2 or 3 challenges you have experienced engaging in this project's virtual professional learning sessions.

11. Please provided additional comments or feedback regarding your experience in the EOSDN Math Project.

Thank you for your time and feedback!

EOSDN Math Project
District Facilitator Feedback Questionnaire
March 2019

Thinking about your experiences to date with virtual networked professional learning in Year 6 of the EOSDN Math Project…

1. Describe opportunities afforded by engaging in virtual networked professional learning.

2. Describe challenges associated with engaging in virtual networked professional learning.

3. What supports have enabled regional engagement in this virtual networked professional learning? (in regional, DSB, school, and/or classroom contexts)

4. Moving forward, how might this virtual networked professional learning project be enhanced to better support desired outcomes for educators and students?

Thank you for your time and thinking!

District Facilitator Focus Group Questions
April 2019

1. Talk to us about your experiences with virtual networked professional learning in Year 6 of the EOSDN Math Project.

    a. What is going well for you and your school teams?
    b. What challenges have you and/or your teams experienced, and how have you navigated these challenges?
    c. How can we better support your engagement in the project?

2. What advice would you give other educators planning for virtual networked professional learning?

3. What advice would you give other educators engaging in virtual networked professional learning?

EOSDN Math Project
Project Lead Focus Group Questions
June 2019

Thinking about our experiences with virtual networked professional learning in Year 6 of the EOSDN Math Project…

1. Describe *opportunities* afforded by engaging in virtual networked professional learning.

2. Describe *challenges* associated with engaging in virtual networked professional learning.

3. What *supports* have enabled regional engagement in this virtual networked professional learning? (consider regional, DSB, school, and classroom contexts)

4. Moving forward…
   a) What advice would you give to educators *facilitating* virtual networked professional learning?

   b) What advice would you give to educators *participating* in virtual networked professional learning?

5. Please provide additional thoughts or feedback regarding Year 6 of the EOSDN Math Project.

Thank you for your time and thinking!

Appendix G: Sample DSB Claim Statements

System Context

If math leads intentionally plan learning experiences for their schools and educators to collaborate to build their understanding of the importance of anticipating student work, noticing and naming student learning, asking effective questions, placing students along the continuum of learning, determining intentional instructional moves based on the students' placement on the continuum, and providing descriptive feedback to their students, then students will be more engaged in their learning, have increased independence and confidence in participating in math activities and in sharing their math thinking and learning, and will build the skills they need to move their learning forward.

If math leads are responsive to what they see and hear from educators, professional learning can be just in time and tailored to the educators' specific needs.

If math leads maintain a focus on students of mystery, then educators will also maintain this focus and use the information gathered to inform instruction for a broader groups of students.

If math leads support educator in using tools such as continua, then educators will have a better understanding of how to move student thinking.

If math leads keep a focus on student work through the use of a common question or assessment, then educators will use common language when noticing and naming math thinking.

If our learning, collaboration, and planning is centered around student work, then students will constantly move towards mastering more sophisticated operational strategies.

School Context

If structures are in place for professional learning (a common task, CASMT protocol, Professional Learning Cycle, tight timeline of 3 months), then educators will plan and implement purposeful next steps.

If school leaders are at the table and follow up with co-learning in classrooms, then educators will feel supported, empowered and allowed to learn collaboratively.

If school leaders build a collaborative community of educators where they examine student learning through observations, conversations and products, and then intentionally plan next instructional moves and student next steps for learning, then students will benefit from personalized learning helping support number fluency as seen by their progression along the continuum.

If school leaders monitor student thinking through common tasks and data then they will start seeing movement.

If educators intentionally name strategies and it becomes common language in the school, then students use the same language and develop awareness of the strategies they are using.

If educators and students are able to use manipulatives consistently through a division then students and educators are able to demonstrate their understanding of various ways of the math concept(s).

Classroom Context

If educators understand their students as individuals and as math learners, and if they have a flexible toolkit of instructional strategies, then they can provide intentional choices and options for students to access the math learning.

If educators have time to learn more about LD learners, then LD students will experience a more inclusive, less frustrating, math learning environment.

If educators are able to investigate and introduce a variety of mathematical strategies, then students will develop richer math toolboxes and thus develop greater self-advocacy skills.

If educators take risks by learning and using new strategies and tools, then students will be more apt to do the same.

If educators use a common assessment tool, then we can identify overall strengths and needs of our students which helps us determine common and shared next steps.

If educators deepen their knowledge on the interconnectedness of their curriculum then students will make cross graded, cross stranded connections and will see improvements in their fundamental skills.

Appendix H: Regional Team Photos

EOSDN Math Project Year 6
Regional Team Consolidation Session
June 2019

6-Year EOSDN Math Project Members
(2013-2019)