GREATER ESSEX COUNTY DISTRICT SCHOOL BOARD

Expertise of All

The GECDSB values mathematical expertise and believes in building content and pedagogical knowledge of all educators. A mathematics teaching model which values mathematics expertise for all teachers, supports the tenets of the GECDSB core beliefs. We believe it is the learner who will become the expert, and at the GECDSB we are *all* learners.

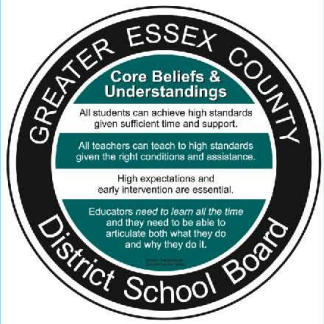
The Greater Essex County District School Board provides mathematics education that engages and empowers students through collaboration, communication, inquiry, critical thinking, and problem-solving, to support each student's learning and nurture a positive attitude towards mathematics.

GECDSB, A Vision for Mathematics, 2016

The purpose of these learning briefs is to share the research, discussion and insight garnered from the intensive work of the Greater Essex County District School Board's Math Task Force. These papers are rooted in the GECDSB core beliefs, These papers are rooted in the GECDSB core beliefs, the Full-Day Early Learning—Kindergarten program and the Ontario Mathematics Curricula for grades 1-8, 9-10, and 11 & 12. The briefs are meant to elevate, enrich and extend the discourse of mathematics education with the intention of encouraging a positive and productive disposition toward mathematics for all learners.

Each paper provides a list of sources to extend the professional conversation and enhance the learning. In addition, live links appear at the end of the papers with connections to various resources.

MATH TASK FORCE



Teaching expertise extends beyond content area knowledge. Pedagogical content knowledge is a highly specialized skill-set that differs from subject specific knowledge and general pedagogical knowledge (Shulman, 1987).

MATH TASK FORCE

2

EXPERTISE OF ALL

The National Council of Teachers of Mathematics (NCTM, 2000) has cited that teacher knowledge, attitide and skill are of central importance in the teaching of mathematics. It is therefore no surprise that the role of content expertise is a critical debate among educators, parents and policy makers. In order for our students to become successful citizens of the 21st century, it is vital that we educate children to become proficient mathematicians and our success is in large part determined by effective teaching. The concept of *mathematics teaching expertise* requires careful study, and a review of the research raises many significant considerations that need to be closely examined at a classroom, school and system level.

Experience, Experts and Expertise

In order to better understand the crux of the issue, we need to explore the concepts of experience, experts and expertise. According to John Hattie, Professor of Education and Director of the Melbourne Education Research Institute in Melbourne, Australia, experienced teachers are those who have years of practice and familiarity in teaching, however Hattie identifies that experience and experts are not necessarily one in the same. He states:

> *Experts and experienced teachers do not differ in the amount of knowledge they have about curriculum matters or knowledge about teaching strategies. But experts do differ in how they organize and use this content knowledge.* (Hattie, 2003)

Certainly within the content rich area of mathematics there is a desire to identify and leverage our expert teachers. Conversations continue about math experts and their roles in schools. In order to best serve the interests of our students we need to expand our definition of *expert* to include *expertise*. If an expert is only defined as someone who has formal education in a content area, then we are missing crucial aspects of teaching expertise.

The well-known work of Lee Shulman (1987) on pedagogical-content-knowledge (PCK) has long demonstrated that teaching expertise extends beyond content area knowledge. Shulman describes content as the "what" and pedagogy as the "how" of teaching. According to his work, pedagogical content knowledge is a highly specialized skill-set that differs from subject specific knowledge and general pedagogical knowledge (Shulman, 1987). Within the context of mathematics teaching we need to adopt a comprehensive definition of the term "expert" which is grounded in research and inclusive of all the domains of expertise.

The use of specialty mathematics teachers is an accepted practice in secondary schools and in some elementary schools who adopt a "rotary" model. This model can have advantages when specialty teachers have demonstrated expertise, but the limitations of this model must be critically considered. The drawbacks include logistical implications for staffing and scheduling as well as the isolation of mathematics instruction to specific blocks of time. This structure impairs the opportunity for meaningful integration of mathematics throughout the instructional day, and this integration is a central principle of the Ontario Mathematics Curriculum. In addition, this model restricts professional learning to only specialty teachers, creating significant long-term impacts on schools and a school-system (Gerretson, Bosnick & Schofield, 2008).

Students engage in mathematics learning throughout their years of elementary and secondary school. Effectively supporting this learning requires all teachers to continue to develop and refine their expertise in mathematics. It is critical for our schools and school system to support deeper and broader understanding of mathematics teaching and learning for *all* educators.

Democratization of Mathematics

The democratic values of education are echoed in the core beliefs of the Greater Essex County District School Board, which

state that "all students can achieve high standards given sufficient time and support," and that "all teachers can teach to high standards given the right conditions and assistance." A mathematics teaching model, which only values mathematics expertise for specific teachers, defies the tenets of the GECDSB core beliefs. In addition, a system that reserves math expertise for only a few perpetuates a culture in which it is acceptable to claim mathematical illiteracy.

Currently, we experience a cultural norm in which it is acceptable to state "I can't do math," however the same posturing is not accepted in literacy. It is uncommon to hear a person publicly announce one's illiteracy, saying "I can't read." In order to challenge these cultural norms and advance the current social standards of mathematics proficiency, we need to remain committed to our core beliefs and demonstrate through our actions as educators that we believe all children can learn math and all teachers can teach math.

Expertise as Proficiency

Expertise should be defined through the lens of math proficiency (National Research Council, 2001). Just as literacy is more than the mere decoding of words, proficiency in mathematics is more than the mere recall of tables, facts, and formulas. Mathematics proficiency as defined in the GECDSB Vision for Mathematics includes five interwoven threads of mathematics skill: adaptive reasoning, strategic competence, procedural fluency, conceptual understanding, and productive disposition. This definition of mathematics proficiency is research–based, comprehensive and reflects our most current understanding of what students need as 21st century learners *and* leaders. Yet, our current reality stands before us.

Mathematics teaching should not look the same as it did decades ago. Years of research has informed our current best practices. Teachers in today's classrooms need to teach math in a way that may be different from how they were once taught. Previous definitions of what it meant to "do and be good at math" have resulted in some people developing limited fluency of mathematical procedures and fragmented understanding of mathematical concepts. In addition, mathematics learning which was exclusively based on rule-learning, speed and accuracy, and devoid of conceptual connections, has given rise to math anxieties and fixed math mindsets (Boaler, 2015). The focus of GECDSB over the past several years has been on developing growth mindsets. Our current challenge is to extend this work to the other mathematical proficiencies in order to develop the expertise of all.

Building Excellence by Building Expertise

Each and every day, our teachers rise to meet the challenge of their calling. We are learners and we believe that "educators need to learn all the time and they need to be able to articulate both what they do and why they do it." Teachers require time, support and resources to continue, extend and sustain the great work which is happening across our system. We must value the expertise of our greatest resource – our educators.

We trust that through our collective and collaborative learning we will find the answers we seek. Expertise is built through learning, and learning is what sustains, improves and empowers us. The GECDSB believes in building the capacity of all educators. We believe that it is *the learner* who will become the expert...and *we are <u>all</u> learners*.

Effectively supporting the learning requires all teachers to continue to develop and refine expertise in mathematics.

In order to challenge these cultural norms and advance the current social standards of mathematics proficiency, we need to remain committed to our core beliefs and demonstrate through our actions as educators that we believe all children can learn math and all teachers can teach math.

Expertise should be defined through the lens of math proficiency: adaptive reasoning, strategic competence, procedural fluency, conceptual understanding, and productive disposition.

Greater Essex County District
School Board
451 Park Street West
P.O. Box 210
Windsor, ON
N9A 6K1

Phone: 519-255-3200
www.publicboard.ca

MATH TASK FORCE

REFERENCES

Boaler, J. (2015). *Mathematical mindsets: Unleashing students' potential through creative math, inspiring messages, and innovative teaching*. San Francisco: Jossey-Bass.

Gerretson, H., Bosnick, J., & Schofield, K. (2008). A Case for Content Specialists as the Elementary Classroom Teacher. *The Teacher Educator, 43*(4), 302-314.

Hattie, J. (2003). Teachers make a difference: What is the research evidence? Presented at the *Australian Council for Educational Research: Annual Conference on Building Teacher Quality*. Melbourne.

National Research Council. (2001). *Adding it up: Helping children learn mathematics*. J. Kilpatrick, J. Swafford & B. Findell (Eds.). Mathematics Learning Study Committee, Center for Education, Division of Behavior and Social Sciences and Education. Washington, DC: National Academy Press.

NCTM Position Statements - National Council of Teachers of Mathematics. (n.d.). Retrieved from http://www.nctm.org/Standards-and-Positions/NCTM-Position-Statements/

Principles and Standards - National Council of Teachers of Mathematics. (2000). Retrieved from http://www.nctm.org/standards

Shulman, L. S. (1987). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15(2)*, 4–14.

LINKS

Seven Foundational Principles for Improvement in Mathematics, K–12
https://www.edu.gov.on.ca/eng/teachers/studentsuccess/FoundationPrincipals.pdf

National Council of Teachers of Mathematics
http://www.nctm.org/

Lucy West - Building Success in Mathematics
https://vimeo.com/153792153

Marian Small—The Art of Mathematics
https://vimeo.com/103956482

Marian Small—It's About Learning
https://vimeo.com/136761933

Cathy Bruce—Professional Learning Key Features
https://www.youtube.com/watch?v=gGgH3RMqg9U