GREATER ESSEX COUNTY
DISTRICT SCHOOL BOARD

Experiencing Mathematics From Concrete to Abstract

Our youngest students come to school as curious learners whose life experiences inform their interests. With logic and reasoning, children make sense of the world around them through exploration, inquiry, play and collaboration. Four and five year olds demonstrate an innate ability to make connections and see patterns; in essence, young learners are able to see mathematics in the world around them through a sense of quantity, fairness, the recognition of patterns and rules. Mathematics is a subject where educators allow critical thinking to flourish. Students are encouraged to mathematize their world, and as facilitators of learning, educators help students represent their thinking more abstractly over time using the language of mathematics. Mathematics will foster the types of thinkers who will be vital to our world. What society needs is problem solvers. The GECDSB is committed to creating a learning environment that develops mathematical proficiency for all students, where thinking is encouraged in a mathematics classroom that promotes equity. One way to unlock this potential is making mathematics concrete.

> ÒThe 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 studentÕs learning and nurture a positive attitude towards mathematics.Ó
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> GECDSB, A Vision for Mathematics, 2016

The purpose of these learning briefs is to share the research, discussion and insights garnered from the intensive work of the Greater Essex County District School Board-Math Task Force. These papers are rooted in the GECDSB core beliefs and the Ontario Mathematics Curriculum, 2005. They are meant to elevate, enrich and extend the discourse of mathematics education with the intention of encouraging a positive and productive disposition toward mathematics.

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Each paper provides a list of sources and resources 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 2.0
TASK FORCE

Another perceived impact of starting concrete is the influence on student disposition towards mathematics. Students who formerly felt left out of the conversation or left behind can gain some footing, and in turn, a positive mindset around their mathematical ability. The use of concrete materials helps educators lower the floor on every single task. With the GECDSB commitment to the use of manipulatives, the stigma that manipulatives are designated for Òthose who canÕtÓ has begun to dissipate. ÒI used to feel really nervous about math. I didnÕt really understand most things and I felt like everyone else knew what to do and I didnÕt. Now that I know that I can use tools, and my friends use the tools too, I can figure it out. Math just makes so much more sense to meÓ (GECDSB student).

With an ongoing commitment to promoting the development of the Five Mathematical Proficiencies, identified by the National Research Council in Adding It Up Ð Helping Children Learn Mathematics, making the mathematics concrete is an approach to support the development of conceptual understanding for both educators and students. Educators were not taught math conceptually.

A focus on concrete and visual representations, allows, but also forces teachers to develop their own conceptual understanding of concepts in order to support student learning. ÒTeachers need to be able to reason through and justify why certain procedures and properties hold true, to talk about how mathematical language is used, to see the connections between mathematical ideas and to understand how they build upon one anotherÓ (Ontario Ministry of Education, 2011, p. 3). It is imperative that the mathematics can be ÒseenÓ to promote sense making and to reveal connections. In order for the math to be seen, teachers and students must determine how to model it. Through this process, all participants will engage in critical thinking, problem solving, and patterns and generalizations will be revealed, rather than told. ÒEach time one prematurely teaches a child something he could have discovered himself, that child is kept from inventing it and consequently from understanding it completelyÓ (Fosnot, 2016).

Using the standard algorithm for multiplication in the Junior Division leaves some students behind and teachers frustrated. Teachers are left to wonder why student cannot remember the steps and why they do not know their facts. Student multiplying double digits forget to add the zero in the second row, and their answer is sometimes completely unreasonable. Teachers then ask the question, ÒHow do students not see that that number doesnÕt make sense?Ó Students likely cannot see that the answer is unreasonable because the algorithm means very little to them. At GECDSB, professional development has been dedicated to understanding models and contexts that promote conceptual understanding of multiplication and the development of fact fluency.

Conclusion

The purpose of Òmaking math concreteÓ is a gateway

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