

**Critical Thinking
OAME/AOEM Position Statement
(June 2019)**

The goal of each OAME/AOEM Position Statement is to outline OAME/AOEM's beliefs on issues surrounding math education by providing transparency and guidance to those involved with mathematics education in Ontario. Any clarification regarding a position or how to proceed in accordance with it can be brought to the attention of the OAME/AOEM Executive Committee.

Focal Question

How do we as a community of educators promote critical thinking in mathematics education in Ontario?

Summary

One of the broad goals of mathematics is to provide our students with tools and strategies so that they are able to approach and break down a problem. After this initial stage of problem solving, students will make decisions about the most efficient way to solve a problem. Promoting critical thinking in our classrooms provides students' opportunities to be independent and creative problem solvers. In addition, students need to be able to use these critical thinking skills developed in the math classroom in order to be critical consumers of the growing amount of information that is presented to them in the 21st century.

To ensure that we are promoting critical thinking in our classroom, we should be providing the following in the math classroom:

- an environment that fosters collaboration, discourse, and an atmosphere of inquiry;
- tools that support thinking;
- tasks and problems that engage and pique students' curiosity;
- opportunities for students to reflect on their thinking both individually and collectively.

What is Critical Thinking?

There is a variety of definitions of critical thinking. Edward Glaser identified three main elements to critical thinking (Horton, 2017):

- a disposition to thoughtfully consider the questions and problems one encounters in one's experience;
- knowledge of the methods of logical inquiry and reasoning;
- skill at applying those methods.

Fullan describes critical thinking as the "ability to design and manage projects, solve problems, and make effective decisions using a variety of tools and resources" (Fullan, 2013, p. 9).

Regardless of the source, the commonalities that emerge from the various definitions include making reasoned judgements when thinking through problems or challenging situations. This is best observed when students are presented with problems or situations that have no predetermined result. Student work is then assessed using criteria such as clarity, logic, and plausibility rather than solely whether or not the final answer is correct.

In Mathematics, critical thinking involves making reasoned decisions about the process one chooses to solve a problem and explaining the thinking, and not just following an algorithm or rule without justifying its relevance.

Why is Critical Thinking Important in Mathematics?

When we consider the amount of information we encounter in our lives, the ability to think critically about the information we are consuming is more important than ever. Critical thinking was identified as one of the 21st century competencies that will have measurable benefits in multiple areas of life for our students in the future. (21st Century Competencies: Foundation Document for Discussion, 2016, p.11-12, see www.edugains.ca/resources21CL/About21stCentury/21CL_21stCenturyCompetencies.pdf)

Part of education (indeed many would say the sole reason for grade school education) is to prepare students for their adult futures. However, their futures will include innovations, technology, and careers that can only be imagined today. Therefore, students' preparation must include learning how to pursue and persist in their education. Hence, thinking critically is a crucial skill.

It is OAME/AOEM's position that students have the right to be provided opportunities to engage in mathematics in a way that allows them to be able to make thoughtful and educated judgements in their futures.

How to Foster an Environment for Critical Thinking

Open-ended tasks with multiple correct solutions or strategies and problems that require students to pull from multiple concepts create opportunities for critical thinking. It is important to emphasize that critical thinking can include, but is not limited to, problems related to real world concepts. It may also include tasks where explicit thinking about the process to arrive at a solution is necessary or encouraged. Students can also reflect on the variety of solutions to determine which is the most efficient in solving a given problem.

Supporting critical thinking in the classroom can be a short, informal task (e.g., the answer to an addition problem is seven. What could the question be?). Critical thinking can also be encouraged by asking students reflect on a solution to consider implications and the consequences of their solution. For example, if a student is extrapolating using a linear model, they should consider if their solution is reasonable and be able to explain their thinking. However, the task may encompass several curriculum expectations and be a longer project (for example, the Culminating Data Management Investigation in Grade 12 Data Management).

While the task itself is important, teachers must also create and support a culture in the classroom where students are willing to take risks in their learning, collaborate with others, and challenge their own thinking as well as the thinking of their classmates and teacher.

Fostering a culture that supports critical thinking requires that students have the skills and tools required to make judgements while engaged with rich tasks and problems. Fostering this

culture also requires that students be given the opportunity to be creative, problem solve and engage in mathematics as they work.

References

Horton, T.A. (2017). *What Works? Research into Practice: Think About It!* Queen's Printer for Ontario. Retrieved from <https://thelearningexchange.ca/wp-content/uploads/2017/06/Think-about-it-WW-67.pdf>

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