MATHEMATICAL LITERACY

TEACHING FOR UNDERSTANDING IN MATH CLASS

Yours is not to reason why, just invert and multiply! You may remember this rhyme which suggests that only the mathematically talented can reason and understand. It could also mean that math doesn't make sense and so we should simply remember 'what to do,' but not why or how we do it.

These beliefs were once widely held. Traditionally, mathematics programs emphasized quick and accurate paper and pencil calculations. We still value these skills but know that to be successful in the 21st century, students must also understand. They must learn to think numerically.

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The best math teachers now focus on students' numeracy skills, teaching them to be mathematically literate. They make sure students understand the why and how. Learning mathematics is more than manipulating symbols and numbers. It involves fluency with how numbers combine, break apart, group and regroup as well as investigation into the relative size of numbers and the relationships among them.

Research into how students develop mathematical understanding shows that, "understanding is never an-all-or nothing proposition. It depends on the existence of appropriate ideas and on the creation of new connections." (Van de Walle & Lovin, 2006) Teachers must sequence and structure lessons so that students develop solid number sense. When new notions and skills are introduced, they must be connected to existing ideas rather than taught in isolation. The goal is overall numeracy, not the singular task at hand.

Our students develop a toolkit of mental math strategies. Visual images, concrete materials, strategy games and practice materials are presented in a carefully thought out sequence. Teachers ask students to represent a problem in different ways, in different contexts and for different ends. Multiple representations help develop strong number sense. They allow students to approach calculations flexibly and creatively and to notice when, in the "real world", a calculation is required.

Students are expected and supported to communicate their learning. The teacher gains insight into their reasoning as students ask questions and share solutions using words,

Let's think about dividing fractions a bit more to see what understanding can look like. ½ ÷ ¼ becomes ½ x 4/1 which equals 4/2 or 2. Why is the answer, the quotient, greater than the number we started with? That's not how division works with whole numbers! Rather than applying a formula, let's make some sense of the mathematics. 6 ÷ 2 can mean: how many groups of 2 are there in a group of 6? When students relate that understanding to ½ ÷ ¼ they think about how many quarters there are in one half and they find there are 2. They can add meaning through a story or drawing and use their understanding to solve real problems in their world.

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The ethics of reciprocal dialogue factor into group problem solving. Students evaluate approaches and consider which is more efficient. In doing so they further develop numeracy skills. Teachers supervise as the students grow as problem solvers able to articulate and defend the thinking behind a position. When students ask themselves "Does this answer make sense?" they develop confidence in their capacity to evaluate their own reasoning and that is the work of mathematicians.

Numeracy skills are used to solve problems and make sense of the world. At The Toronto Heschel School numeracy skills are utilized daily by students through their ongoing school energy audit. They evaluate techniques to save energy, quantifying their results such as the effect of waste free lunches.

When students understand, they start to trust their thinking. They can use the math they know to figure out what they don't know. They display their understanding by applying mental math and computational skills to new situations using numbers and operations that make sense. Mathematically literate students are flexible and creative thinkers who approach and solve real world problems with curiosity and confidence.

Students see that numeracy skills are valuable to mathematics and to non-mathematical pursuits as well. Applying ground rules, formulae and logic to new situations is a life skill of wide application.