Making Math Meaningful

I do not question the premise that math is innately beautiful and meaningful and valuable anymore than I do, theoretically, the same premise for the arts. Perhaps the beauty, meaning, and innate value lie both in the "Thing Itself" and in the discovery and experience each of us has in our relationship and interfacing with that "Thing Itself."

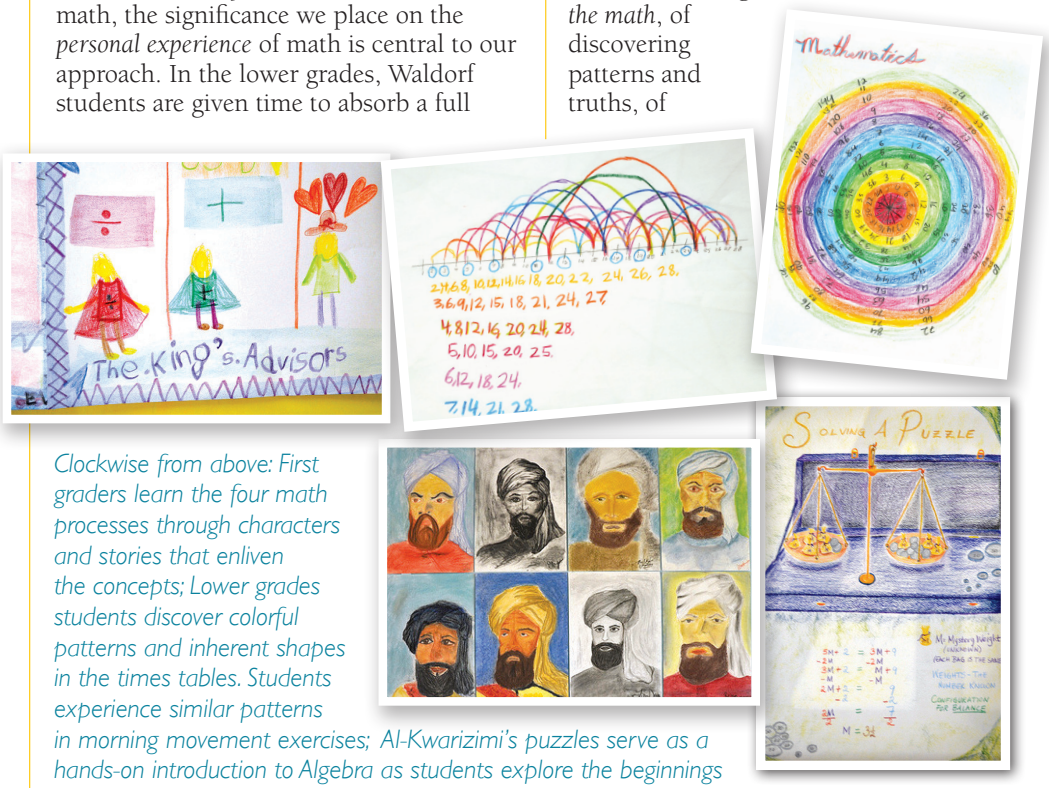
Making Math Meaningful… Do we? Can we? What does it mean to be *meaningful*, or even *mathematical*? At Linden Waldorf School, we hold the beauty and majesty of mathematics within the context of reverence for each student and respect for the developmental milestones laid out in Waldorf teachings and traditions. Our middle school math workbooks, by Jamie York, share this article's title. The words themselves do not confer *meaning*, so what is and wherein lies this quality of meaningfulness? Let's start with another question: is Waldorf math *different* from regular math?

I am often asked if Waldorf math is different from ordinary math. The answer is, of course, *clearly* yes *and* no. Knowledge and skills needed to be successful at the next level in school are central to our curriculum. This is the same mathematics taught in other schools. The main topics for middle school are fractions, decimals, percentages, ratios, area & volume, dimensional analysis, and beginning algebra. These skills have practical applications and they are the foundation for high school and college math courses. Conscientious daily practice in this type of mathematics strengthens self-discipline, focused attention, independence, and clarity of thought. Ideally, students meet challenges, develop a tolerance for temporary confusion and frustration, and learn to persist through struggles toward personal victories and self-confidence!

Perhaps a special focus in Waldorf math that sets it apart is its emphasis on addressing the *Imagination*. Here I'm not referring to fantasy, per se, but to the ability to *form pictures in the mind*, to see patterns, to craft new possibilities, to *problem solve creatively*. Imagination in math is kindled through inspiring recreations of the methods and discoveries of the ancient intellectual giants like constructing visual proofs of Pythagoras' famous Theorem or discovering the Golden Ratio through the "five-division" of the circle into its nested pentagons and pentagrams and through the puzzle of Fibonacci's number series. Artistic activities and experiential lessons offer the students the chance to *feel for themselves* the fascination, the interconnectedness, the beauty and order of the world of numbers, the sense that they themselves have the human capacity to seek and experience their own "ah-ha" moments in glimpsing mathematical truths.

Whether unique or not to Waldorf math, the significance we place on the *personal experience* of math is central to our approach. In the lower grades, Waldorf students are given time to absorb a full sense of numbers, their qualities, their patterns, their component parts. Working from the "whole" to the "part," flexibility and natural numeracy are integral to the lessons. For example, eight is five and three, but eight is also four and four or seven and one, etc. An understanding of "eightness" includes the early concepts of subtraction, factoring, division, etc. Through movement like step- and skip-counting, stories, songs, and games, as well as written work, the young students *internalize* these experiences and develop an inner sense of numbers.

This "knowing in an inner way" is continued in the upper grades through "mental math" exercises (computations relying on patterns and numeracy, without written work) and through hands-on work like deriving the formula for the area of a circle by cutting circles into pie pieces and forming rectangles, or using a balance scale to unravel the first algebraic equation. Our goal here is to connect the student's inner *feeling life* and kinesthetic wisdom with his/her thinking processes. If the students can *feel* that mathematics is fascinating or magical, if they have an inner experience as the actor *doing the math*, of discovering patterns and truths, of conquering computational challenges with vigor, then this *personal connection* holds the key to finding meaning in mathematics.



Clockwise from above: First graders learn the four math processes through characters and stories that enliven the concepts; Lower grades students discover colorful patterns and inherent shapes in the times tables. Students experience similar patterns in morning movement exercises; Al-Kwarizimi's puzzles serve as a hands-on introduction to Algebra as students explore the beginnings of the Renaissance.

Jamie York tells us that Rudolf Steiner spoke about mathematics as training in sense-free thinking. I tell the students that it is great "cross training" for whatever they do in life! Developing mathematical capacities helps organize our thoughts, strengthens our clarity and logical reasoning, and is a springboard to thinking flexibly and creatively. The world desperately needs creative critical and analytical thinking and problem solving! Our future is counting on it.

Let me leave you with this thought:

$\sqrt{-1}\ 2^3\ \Sigma\ \Pi$…and it was delicious!

— Anna Bridgers, LWS math teacher

Credits: Jamie York, *Making Math Meaningful,* and Sylvia Hurdle as consultant

From a Parent's Point of View

Inspiring Innovation

Linden Waldorf School parent, Michael Goldfarb, was recently named by Popular Mechanics as one of 10 Innovators Who Changed the World in 2013! Here are his thoughts on Why Waldorf Works

In my field of research, what distinguishes a good researcher from a great one is the ability to innovate. I don't believe that this ability is developed in institutions of higher learning. That is, institutions of higher learning are quite effective at teaching the analytical tools of various trades; based on my experience, however, if the basis for innovative thinking has not been developed in a student before entering college, there is relatively little that can be done at the collegiate level to develop such creative tendencies. One of the things I think Waldorf does extremely well is to develop the basis for innovative thinking (specifically by encouraging students to digest material thoroughly, think uniquely, and explore their creative instincts), at a time in a child's cognitive development when it is most critical. Einstein said "Creativity is more important than knowledge." Both are important. I believe the former must be developed at a young age, while the latter is quite effectively imparted in college and graduate school. Unfortunately, it seems creativity in primary education has become marginalized by modern educational trends. Fortunately, Waldorf retains its strong emphasis on fostering creativity. I'm delighted my children have been able to have a Waldorf education. I believe they are developing creativity and knowledge, and developing the former in a window of time that I believe is the most appropriate and effective for doing so.

ABOUT THE AUTHOR:

Michael Godfarb, PhD is the H. Fort Flowers Professor of Mechanical Engineering in the School of Engineering, with secondary appointments as a Professor of Electrical Engineering, and Professor of Physical Medicine and Rehabilitation in the School of Medicine at Vanderbilt University. Dr. Goldfarb is the director of the Center for Intelligent Mechatronics, the mission of which is to develop intelligent assistive devices that improve quality of life for people with physical disabilities.

One of the things I think Waldorf does extremely well is to develop the basis for innovative thinking…at a time in a child's cognitive development when it is most critical.

—Michael Goldfarb, PhD.

Waldorf Education addresses the child as no other education does. Learning, whether in chemistry, mathematics, history or geography, is imbued with life and so with joy, which is the only true basis for later study.

By the time they reach us at the college and university level, these students are grounded broadly and deeply and have a remarkable enthusiasm for learning. Such students possess the eye of the discoverer, and the compassionate heart of the reformer which, when joined to a task, can change the planet.

—Arthur Zajonc, Ph.D., Professor Emeritus of Physics, Amherst College

Linden WALDORF SCHOOL 3201 Hillsboro Pike • Nashville, TN 37215 • 615.354.0270 • www.lindenwaldorf.org