

# Missing Pieces to Traditional Math Curriculum

by Sarah Barrett

<https://www.lotusandivy.com/l-i-waldorfinspired-blog/2022/7/25/missing-pieces-to-traditional-math-curriculum>

25%  $\frac{25}{100}$  1%  $\frac{1}{100}$   
50%  $\frac{50}{100}$

1% 25%  
50%

% PERCENT  
"Cent" means one hundred in latin. A percent is a part of one hundred.  
 $100 = \frac{100}{100}$

75%  $\frac{75}{100}$  5%  $\frac{5}{100}$  16%  $\frac{16}{100}$  10%  $\frac{10}{100}$   
6%  $\frac{6}{100}$

5% 6%  
75% 16% 16%  
10% 16%

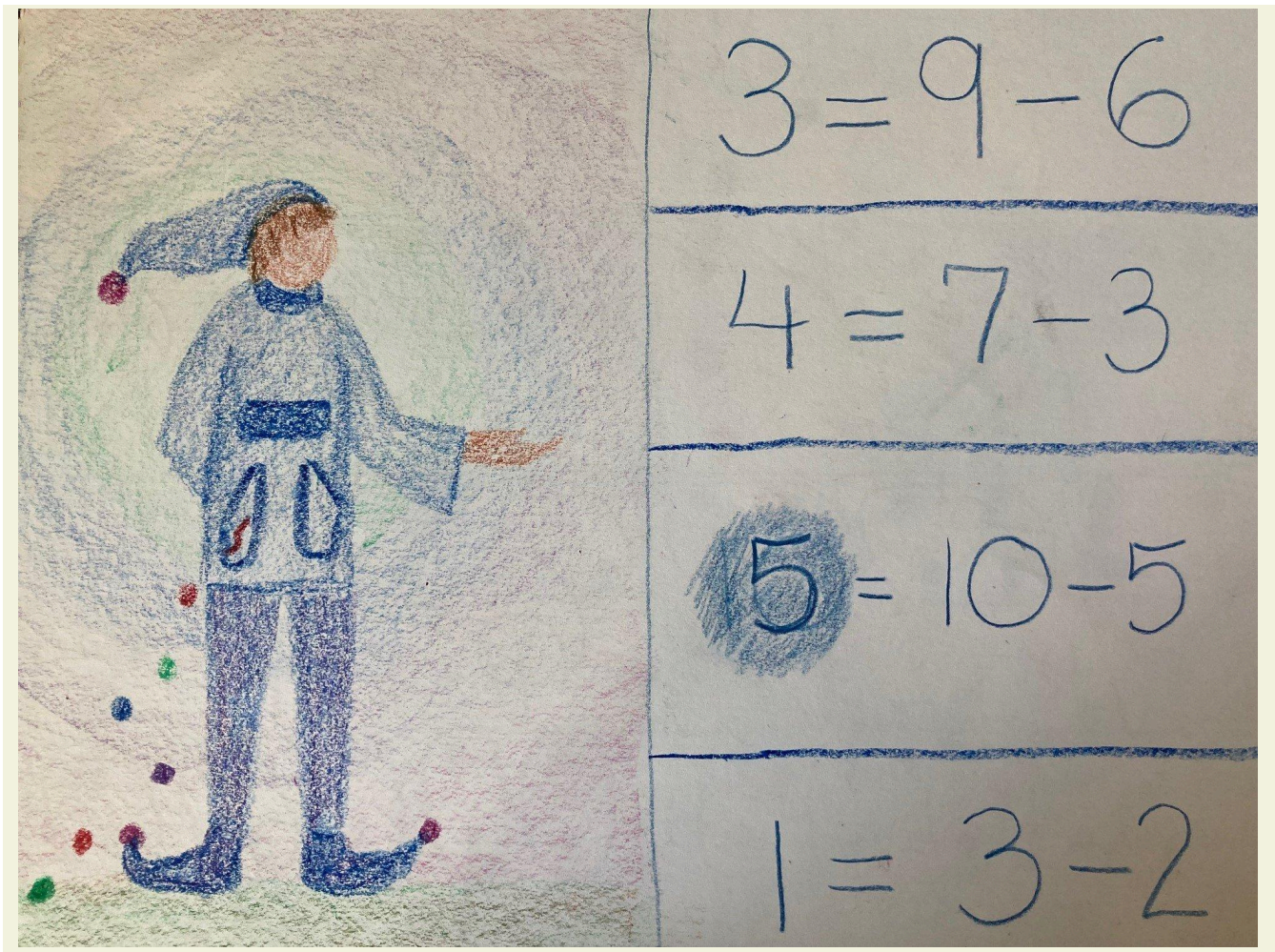
The page features four hand-drawn diagrams on graph paper. The top-left diagram shows a square divided into a 50% blue section, a 25% brown section, and a 1% orange section. The top-right diagram shows a square divided into a 75% blue section, a 6% red section, and a 5% brown section. The bottom-left diagram shows a square divided into a 16% blue section, a 16% red section, a 10% brown section, and a 16% orange section. The bottom-right diagram shows a square divided into a 75% blue section, a 6% red section, and a 5% brown section. The page includes a definition of percent and a fraction representation of 100.

I remember learning about the Pythagorean Theorem in 8th grade Algebra class. The teacher wrote the formula  $a^2 + b^2 = c^2$  on the board and taught us how to “plug in” numbers to find the value of a, b, or c. Easy enough.

Fast forward almost 30 years and I had continued my math journey going to a top engineering school and then having a career as an Industrial Engineer. Later, homeschooling my own children using a curriculum written by a teacher who received Waldorf training at Emerson College in England and preparing to teach my own 7th grader the Introduction to Algebra Main Lesson. The curriculum was guiding me to introduce her to the Pythagorean Theorem by telling a story about Pythagoras and his intriguing secret society among other interesting aspects of his life. We then imagine Pythagoras studying the floor tiles and we draw a diagram of the floor tiles and cut the square formed by the two smaller sides to see how they perfectly fit into the square formed by the larger side. That was the day I learned what the Pythagorean Theorem actually is!

I had fallen in love with this type of education after meeting a friend whose children went to the City of Lakes Waldorf School of Minneapolis years before that, but this reinforced my belief that leading students to the discovery of math concepts through stories, art, drawing, or other hands-on activities makes math so much more meaningful and interesting to them. If I want my kids to enjoy learning math, this is the way.

Through my years of studying this approach to education, I have found more benefits to arts-based learning. Here are what I like to call the “Golden Nuggets of Teaching Math Through Discovery.”



According to an article published by the Waldorf Research Institute entitled “Waldorf Education is Developmentally Appropriate – What Exactly Does this Mean?”,

“Recent MRI equipment has illuminated the fact that in young children, artistic work, full body playing, and sensory stimulation all light up the whole brain. Focused academic work, on the other hand, only lights up small parts of the brain. That ‘lighting’ up points to the development of neurons, making the child’s brain replete with neurons which end up looking, at their best, like a gorgeous, mature tree crown. Once myelinated, these neurons communicate for clear thinking, flexible problem solving, executive function, and creativity.”

(<https://www.waldorflibrary.org/articles/1249-waldorf-education-is-developmentally-appropriate-what-exactly-does-this-mean>)

Cutting-edge studies by neuroscientists and educators at the Learning & Brain conference in San Francisco in 2015 found that students in arts-integrated classrooms are more creative, positively challenged, and more engaged in their schoolwork than those not in arts-integrated classrooms. After a decade of studying the human brain, scientists at this conference were able to confirm that “the arts enhance math and science comprehension.”

Research presented at the Learning & Brain conference highlight how the arts:

- encourage joyful, active learning.
- help students make and express personal connections to content.
- help students understand and express abstract concepts.
- stimulate higher level thinking.
- connect students to authentic learning that matters to them.
- provide opportunities for all learners—even struggling learners—to be successful.
- develop feelings of self-efficacy.
- increase intrinsic motivation to learn.
- develop students’ abilities to apply learning to new situations and experiences.
- motivate students to engage more fully with the related subject area.
- extend how learners process and retain information because it combines several learning modalities (visual, aural, and kinesthetic) and thus reach a wider range of students.
- (focused on drama and storytelling) “strengthen students’ visualization of the text and their emotional engagement with it, both of which contribute to greater retention and understanding.”
- naturally involve several ways of processing information that may have positive effects on long-term memory.

Research from the Kennedy Center was presented at this same conference, and you can find a lot more about the science behind arts-infused curriculum here:

<https://www.kennedy-center.org/education/resources-for-educators/classroom-resources/articles-and-hot-tos/articles/collections/arts-integration-resources/>.

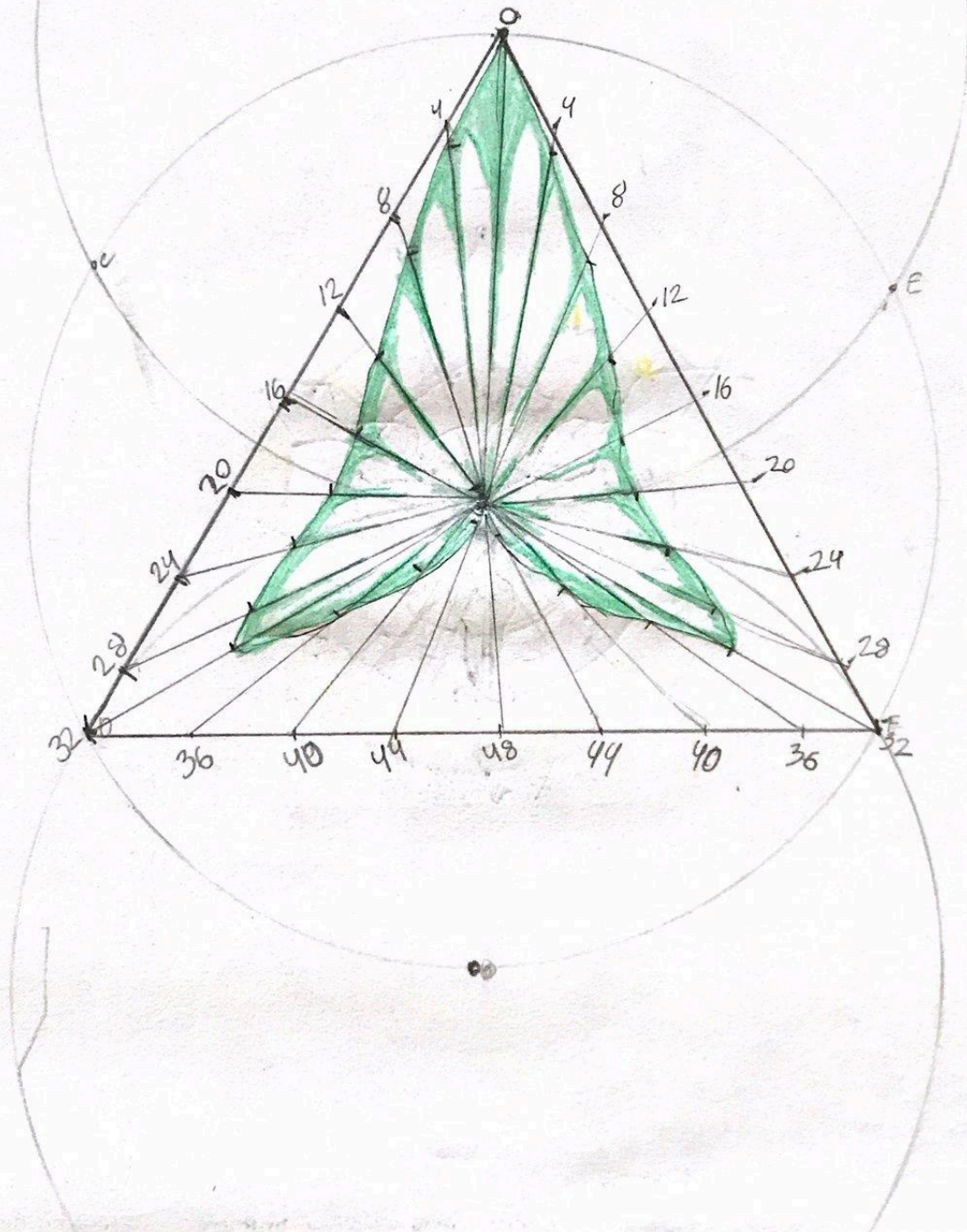
This is one of my favorite videos on this topic: Video: The Powerful Effects of Drawing on Learning.

<https://www.edutopia.org/video/powerful-effects-drawing-learning?fbclid=IwAR3C1I92P2B2hwtX89rNJizuLFkhewMVp0LoL3IG2pM-oGrcA4fZRFidFUw>

Students who draw content remember twice as much as their counterparts, and it is not attributed to learning style! Drawing taps visual, kinesthetic, and linguistic parts of the brain at same time.

If you are interested in more research on this topic, I will list some more resources at the end of this article. At Lotus & Ivy, we incorporate the arts into all our classes, not only for optimal brain development, but to make education a more meaningful and fun experience for our virtual and in-person Pod students.

# Geometry of a calla lily



## More Resources on the Benefits of Drawing in Math and Science Lessons:

Study: “The drawing of visual representations is important for learners and scientists alike, such as the drawing of models to enable visual model-based reasoning. Yet few biology instructors recognize drawing as a teachable science process skill....”

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4353088/>

Study: “Drawings are an integral part of the dialogue a designer conducts with him or herself during design. They are a kind of external representation, a cognitive tool developed to facilitate information processing.” (Applies to solving word problems in math.)

<http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.89.8835>

Study: “Findings indicate that level of spatial understanding and use of schematic drawings both were significantly correlated to problem solving performance....The art classroom is an important context for developing students' spatial understanding and proportional thinking abilities associated with artistic as well as mathematical ability.”

<https://www.tandfonline.com/doi/abs/10.1080/00393541.2007.11650106>

Article: Why is Teaching Kids to Draw Not a More Important Part of the Curriculum?

<https://theconversation.com/why-is-teaching-kids-to-draw-not-a-more-important-part-of-the-curriculum-60379>