

CCSS Math: Building Math Understanding at All Grade Levels

**A two-day workshop for all teachers by
Thornburg Center for Professional Development**

Schedule workshop dates by contacting dthornburg@aol.com or call 847-277-7695 and leave a message for rapid call-back.

Presenters may include any or all of the following:

David Thornburg, PhD

Norma Thornburg, MA

Sara Armstrong, PhD

Workshop Abstract:

The new CCSS math standards focus on developing the power of true mathematical thinking in students as opposed to older models that relied more on rote learning. While basic numeracy continues to remain important, the doors are opened to develop mathematical skills through the kinds of explorations that are pursued by professional mathematicians.

The success of the five-year primetime TV series *Numb3rs* showed that applications of pure mathematics can be quite interesting. The same level of interest can be supported in schools through use of many approaches including the use of free software tools such as Geogebra, Inkscape, and Logo. We work with educators so they can help students explore mathematical ideas that go beyond the arithmetic instruction most of us received when we went to school. Whether it is exploring the challenges of cutting pizzas or finding the Golden Mean in Renaissance artwork, the boundaries are limitless. Topics from algebra to topology, tessellation (tiling) patterns and others can all be transformed with the guidance of the new standards. The goal is for math instruction to be realized in rich ways that go beyond learning about mathematics, to actually doing the kinds of things mathematicians do.

The workshop explores the reasons for the new standards, and shows examples of tools that can help teachers of almost any grade embrace the spirit of them in their work with students. Inquiry-driven project-based learning is a perfect practice in the math classroom, and connections to other subjects will be explored in this workshop. Through a series of discussions and hands-on activities, participants will develop a deeper understanding of the expectations of the new standards, as well as explore and implement strategies to shift the dominant pedagogical model to one that celebrates transdisciplinarity and a deeper understanding of the ways mathematicians practice their craft.

Workshop Outline:

Day 1

- What passion for mathematics looks like.
- How mathematicians see themselves (activity on epistemic frames.)
- Second activity: Quick overview of the CCSS Math framework, including finding out what areas are of major interest to the attendees. This information will be used to set the emphasis areas for the workshop. Furthermore, participants will use the list of eight standards throughout the workshop to evaluate various math projects, including the design of their own units.
- Examples of math activities that explore big problems with basic numeracy skills.
- The challenge of word problems.
- Project Cycle: driving question, research, project, sharing, evaluation – repeat with new questions.
- Discussion on Driving Questions: working through an open-ended challenge – samples from the Knights of Knowledge inquiry-starter videos available online.
- Experiment with powerful math software (Geogebra, etc.) tools to explore interesting ideas.
- Evaluation: the role of rubrics
- How to create driving questions of your own.
- Practice in coming up with your own questions
- How to create an inquiry-driven project in mathematics.
- Project creation and sharing
- Homework: for the next day, bring a math topic that you will transform in support of the CCSS Math standards.

Day 2

- Work on new activity design aligned to the new standards.
- Presentations by participants to the group
- Programming languages as tools for learning mathematical thinking
- Scratch
- Logo
- The role of manipulatives across the grades (including experimentation)
- 3D printing and mathematics exploration (optional)

Audience: All

Grades: K-12, and beneficial to teacher education as well.

Topic: Implementing the new math standards

Duration: Two-day workshop preferred, but if only one day is available, we can still accomplish a lot.

Computers: While we prefer that participants bring laptops (Windows or Mac) to the workshop, variations of the workshop can be done with Chromebooks and (to a lesser extent) tablets. Note that, as of this writing, some powerful tools we want to use only run on traditional computers, but this is changing. The workshop leaders will likely use Chromebooks as their primary tool.

Materials: Each participant will receive all needed materials.

Size limits: We can work with a maximum of forty participants.

Requirements: For the workshop, teachers need their own computers or Chromebooks. They will also need Internet access. All other curricular material is included (we need an exact headcount for this). Facilitators need Internet access and projection system with audio for their computers. (One shared projector is sufficient.) We also will need an additional table for other technological tools, such as a 3D printer (if used in the workshop).

Our leadership team:

David Thornburg, PhD

David is founder of the Thornburg Center and has worked in the field of education and educational technology for well over 30 years. His educational philosophy is based on the idea that students learn best when they are constructors of their own knowledge. He also believes that students who are taught in ways that honor their learning styles and dominant intelligences retain the native engagement with learning with which they entered school. A central theme of his work is that we must prepare students for their future, not for our past.

He was one of the reviewers for the Next Generation Science Standards, and the Knights of Knowledge™ project grew out of his long interest in inquiry-driven project-based learning - what he believes to be the key pedagogical model for the rest of this century. His strong background and passion for mathematics makes him the ideal person to run this workshop. He, along with others of the Thornburg Center team, worked on a three-year NSF-funded project incorporating Inquiry into STEM education.

Dr. Thornburg is the recipient of several awards for product design and is the recipient of both the Gold and Platinum Disk awards from CUE (Computer Using Educators, Inc.) for his contributions to the advancement of learning and learning technologies. In 1999 he was selected as one of twenty "pioneers" in the field of educational technology by ISTE, the premiere organization devoted to the advancement of technology in learning, and was named by Technology and Learning magazine as one of the top ten most influential people in the field of educational technology in the past twenty years. He has spoken at TEDx and was the subject of a short documentary created by the George Lucas Educational Foundation. In years past, he was an active participant in the California Math Council conferences in Pacific Grove, California.

Norma Thornburg, MA

Norma is a long-time contributor to educational projects and provides materials in Portuguese for Brazilian educators. She has been a classroom teacher, a principal, a technology coordinator, and an educational consultant. Her work brings her all over the world.

Norma's work in support of constructivist learning led her to write the first book on the Logo programming language in Brazil. She has many years experience working in the field of

inquiry-driven project-based learning (PBL) and was the lead designer of a five-year PBL program that, at its peak, reached over 15,000 students throughout Brazil.

Norma is one of the leaders in constructivist and constructionist education in both Brazil and the United States, and her insights are in demand worldwide.

Norma received her MA in Instructional Technology from San José State University, and her Bachelor's in Education at Universidade Católica de Petrópolis in Petrópolis, Brazil.

Sara Armstrong, Ph.D.

Sara is a member of the Thornburg Center where she brings her deep experience in project-based learning and her equally impressive work on rubric development for assessment.

She has been an educator for over 40 years - as a classroom teacher, principal, and professional developer. Sara is recognized for her dedication to project-based learning and the benefits that accrue to students and teachers through this practice, particularly in the elementary grades. She conducts workshops in developing effective projects across the country, and throughout the world. She is a firm believer in meaningful assessment, and presents workshops on developing effective rubrics for all aspects of project work. Sara is also interested in the power of story and storytelling, and infuses it into her presentations and workshops.

Sara is a recipient of both the Gold and Platinum Disks from Computer-Using Educators.