Anser

Charter School

Oct. 6-8, 2014

Expeditionary Learning **Math Institute**

Inside…

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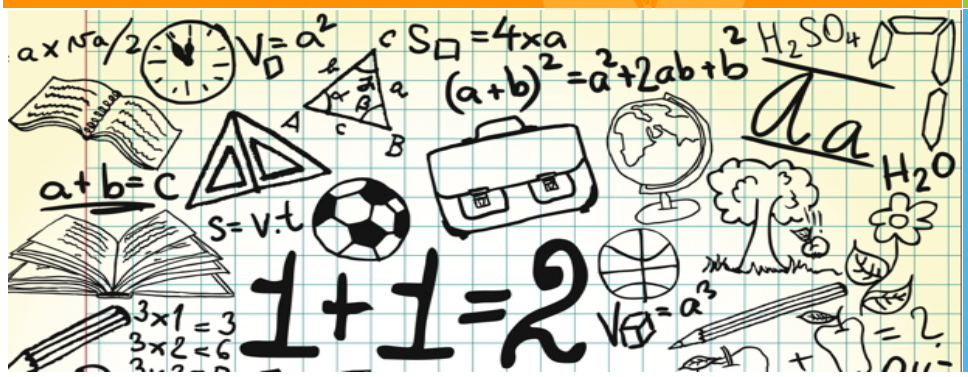
Welcome to the Anser Math Institute!

On behalf of Expeditionary Learning, Anser Charter School and the Initiative for Developing Mathematical Thinking, we would like to welcome you to our inaugural **Anser Math Institute**.

This informational flyer is to help support your experience at this institute. We hope your time with us will inspire, push and enhance your current understanding of what it means to build mathematical thinking in your school.

Our goal is for educators to be a catalyst for promoting mathematical thinking with the students they work with and to love teaching math!



Anser Math Institute

Instructors

Who will be the instructors at the Anser Math Institute?

Giselle Isbell

gisbell@anserscharterschool.org

Giselle Isbell joined Anser in the fall of 2000 as the Upper Childhood teacher. Giselle consults with DMT and is currently a teacher of teachers in the math arena. She has a B.A. from Tulane University and a Master in Public Administration from Boise State University. She has previous teaching experience in New Orleans and at St. Mary's School in Boise. Watch Giselle in action as she demonstrates how to promote mathematical thinking in a classroom http://vimeo.com/78372984.

Jonathon Brendefur, PhD

jbrendef@boisestate.edu

Jonathan Brendefur is professor of Mathematics Education at Boise State University. Dr. Brendefur is currently the Director of the Initiative for Developing Mathematical Thinking, which currently hosts two grants: a Mathematics Science Partnership Grant that works with teachers and staff at 8 elementary and middle schools over a three year period. He also has been awarded a five year grant from the Idaho State Department to provide mathematics professional development to over 12,000 teachers K-12 teachers and administrators across the state. He has written numerous chapters, journal articles, technical reports and curriculum and has presented over 60 conference papers. His area of research is on mathematical learning progressions and teacher professional development.

Keith Krone

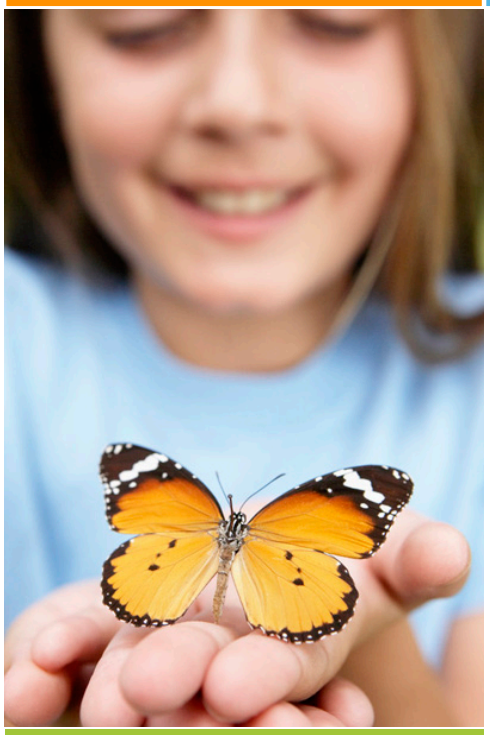
kkrone@boisestate.edu

Keith Krone is currently the Associate Director of the Mathematical Thinking for Instruction (MTI) Project within the Initiative for Developing Mathematical Thinking at Boise State University. Keith now organizes all aspects of the required MTI courses for Idaho teachers in the Boise and Twin Falls areas and provides professional development opportunities for teachers who have taken the course. Prior to working for Boise State University, Keith was a math coach and administrator for the Vallivue School District in Nampa and Caldwell, Idaho. Keith was a former teacher in Eastern Idaho and Missoula, Montana. Keith's wife, Kasey, teaches math at Eagle High School and has two children, Jensen and Brenna, who attend the West Ada School District.

David Denhartog

ddenhartog@elschools.org

While serving as a School Designer for Expeditionary Learning these last nine years, David has had the opportunity to work with a variety of fantastic schools dedicated to implementing the EL model. Previously as a classroom teacher, school principal and now school coach, David gets to fulfill his passion for helping to improve education and build model schools. Currently, David supports nine different schools and helps to lead both regional and national EL professional development.



OUR Mission

"Educate the whole child in a collaborative learning community where individuals are inspired to be self-motivated and to feel a sense of connection and responsibility to the world."

Anser Charter School

How We Do School

Anser is an award-winning Expeditionary Learning public charter school located in Garden City Idaho. Through our innovative approach to education Anser challenges students to meet rigorous academic and character standards and to provide service to others. Students learn to take responsibility for achieving their personal best. They participate in learning expeditions – purposeful, extensive studies of a single topic. Harnessing the power of adventure and discovery, expeditions lead students to become more motivated in their academic work while developing perseverance and self-discipline.

Anser serves students in Kindergarten through Eighth grade with a vision to educate the whole child in a collaborative learning community where individuals are inspired to achieve their academic potential, be self-motivated and feel a sense of connection and responsibility to the world.

In the spring of 2011, Anser was named an Expeditionary Learning Mentor School; a distinction shared with only 17 schools nationwide. The award recognizes Anser Charter School as one of the top performing schools in Expeditionary Learning's national network of 165 schools in 30 states.

Go to www.anserscharterschool.org for more details of "how we do school!"

Course Objectives

Goals for Math Institute participants:

- Become knowledgeable about instructional practices emphasizing mathematical reasoning, communications, connections, and problem-solving
- Develop knowledge of the mathematics curriculum and practices for grades K-8 as reflected in the Common Core State Standards
- Become familiar with assessing and using children's thinking as a guide to planning instruction
- Understand a framework for children's development in mathematics and understand how instruction can promote learning while still considering issues related to development

FYI

Locations:

Monday, Oct. 6th and Wednesday, Oct. 8th we will be on the Anser campus located at ***202 East 42nd Street Garden City, ID***

Tuesday, Oct. 7th we will be at The Riverside Hotel in three conference rooms at ***2900 Chinden Blvd Boise, ID***

Meals:

Breakfast and lunch will be provided all three days.

Clothing:

Casual dress is appropriate and encouraged.

Anser Contact Persons:

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Course Schedule

Schedule is tentative and subject to small changes

Monday, Oct. 6, 2014

Location: Anser Charter School Campus

7:30-8:00	Breakfast
8:00-8:30	Greeting/Introductions
8:30-10:00	Whole Group Work time
10:00-10:10	Morning Break
10:10-11:00	Keynote Speaker – Jonathan Brendefur
11:00-12:00	Break Out Session #1 (K-2, 3-5, 6-8 grade levels)
12:00-12:45	Lunch (serve at the school)
12:30-12:45	School Tour available
12:45-1:30	Whole Group
1:30-2:30	Break Out Session #2 (K-2, 3-5, 6-8 grade levels)
2:30-2:40	Afternoon Break
2:40-3:45	Break Out Session #2 continues
3:45-4:00	Closure/Debrief

Tuesday, Oct. 7, 2014

Location: Riverside Meeting rooms

8:00-9:00	Opening
9:00-10:00	Break Out Session #3 (K-2, 3-5, 6-8 grade levels)
10:00-10:10	Morning Break
10:10-12:00	Break Out Session #3 continues
12:00-12:45	Lunch (serve in our meeting rooms)
12:45-2:00	Break Out Session #4 (K-2, 3-5, 6-8 grade levels)
2:00-2:10	Afternoon Break
2:10-3:15	Break Out Session #4 continues
3:15-4:00	Closure/Debrief

Wednesday, Oct. 8, 2014

Location: Anser Charter School Campus

7:30-8:00	Breakfast
8:00-11:30	Observe Anser Whole School Community and Classrooms (schedule and map will be provided)
11:30-12:30	Lunch (serve at the school)
12:30-2:00	Continue observing Anser Classrooms
2:00-2:15	Afternoon Break (serve at the east end of the gym)
2:15-3:00	Institute Debrief/Closure

Initiative for Developing Mathematical Thinking

Article

What Does It Mean to Develop Mathematical Thinking?

Mathematics is a study of patterns, a way to find order in the natural word, an artistic science and a language by which logic and reason are shared. Historically, the world's greatest civilizations arose simultaneously with their development of new mathematical ideas and discoveries. Unfortunately, for many current students and their parents, mathematics is perceived as a collection of rules, procedures and formulas that must be followed or repeated to produce "answers" to "problems." For many who hold this perception, mathematics is a burden to overcome or a topic that is socially acceptable to struggle with.

To improve students' learning of mathematics and to further both their achievement and interest in the topic, Dr. Jonathan Brendefur (Director of the Initiative for Developing Mathematical Thinking) designed a research-based framework applicable to daily classroom teaching. The five part framework consists of the following components:

- **Taking students' ideas seriously**
- **Promoting conceptual understanding**
- **Including multiple strategies and models**
- **Addressing misconceptions**
- **Focusing on the structure of mathematics**

From 2004-2007 the Developing Mathematical Thinking (DMT) framework was implemented and evaluated in classrooms around the western United States. As students' achievement in math increased in those schools participating in DMT projects, so too did notoriety for the instructional approach. In 2008, the Idaho State Department of Education requested Dr. Brendefur lead the implementation of the Idaho Math Initiative sponsored by the State Department of Education. From this initiative came the Mathematical Thinking for Instruction (MTI) Courses, which were designed with the DMT framework as a foundation.

Because of the crucial place the DMT framework holds within the MTI courses (as well as related follow-up workshops) it is worthwhile to use this newsletter to describe the DMT framework in greater detail. Specifically, it is our hope that this article will capture what it means to develop mathematical thinking and what this process looks like in a typical classroom setting. To do this, we will look at a typical day in a DMT classroom from the beginning, middle and end of a lesson.

Beginning: Problem-solving Situations

When introducing mathematical concepts, the DMT instructional approach advocates placing students in problem-solving scenarios before procedures and rules have been taught. While this might seem to be in reverse order (*How can students solve problems for which they don't the steps to find a correct answer quickly?)* it is a very intentional aspect of the DMT framework. First, it is important to clarify that from a DMT perspective, a problem is not a single math equation to solve in only one way (such as 213 + 94) but instead a realistic contextualized scenario (e.g. story problem) or a task requiring students to examine a visual model or diagram such as the example shown in Figure 1. Presented with this number line, students might be asked to name the location marked 'A' with as many names they can think of and show how that name is correct by modeling it with new marks on the number line. For example, to show

"What Does It Mean to Develop Mathematical Thinking?" *cont.*

For example, to show A could be named .5, students might partition (split) the length from 0 to 1 into ten equal lengths of tenths and then demonstrate how A is precisely at the end of five one-tenth units of length. Students may also be asked to generate an incorrect response they think would be common and explain why that answer is in- correct.

Figure 1.

By placing students into problem-situations teachers allow students to generate their own ideas. Note that his one of the five components of the DMT framework; **taking students' ideas seriously.** After students have shared what they *think* are correct answers and strategies, the teacher has the opportunity to **promote conceptual understanding** by asking students to compare and contrast the various ideas shared by classmates. If students are directly told how to solve a given problem initially, no ideas they already have will be shared nor will the underlying mathematical concepts evident in students' initial ideas be developed in ways that allow the students to see the correctness or flaws in their own way of thinking prior to instruction.

Middle: Building on Students' Ideas

As critical as it is for teachers to allow students to make sense of a given problem using the students' own ideas, those notions are likely to be informal in nature and therefore not ideal for long term mathematical understanding.

It is at this mid-point in a typical DMT lesson in which the teacher must ensure **multiple strategies and models are included** in the class' work. As described previously, students are likely to generate many solution strategies to a problem but the teacher's role is to now focus on those strategies that offer the greatest instructional opportunities. For example, students in the class may have generated two different answers to a problem. By presenting the class with the two most common strategies that generated each answer, the teacher and students can begin to make sense of what steps might be necessary to derive a correct answer as well as what the correct answer even is. In order to justify how these steps appropriately solve the problem, **models** can be introduced by the teacher to visually represent the concepts inherent in various strategies. Many problem- solving settings can also influence the use of models, such as problems about lengths of ribbon or string that imply the number line. This is precisely the reason there has been a recent emphasis on visual models such as the number line, bar models, arrays or area models, and the coordinate grid in many efforts to improve math instruction the U.S. These models, when specifically related to students' solution strategies also afford the teacher an understandable way to **address misconceptions.** Students come to math classrooms with many misconceptions often because mathematical concepts and procedures do not always match peoples' intuitive ways of thinking. For example, in Figure 1 (shown previously) some students may incorrectly name the location A as 1.2 because they see it as "half" or "1/2." This error highlights a significant misunderstanding about place value, fraction notation, and also the relationship be- tween base-10 decimals and fractions. By directly addressing this misconception (often using a model to help clarify the correct and in- correct ideas students have) the teacher alleviates the need to reteach these concepts later in the year and improves student learning in immediate setting.

End: Make Connections and Extend Student Thinking

If the DMT process described to this point has occurred, students are likely to have developed some well-rounded ideas about a given math topic. The teacher is now able to guide students to seeing how the concepts recently learned connect to newer concepts or can be extended so as to be used in many situations. This is what it means to **focus on the structure of mathematics**. By enabling students to see mathematics as an interconnected topic, rather than as a set of memorized steps, teachers help their students use what they know in new situations, obtain a correct answer, and know *why* the answer is correct. If students worked on solving an addition story problem and found that it made sense to use place value (e.g. adding tens and tens, ones and ones) the teacher could challenge students to use the idea of adding like units of place value on a series of related but increasingly difficult problems. This extends students thinking in a rigorous way but also allows students to use the ideas they have recently developed along with meaningful strategies and understandable models to make sense of the mathematics they are learning.

This is the essence of what it means to development mathematical thinking.