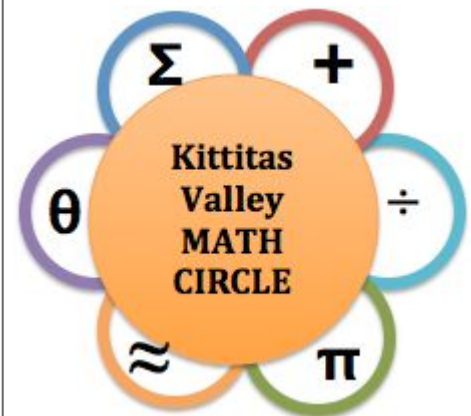


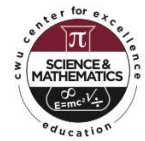
Kittitas Valley Math Circle

**Circling parents, guardians,
and other adults to join in
their student's Math Circle
experience.**

B. Wieggers, D. Klyve, A Rogan-Klyve, and J. Shiver
Central Washington University



KVMC is Sponsored by:



KVMC Leadership Team



Brandy Wieggers
Math



Dominic Klyve
Math



Janet Shiver
Math Education



Allyson Rogan-Klyve
Science Education

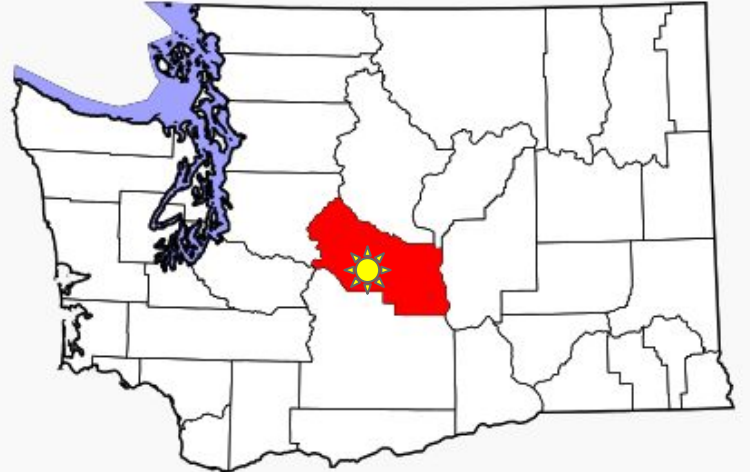
Where is Kittitas County?

Population: 40,915 (in 2010).
7,484 children under 18 (18%)

Total Area: 2,315 square miles



Washington's location in the **U.S.**



Location in the state of **Washington**

Image from https://en.wikipedia.org/wiki/Kittitas_County,_Washington

Data from: <https://www.co.kittitas.wa.us/about/default.aspx>

Central Washington University Ellensburg, WA



Creating KVMC- Using Resources Wisely

Comprehensive (non-R1) University

- Undergraduate Mentors
- Quarters (10 weeks)
- Supportive STEM outreach

Small Rural Town (19,786)

- Sports
- Bible Study
- Other outreach projects
- Driving distance

Elementary Math Circle:

2nd- 6th grade students

Topic blocks

(5 weeks, one topic per quarter)

Parents/ guardians are invited to attend a specific adult session for the 1st two weeks of each topic block.

Creating KVMC- Using Resources Wisely

“I have colleagues at Central who have trouble understanding their children’s math homework. It doesn’t look like the math they learned themselves.”

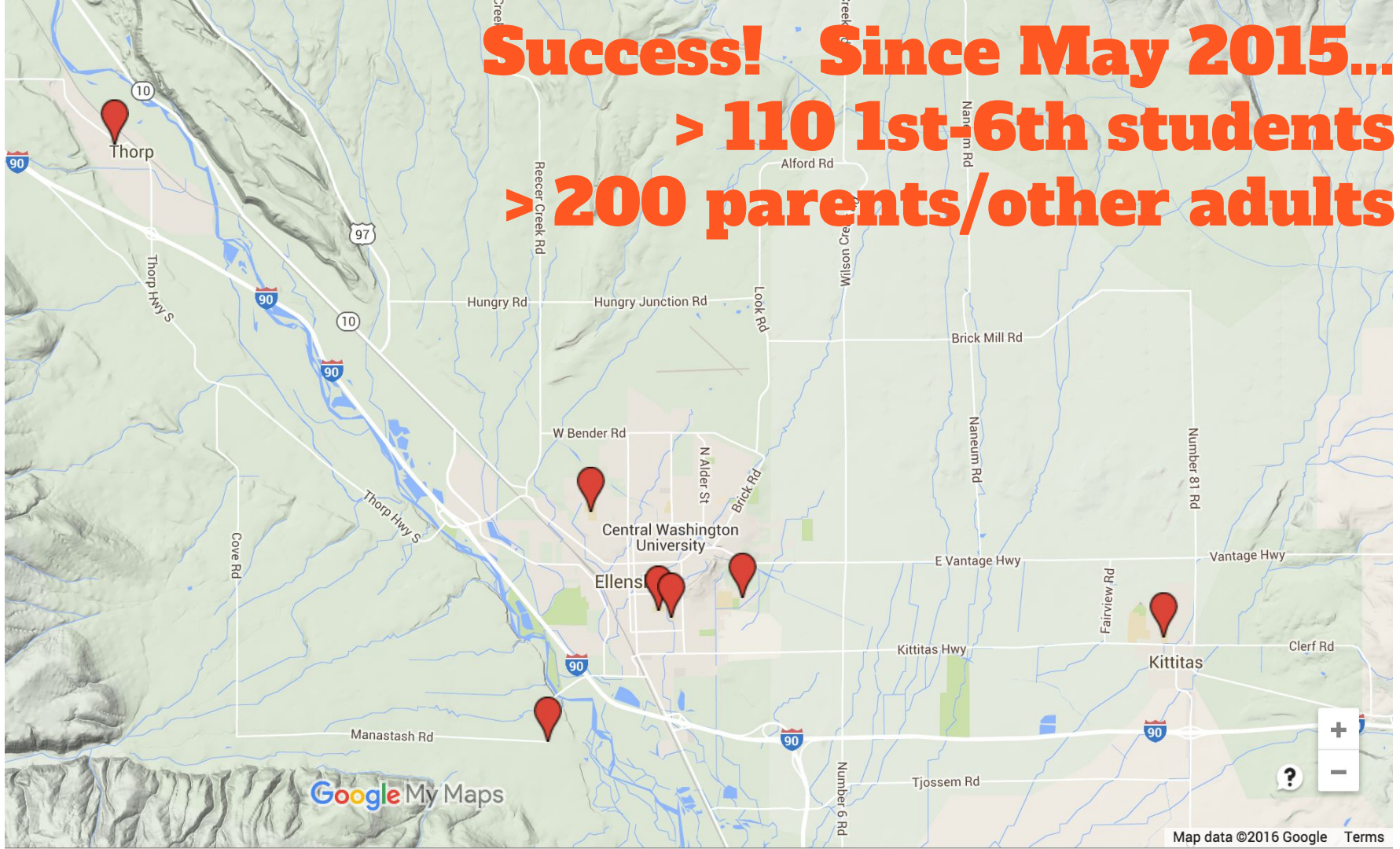


Dominic Klyve

Success!



Success! Since May 2015...
> 110 1st-6th students
> 200 parents/other adults



It's working...

Parent 1: “ We liked that it seemed empowering for our child. He had fun and felt successful. I appreciate that--we want him to love the problem solving and visual aspects of math. We never want him to develop an attitude of ‘I am not a math person’.”

Parent 2:



Creating Success

- Fun Topics!
- Undergraduate Mentors
- Parent/ Guardian Program



KVMC: 5 weeks on 1 Mathematical Topic

- Mathematical Problem Solving
- Mathematical Patterns
- Cryptography
- Geometry Games
- Probability
- Mathematical Explosions
- Math Found Outside

This year:

- Math Around the World
- Math and Art
- Math and Technology



Fall 2017 - Math Around the World

Week 1: Mancala

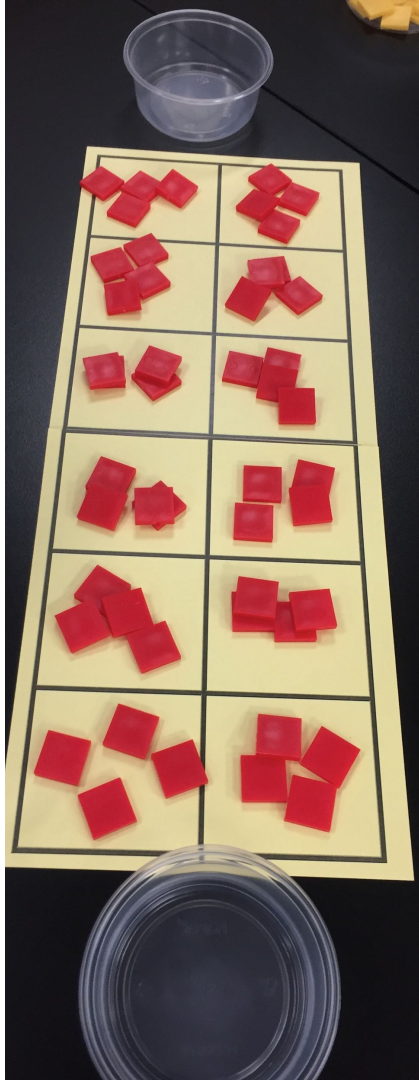
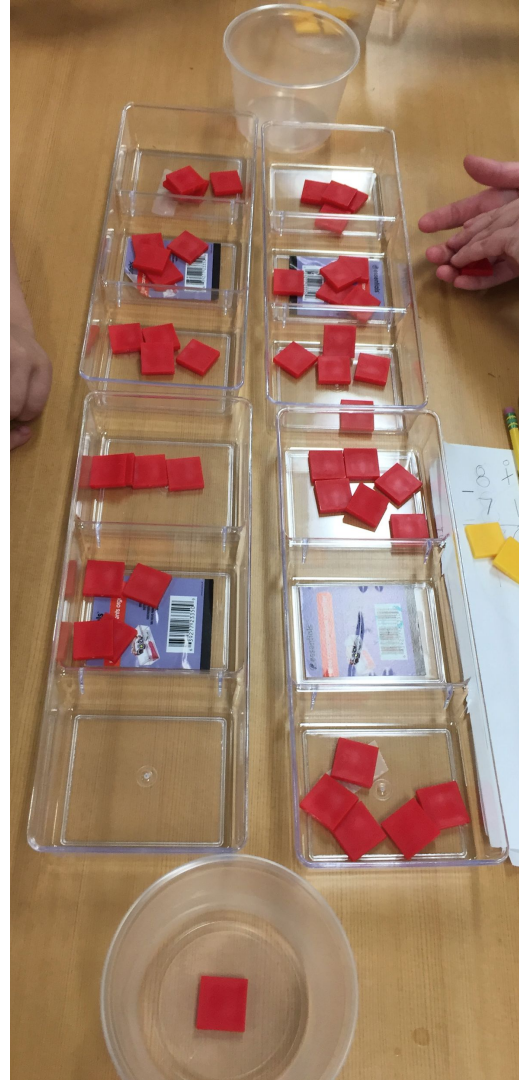
Week 2: Global Math Week
(10/10/2017)

Week 3: Global Math Stations

Week 4: Global Math Stations -
week 2.

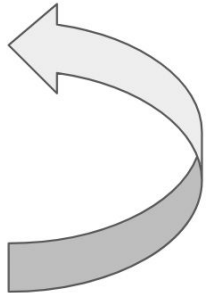
Week 5: HALLOWEEN - No
Meeting!





How to play mancala

1. The Mancala board is made up of two rows of six holes, or pits, each.
2. Four pieces—marbles, chips, or stones—are placed in each of the 12 holes. The color of the pieces is irrelevant.
3. Each player has a store (called a Mancala) to the right side of the Mancala board.
4. The game begins with one player picking up all of the pieces in any one of the holes on their side.
5. Moving counter-clockwise, the player deposits one of the stones in each hole until the stones run out.
 - a. If you pass your own store, deposit one piece in it. If you pass into your opponent's store, skip it.
 - b. If the last piece you drop is in an empty hole on your side, you capture that piece and any pieces in the hole directly opposite.
 - c. Always place all captured pieces in your store.
6. The game ends when all six spaces on one side of the Mancala board are empty.
 - a. Count all the pieces in each store. The winner is the player with the most pieces.



What happens at parent meetings?

Discussing Mathematics

- Introduction to the games their students are playing with
- Math at Home: Challenge opportunities

Discussing Their Students' Math Experiences

- Discussion of Shifting Classroom Experience
- Common Core State Standards
- Introduction to mathematical/ education approaches

Providing Resources for more fun at home

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KVMC Leadership Team



2nd - 3rd Grade
Brandy Wieggers
Math



4th - 6th Grade
Dominic Klyve
Math



Parent/ Adult Session
Janet Shiver
Math Education

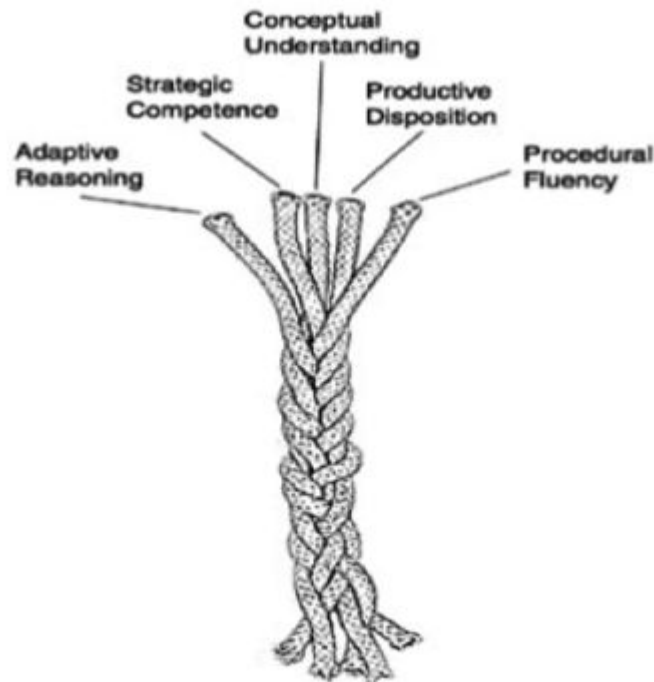


Parent/ Adult Session
Allyson Rogan-Klyve
Science Education

Discussing Their Students' Math Experiences

Shifting Classroom Experience

- Classes become mathematical communities rather than collections of individuals
- Logic and use of mathematical evidence are given priority rather than viewing the teacher as the only authority
- Students work on use mathematical reasoning rather than memorizing procedures
- Increased focus on conjecturing, inventing, and problem solving
- Creation of close connections between mathematics and its applications



Discussing Their Students' Math Experiences

Common Core State Standards

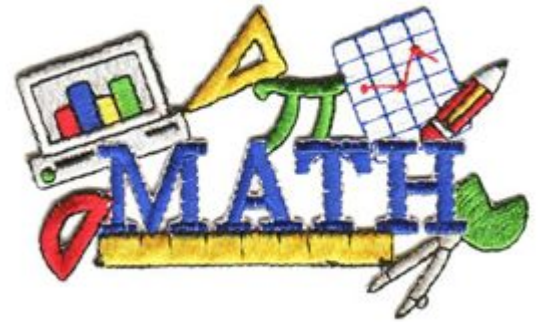
Effort by 26 states to develop standards that are meant to support this vision of math and math learning (and English Language Arts)

- Set of Standards
- Not a curriculum
- Not an assessment

Discussing Their Students' Math Experiences

Introduction to mathematical/ education approaches

- Concrete-Pictorial-Abstract Approach
- Productive Disposition
- Patterns
- Mathematical Thinking and Games
- Meaning of Fraction



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Meaning of Fraction

- Interpreting fractions
- Part-whole interpretation
- Measurement interpretation
- Division interpretation

Resources

Kittitas Valley Math Circles

What we talked about today:



Meaning of Fraction

In the fraction $\frac{A}{B}$, A is referred to as the *numerator* and B is referred to as the *denominator*. The numerator tells us the number of parts of interest (3 parts, 6 parts, etc.), while the denominator tells us the type or name of parts being considered (halves, thirds, fourths, etc.). For example, in the fraction $\frac{2}{3}$, the numerator tells us we are interested in 2 pieces. The denominator tells us the whole has been divided into 5 equal parts making the size of each piece one-fifth of the whole. So, altogether the fraction tells us we are interested in two, one-fifth pieces. Fractions are always defined in relation to a whole. That whole can be a single object, a quantity, or a collection of objects. It is important that students understand that there is always a whole associated with any fraction, even if it is not defined.

Interpreting fractions - The fraction $\frac{A}{B}$ can have many interpretations. Here are three common interpretations that students will learn in elementary school.

Part-whole interpretation This interpretation means A pieces out of a total of B pieces of a whole object. For example using this interpretation, the fraction $\frac{2}{3}$ could mean you have taken an object and cut it into 3 equal pieces and you have 2 of those pieces.

Measurement interpretation In this interpretation the numerator A represents the number (or count) of pieces of interest. One over the denominator, $\frac{1}{B}$, represents the size of the pieces of interest. For example using this interpretation, the fraction $\frac{2}{3}$ means you have *two*, one-third pieces.

Division interpretation This interpretation means A is divided into B pieces. How big is each piece? For example using this interpretation, the fraction $\frac{2}{3}$ means two whole objects divided into three equal pieces. Each piece is $\frac{2}{3}$ of one whole.

Resources

Board Games

- Fraction Dominos
- Numeracy: Fractions
- Fraction Formula

Math at Home

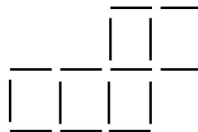
For fun at home try solving the following problem.

Toothpick Teasers

1. Create 7 squares by moving only two toothpicks.



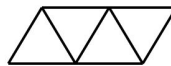
2. Create 4 small squares by moving only two toothpicks.



3. Remove 6 toothpicks completely, leaving 10 on the table.



4. **Challenge!!!** The picture shows how to make 4 equilateral triangles with 9 toothpicks. Can you make 4 equilateral triangles with just 6 toothpicks?



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Providing Resources for more fun at home

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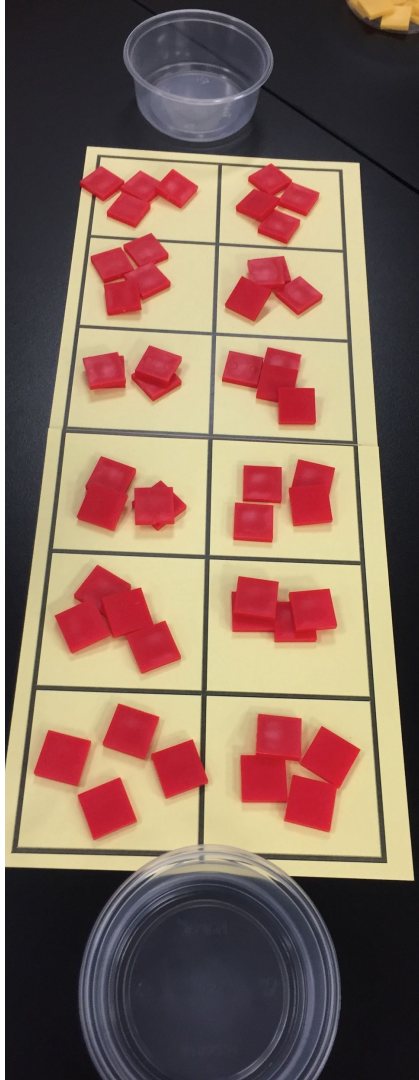
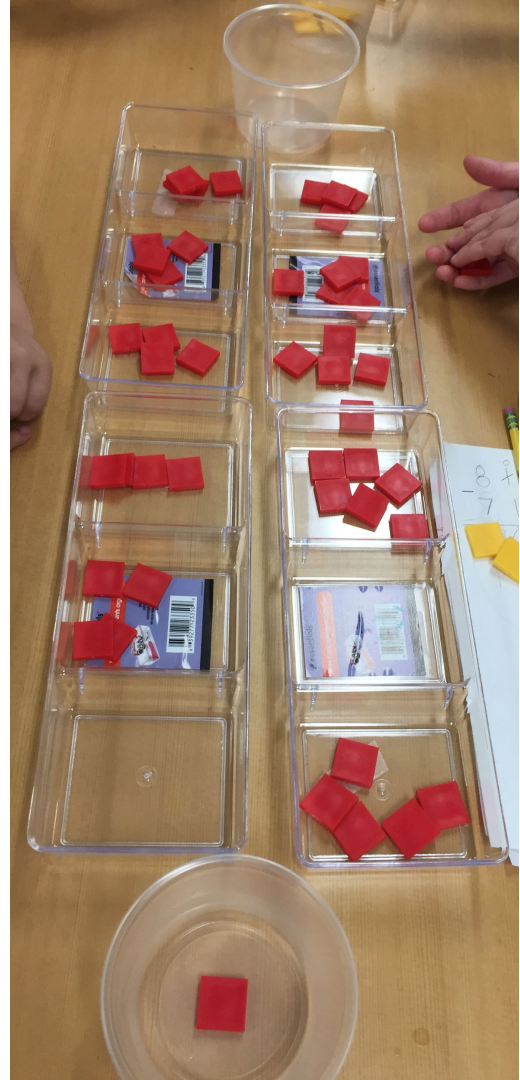
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Providing Resources for more fun at home



Math Circle Training...



DO NO

HARM

Kittitas Valley Math Circle:

Circling parents, guardians, and other adults to join in their student's Math Circle experience.

I don't know, let's figure it out together



Resources

Kittitas Valley Math Circles

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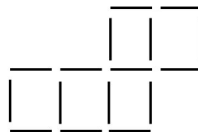
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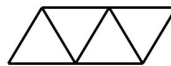
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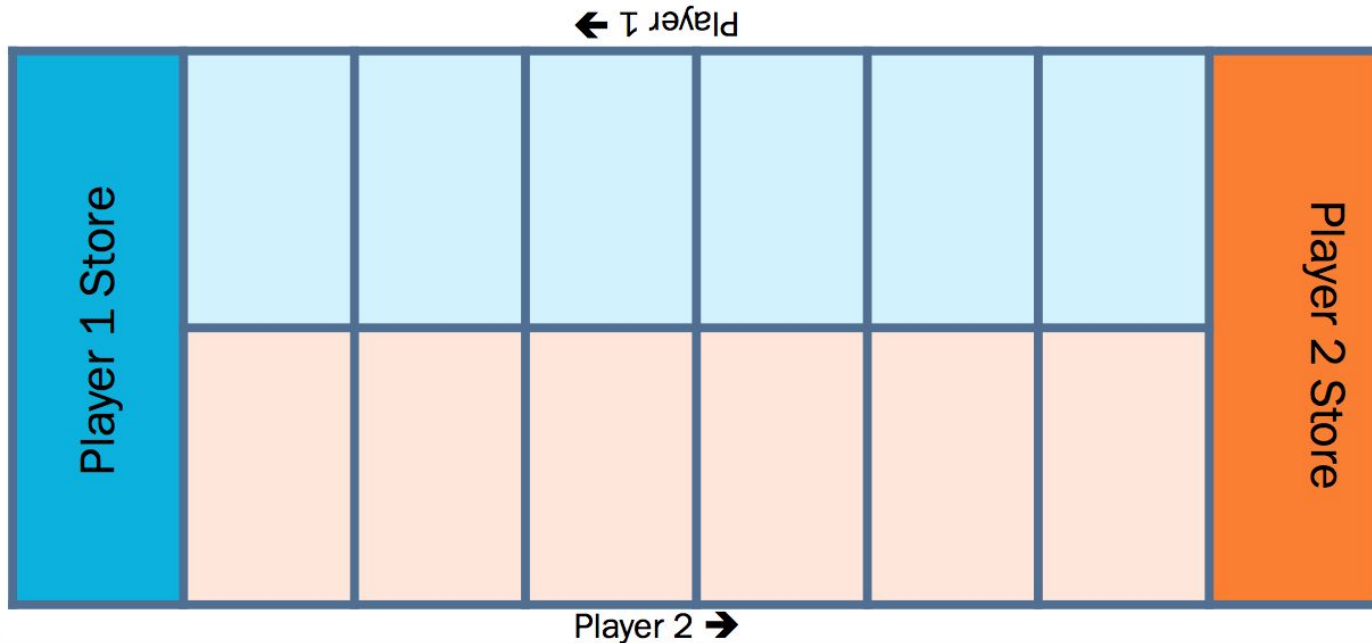


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Playing Mancala

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- The game begins with one player picking up all of the pieces in any one of the holes on their side.
- Moving counter-clockwise, the player deposits one of the stones in each hole until the stones run out.

- If you pass your own store, deposit one piece in it. If you pass into your opponent's store, skip it.
- If the last piece you drop is in an empty hole on your side, you capture that piece and any pieces in the hole directly opposite.
- Always place all captured pieces in your store.
- The game ends when all six spaces on one side of the Mancala board are empty.
- Count all the pieces in each store. The winner is the player with the most pieces.

Math 4 Love Tips for Asking Questions

- What happens if we make it smaller/easier/ shorter / lazier?
- Can we organize the data?
Picture. Table. List.
- What does your partner think?
- Can you explain your thinking to me?
- Can you give a hint without giving away the answer?
- Tell me why you think it is right.
- Can you break this into parts?
- What would you do if you did know what to do?
- How sure are you?
- What would make you more sure? What can you test?
- Can you break your pattern?
- What have you done so far that has helped you? What got you more stuck?

Do you remember how excited your children were about maths* when they were young? How they were excited by patterns in nature? How they rearranged a set of objects and found, with delight, that they had the same number? Before children start school they often talk about maths with curiosity and wonder, but soon after they start school many children decide that maths is confusing and scary and they are not a "math person". This is because maths in many schools is all about procedures, memorization and deciding which children can and which cannot. Maths has become a performance subject and students of all ages are more likely to tell you that maths is all about answering questions correctly than tell you about the beauty of the subject or the way it piques their interest.

Given the performance and test-driven culture of our schools, with over-packed curriculum and stressed out students, what can parents do to transform maths for their children? Here are some steps to take:

1 Encourage children to play maths puzzles and games. Award winning mathematician, Sarah Flannery reported that her maths achievement and enthusiasm came not from school but from the puzzles she was given to solve at home. Puzzles and games – anything with a dice really – will help kids enjoy maths, and develop number sense, which is critically important.

2 Always be encouraging and never tell kids they are wrong when they are working on maths problems. Instead find the logic in their thinking – there is always some logic to what they say. For example if your child multiplies 3 by 4 and gets 7, say – Oh I see what you are thinking, you are using what you know about addition to add 3 and 4, when we multiply we have 4 groups of 3...

3 Never associate maths with speed. It is not important to work quickly, and we now know that forcing kids to work quickly on maths is the best way to start maths anxiety for children, especially girls. Don't use flashcards or other speed drills. Instead use visual activities such as <https://bh61nm2cr3mkdgtk1dtaov18-wpengine.netdna-ssl.com/wp-content/uploads/2015/03/FluencyWithoutFear-2015.pdf>

4 Never share with your children the idea that you were bad at maths at school or you dislike it – especially if you are a mother. Researchers found that as soon as mothers shared that idea with their daughters, their daughter's achievement went down.

5 Encourage number sense. What separates high and low achievers is number sense – having an idea of the size of numbers and being able to separate and combine numbers flexibly. For example, when working out $29 + 56$, if you take one from the 56 and make it $30 + 55$, it is much easier to work out. The flexibility to work with numbers in this way is what is called number sense and it is very important.

6 Perhaps most important of all – encourage a "growth mindset" let students know that they have unlimited maths potential and that being good at maths is all about working hard. When children have a growth mindset, they do well with challenges and do better in school overall. When children have a fixed mindset and they encounter difficult work, they often conclude that they are not "a math person". One way in which parents encourage a fixed mindset is by telling their children they are "smart" when they do something well. That seems like a nice thing to do, but it sets children up for difficulties later, as when kids fail at something they will inevitably conclude that they aren't smart after all. Instead use growth praise such as "it is great that you have learned that", "I really like your thinking about that". When they tell you something is hard for them, or they have made a mistake, tell them: "That's wonderful, your brain is growing!"



* I use maths, rather than math, partly because I am from the UK and we say maths there and partly because maths is short for mathematics, it is a plural noun. Mathematics was chosen to be plural to reflect all the many parts of mathematics - drawing, modeling, asking questions, communicating, etc. Math sounds more singular and narrow (Do the math, usually means do a calculation!), and I prefer to keep the idea that maths is a multidimensional and varied set of mathematical forms and ideas.

It's working...

*“My daughter (4th grade) said that this was absolutely her favorite activity this year, and she has tried a lot of different things. It gave her a boost of confidence and enthusiasm. Meanwhile, I really enjoyed the parent program. I found the idea of "growth mindset" to be incredibly valuable, and **it has impacted how I approach my children and my own students.** It also reminded me of how fun it can be to work on math problems, especially in a setting with like-minded peers.”*

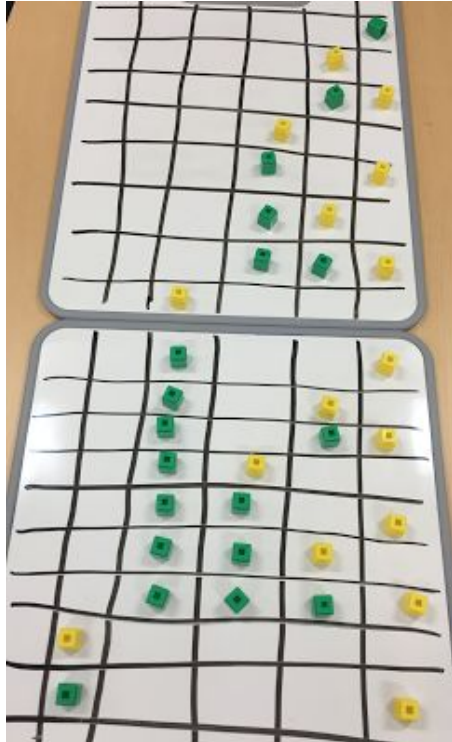
Where do we go next?

- Incorporating more faculty into the program.
- Writing grants and working with on-campus foundation support.
- Publishing STEM activities in the local paper - our kids are not only doing sports!
- Math Circle in Spanish for middle school students.



Global Math Week - 10/10

<https://gmw.globalmathproject.org/>



My Lesson Plan Writeup:

<https://sites.google.com/site/drbrandymath/mathcircles/explodingdotskeepblowingupwiththenewglobalmathweek>



**Thank you to JMM/MAA, the organizers,
this awesome audience, my great leadership
team, and our sponsors...**



**[http://www.cwu.edu/math/
kittitas-valley-math-circle](http://www.cwu.edu/math/kittitas-valley-math-circle)**

Dr. Brandy Wieggers

brandy.wieggers@cwu.edu, [@drbrandy](#)

