



**Tools for Building Conceptual Understanding in Geometry**

Genni Steele  
9:30-10:30  
Convention Center  
Room 103/104



What is conceptual understanding?



***"Conceptual Understanding - comprehension of mathematical concepts, operations, and relations"***

*Adding It Up Helping Children Learn Mathematics*, National Research Council, 2001  
National Academy of the Sciences



**Declarative (Conceptual) Knowledge**

- Knowledge rich in relationships and understanding.
- It is a connected web of knowledge, a network in which the linking relationships are as prominent as the discrete bits of information.
- Examples of concepts: square, square root, function, area, division, linear equation, derivative, polyhedron.
- By definition, conceptual knowledge cannot be learned by rote. It must be learned by thoughtful, reflective mental activity.
- Is it possible to have conceptual knowledge/understanding about something without procedural knowledge?

*Concept-Rich Mathematics Instruction*, by Meir Ben-Hur



**Procedural Knowledge**

- Knowledge of formal language or symbolic representations.
- Knowledge of rules, algorithms, and procedures.
- Can procedures be learned by rote?
- Is it possible to have procedural knowledge without conceptual knowledge?

*Concept-Rich Mathematics Instruction*, by Meir Ben-Hur



No matter how lucidly and patiently teachers explain to their students, they cannot **understand** for their students.

~Schifter & Fosnot (1993)

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**My Story**

$y = 2x + 3$

**My Story**

<http://oldcomputers.net/picaapple-system.jpg>

What are available tools?

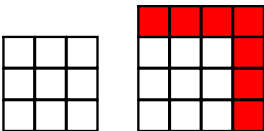
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**Common Core State Standards**  
Standards for Mathematical Practice

**5. Use appropriate tools strategically**  
*Mathematically proficient students consider the available tools when solving a mathematical problem. These may include paper and pencil, concrete models, ruler, protractor, computer applications, or dynamic software programs.*

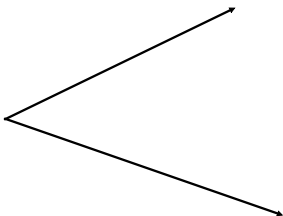
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**Concept of Square Root**

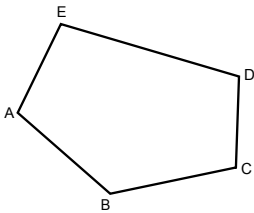


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**Angles Measure**



Angles Measure



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Angle Measure

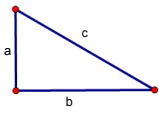
Dynamic Software

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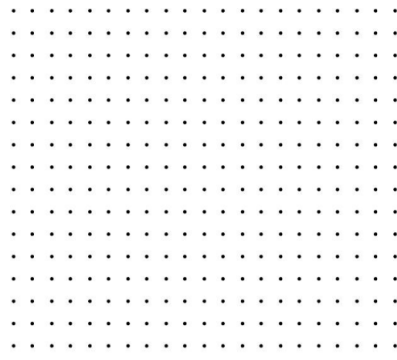
What, if any, impact has the use of technology or other tools had on your teaching?

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Pythagorean Theorem

$$a^2 + b^2 = c^2$$


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Pythagorean Theorem

Dynamic software

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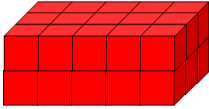
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Volume and Surface Area



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Volume and Surface Area



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Volume and Surface Area  
Dynamic software

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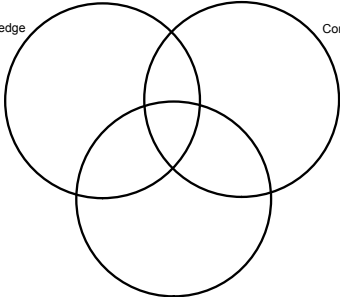
A question we need to ask ourselves as we work with students and choose a tool -

Is it something that will engage our students in the activity or is it just another way to "deliver" instruction?


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Tools can create the illusion of active learning.

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TPACK.org



Keep in mind:

- Learning Goals
- Pedagogical Decisions
- Selection and Sequencing of Activities
- Formative and Summative Assessment
- Tools and Resources



If we teach today as we taught yesterday,  
we rob our children of tomorrow.

John Dewey



**Math Solutions.**  
FOUNDED BY MARILYN BURNS

***Thank you***

***Booth #1534***

Slides available at:  
[www.mathsolutions.com/presentations](http://www.mathsolutions.com/presentations)