



Using Virtual Manipulatives to Enhance Student Understanding

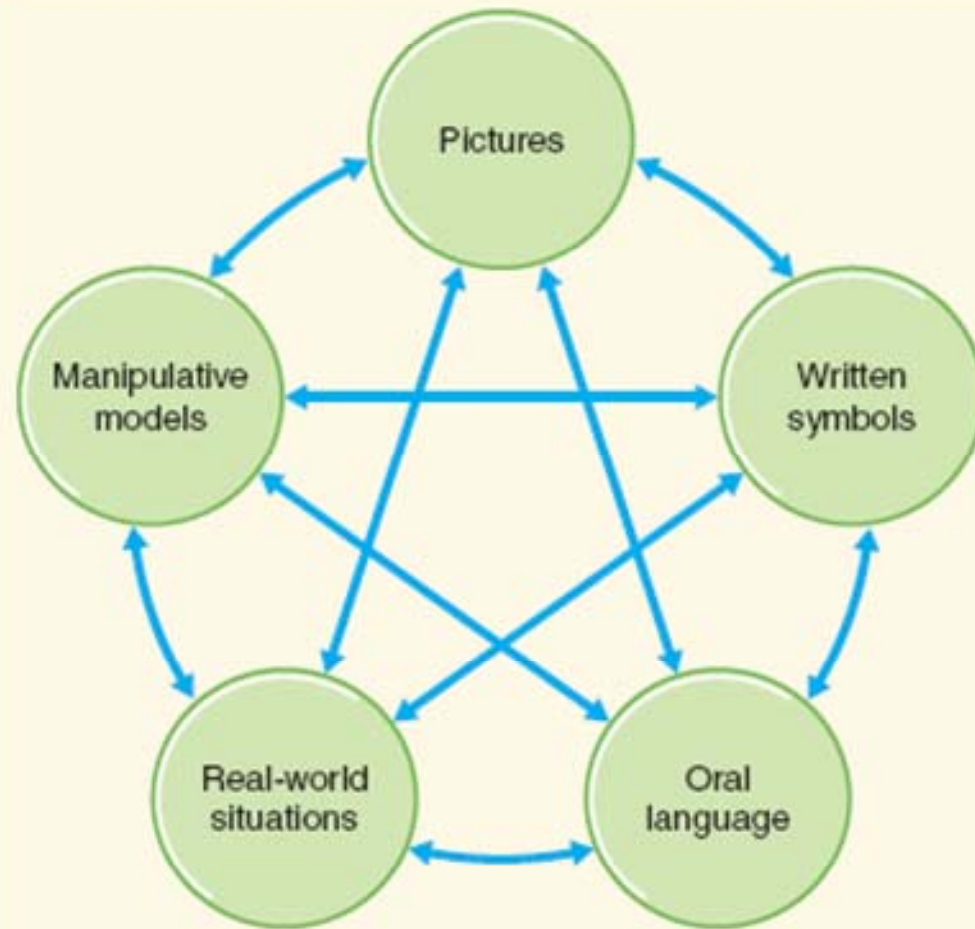
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The Role of Technology in the Teaching and Learning of Mathematics

- What can VM's be used for?
- When should VM's be used?
- What is/are the role(s) of the teacher when VM's are used?
- What can't VM's do?

Building Connections in Meaning





Virtual Manipulatives

- **What is a manipulative?**
 - *A tool that students can put their hands on and alter its form in some way.*


- **How does being “virtual” change the tool?**
 - *Instead of having a physical block or tool, the instrument was created on the computer. Instead of putting their hands on it, students can alter the forms with the mouse and computer commands.*



High School Virtual Manipulatives

Catalog Pages

- National Library of Virtual Manipulatives
 - <http://nlvm.usu.edu/en/nav/vlibrary.html>
- Math Tools
 - <http://www.mathforum.org/mathtools>
- Illuminations:
 - <http://illuminations.nctm.org>
- Manipula Math with Java
 - <http://www.ies.co.jp/math/java/>
- NorthEast & Islands Regional Technology in Education Consortium
 - <http://www.neirtec.org/math/#applets>



Connecting Algebra Equation Meaning to Physical Objects

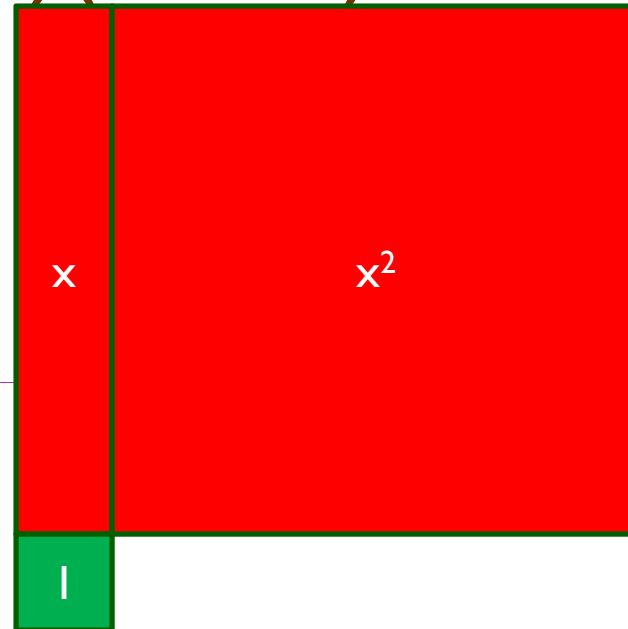
- Balance beam and Negatives
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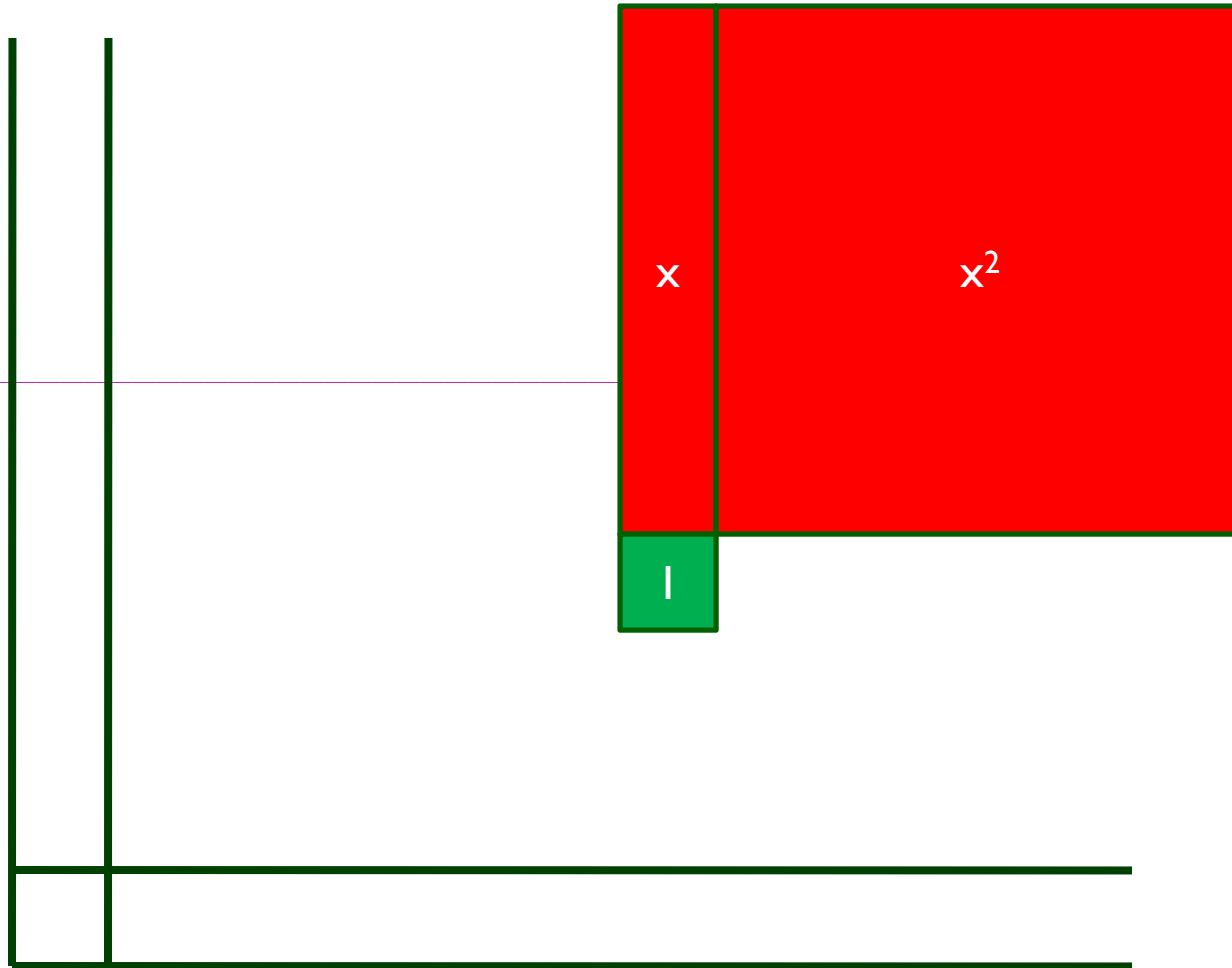
Advanced Mathematics – Manipula Math

- Behavior of Parabolic Focus
- Trigonometric Applets
 - Sin x + Cos x
 - Developing a relationship between unit circle, sine values, and central angle measures.
- Calculus

Multiply $(x + 2)(2x + 3)$

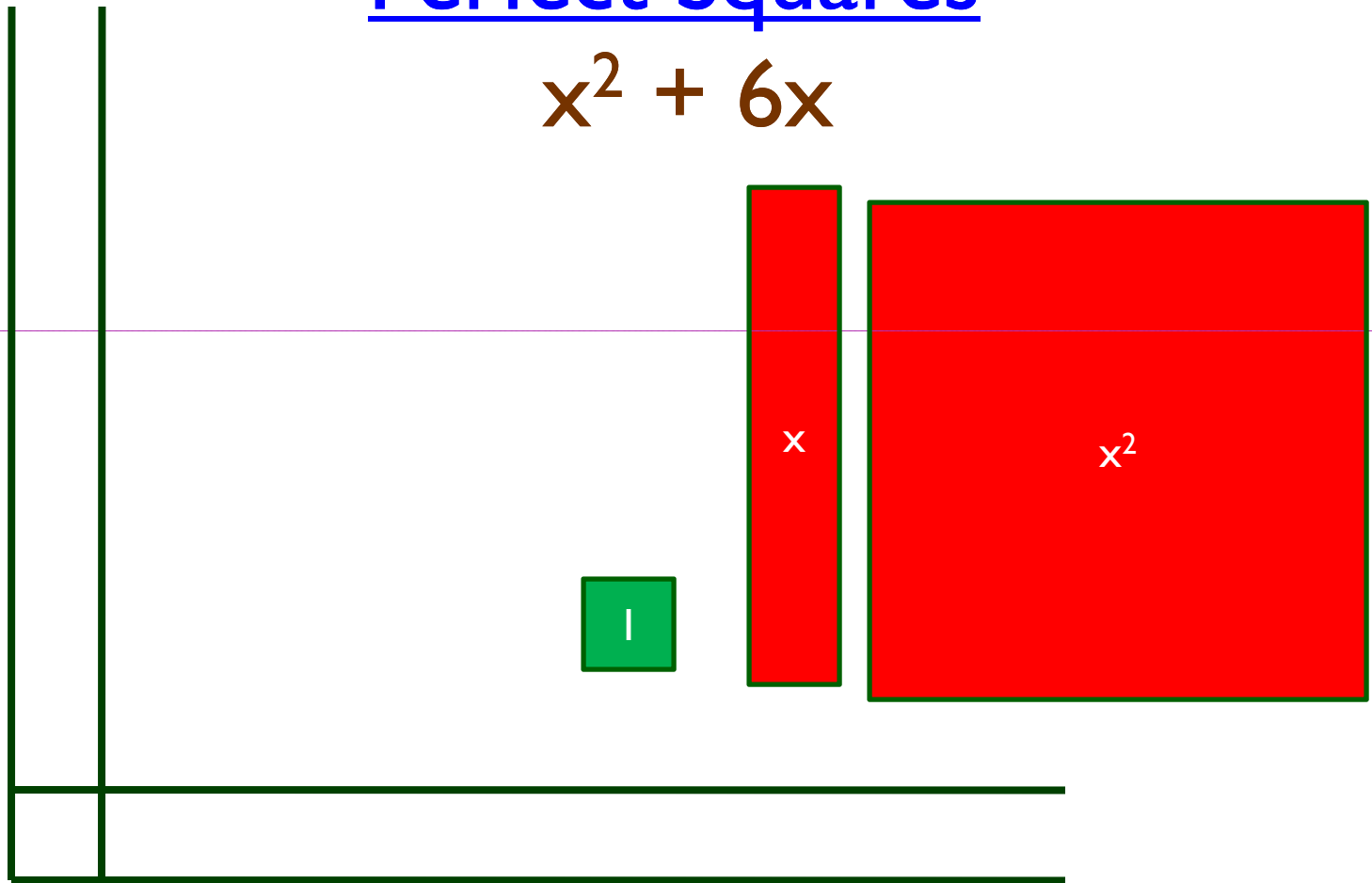


Factor $x^2 + 7x + 12$

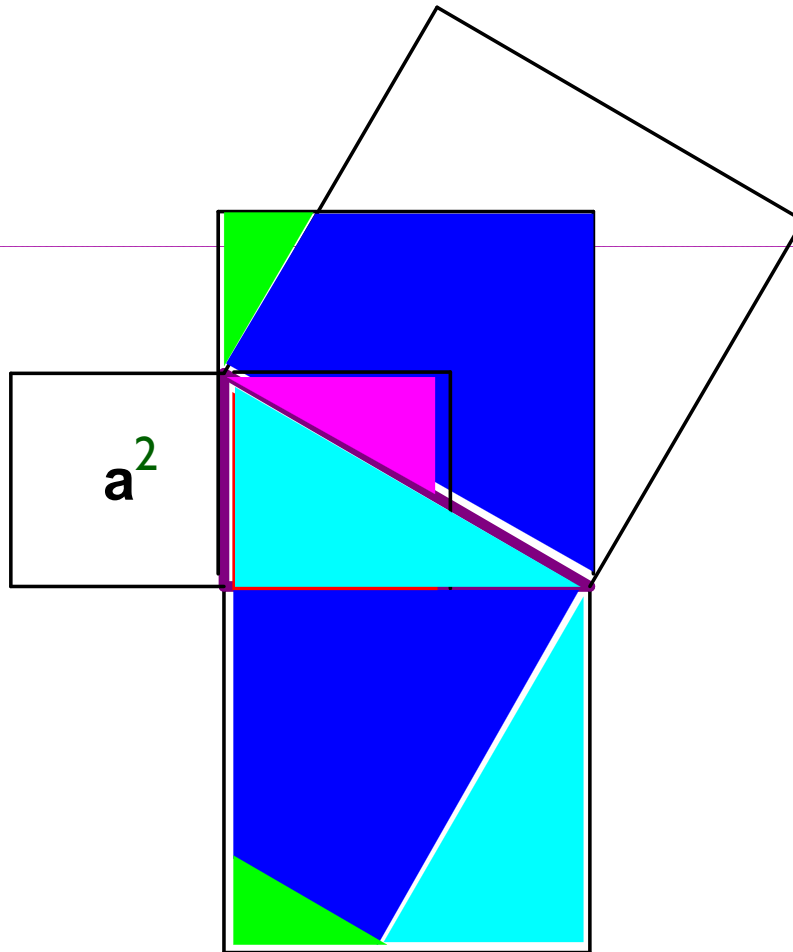


Demonstrating the Meaning of Perfect Squares

$$x^2 + 6x$$



Demonstrating the Pythagorean Theorem



NLVM

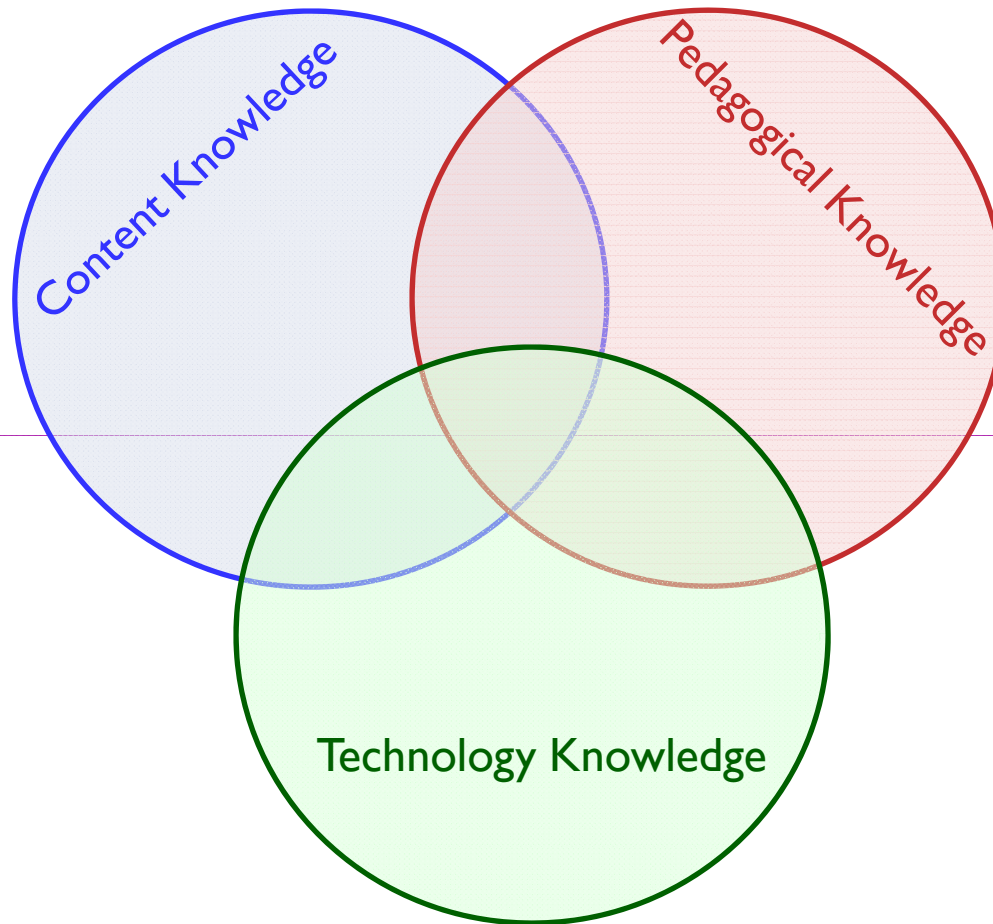
IES



Don't Forget Dynamic Geometry Software!

- The Geometer's Sketchpad
- Geogebra (<http://www.geogebra.org>)
- WinGeom
(<http://math.exeter.edu/rparris/winggeom.html>)

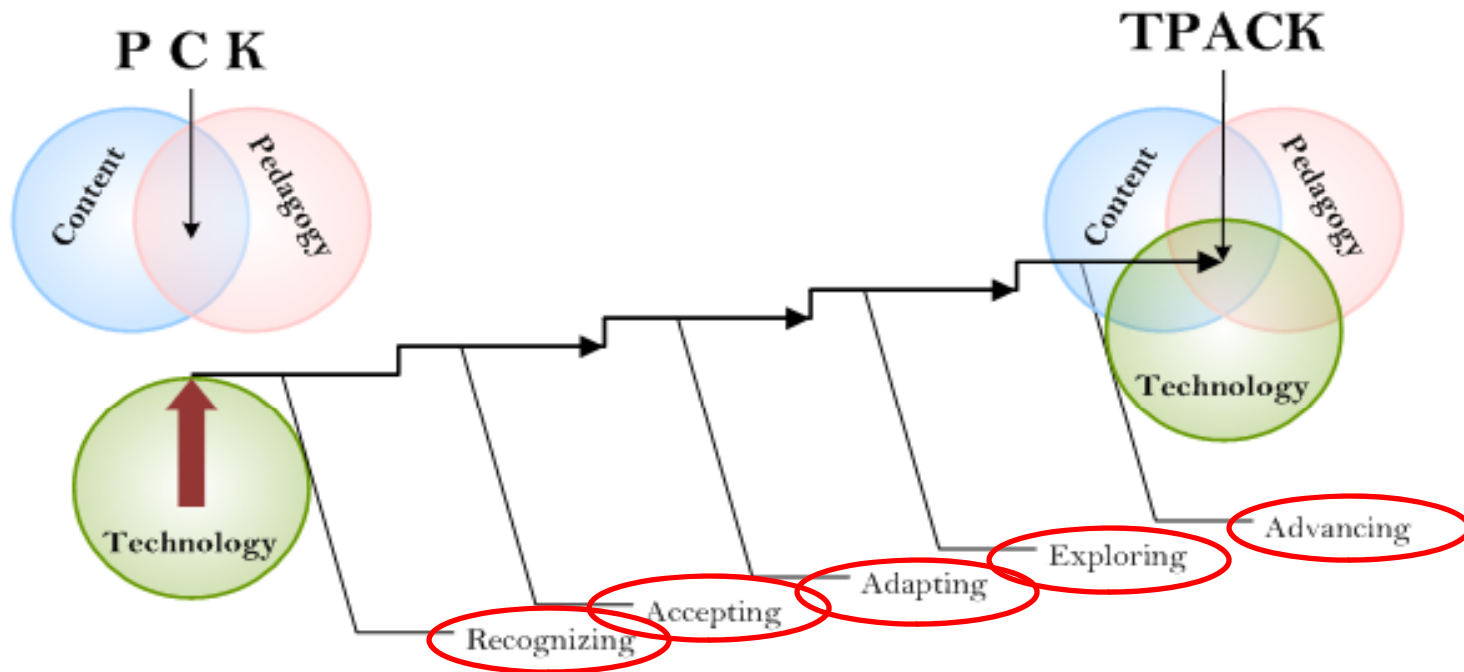
TPACK



AMTE TPACK Framework

<http://www.amte.net/Math%20TPACK%20Framework.pdf>

5 Stages of TPACK Growth



Recognizing (knowledge):
 Teachers are able to use the technology and recognize the alignment of the technology with subject matter content yet do not integrate the technology capabilities into the teaching and learning of subject matter.

Accepting (implementation):
 Teachers take real steps to integrate technology as a tool to aid teaching and learning subject matter content with an appropriate technology.

Adapting (adaptation):
 Teachers take real steps to integrate technology as a tool to aid teaching and learning subject matter content with an appropriate technology.

Exploring (exploration):
 Teachers take real steps to integrate technology as a tool to aid teaching and learning subject matter content with an appropriate technology.

Advancing (advancement):
 Teachers take real steps to integrate technology as a tool to aid teaching and learning subject matter content with an appropriate technology.



Thank You!

- This PowerPoint is available at <http://applets.yolasite.com>
 - Questions?
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