

# Engaging Students (and Teachers!) in Learning Mathematics Using the TPACK Framework

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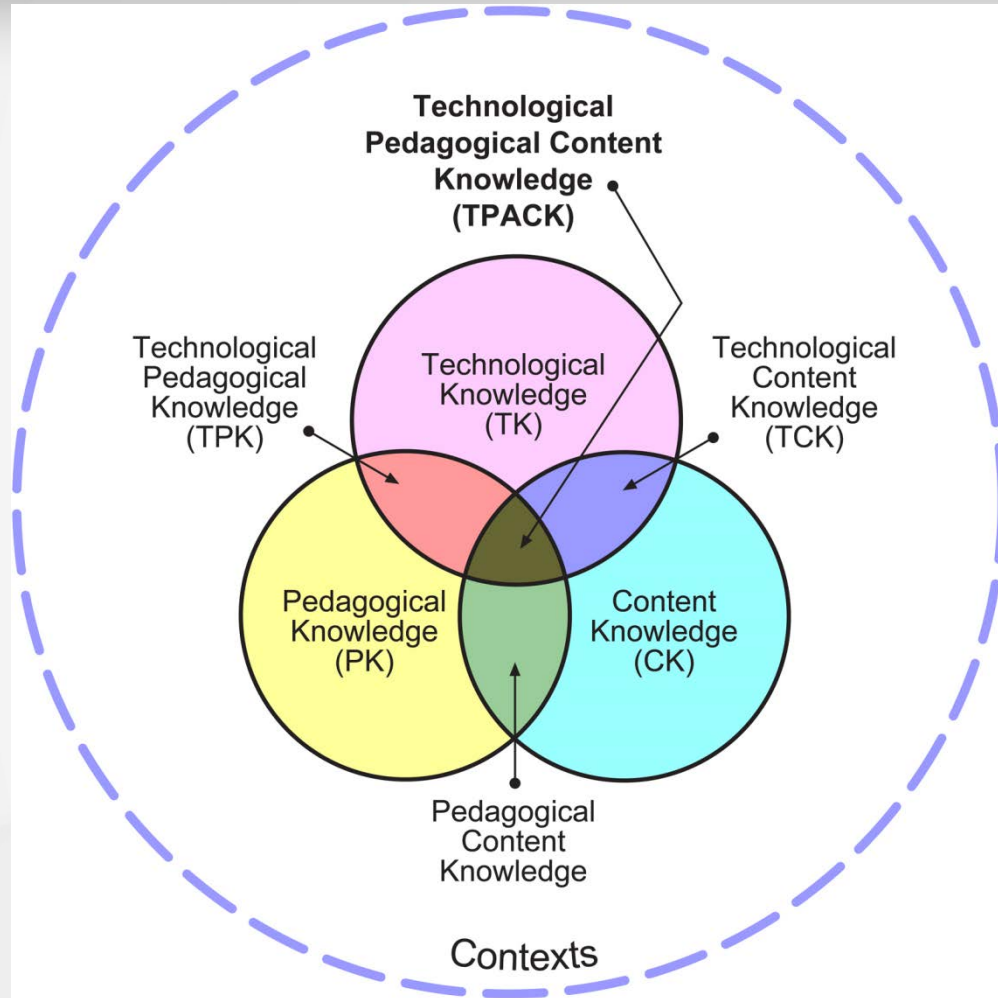
# Sharing Technology Experiences

## ***Guiding Questions:***

- 1) What access do you have to content-specific math technology?
- 2) How do you currently use technology in teaching math?



# What is TPACK?



**Technology,  
Pedagogy,  
And  
Content  
Knowledge**



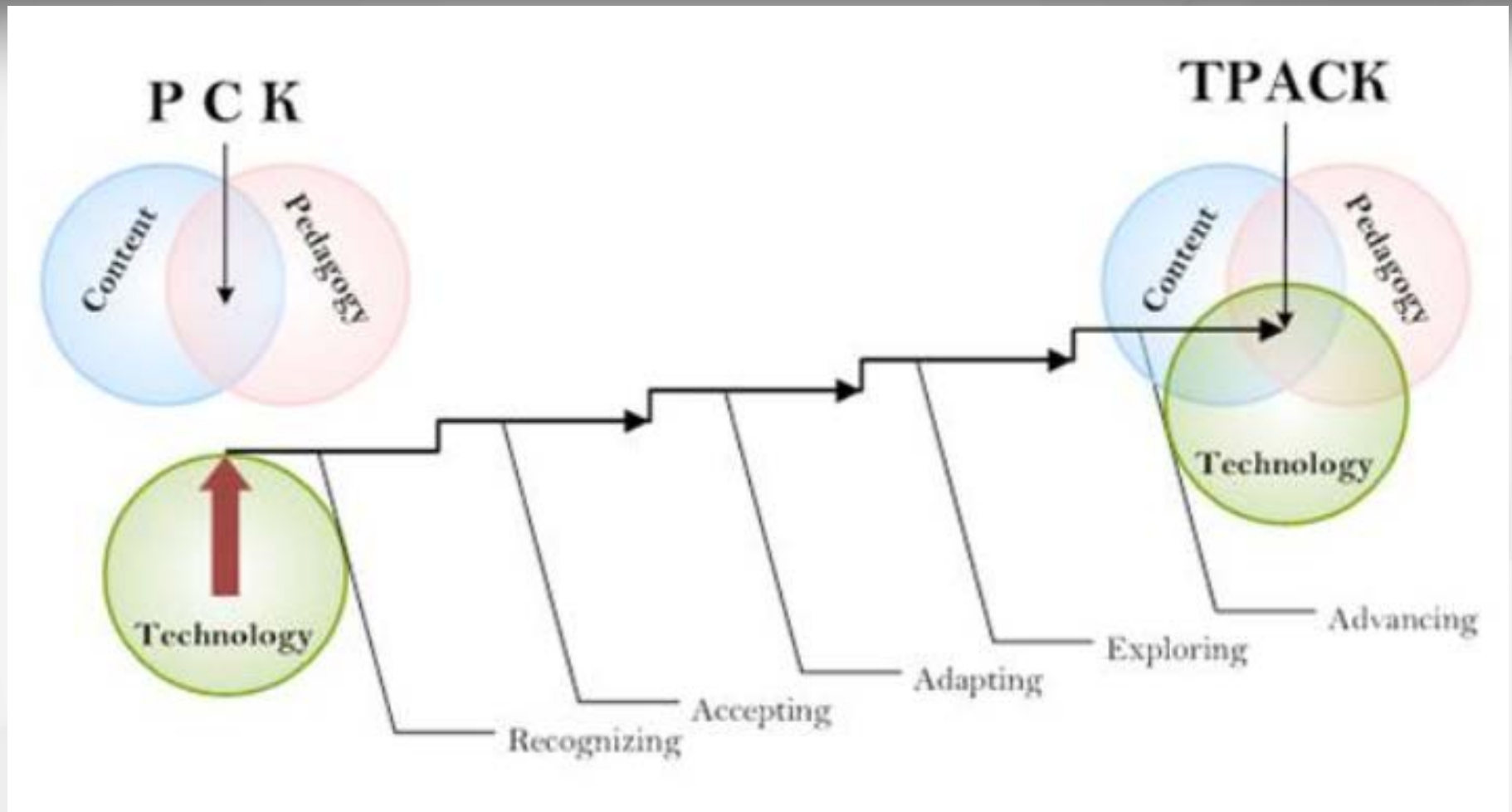
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# Why TPACK?

- TPACK emphasizes the purpose for incorporating technology; knowledge of students' understandings, thinking, and learning; knowledge of curriculum and materials that integrate technology; and instructional strategies and representations that impact the teaching and learning of mathematics with technology (Neiss, 2005; Neiss et al., 2009).
- TPACK is considered a useful organizational structure to define what teachers need to know in order to effectively integrate technology in mathematics teaching and learning (Archambault & Crippen, 2009).



# Five-Stage Development Process to Integrating TPACK in Math





# Five-Stage Development Process to Integrating TPACK in Math

## **Stage 1: Recognizing** (*knowledge*)

ability to use technology & recognize the alignment of technology with mathematics content; do not yet integrate the technology in teaching & learning of mathematics.

## **Stage 2: Accepting** (*persuasion*)

form favorable or unfavorable attitudes toward teaching & learning mathematics with an appropriate technology.

## **Stage 3: Adapting** (*decision*)

engage in activities that lead to a choice to adopt or reject teaching & learning mathematics with technology

# Five-Stage Development Process to Integrating TPACK in Math

## **Stage 4: Exploring** (*implementation*)

actively integrate teaching & learning of mathematics with technology

## **Stage 5: Advancing** (*confirmation*)

evaluate the results of the decision to integrate teaching & learning mathematics with technology

# Descriptors for Major Themes in Math Teacher TPACK Development Model

Theme	Descriptors
Curriculum & Assessment	<ul style="list-style-type: none"><li>• Curriculum, the treatment of the subject matter</li><li>• Assessment, assessing the students' understandings</li></ul>
Learning	<ul style="list-style-type: none"><li>• Focus on subject matter (i.e., learning of mathematics topics)</li><li>• Demonstration of conceptions of how students learn (development of students' thinking skills)</li></ul>
Teaching	<ul style="list-style-type: none"><li>• Focus on subject matter (i.e., learning of mathematics topics)</li><li>• Instructional approaches</li><li>• Classroom environment</li><li>• Professional development</li></ul>
Access	<ul style="list-style-type: none"><li>• Usage (whether or not students are allowed to use technology)</li><li>• Barriers (how teachers address barriers to technology integration)</li><li>• Availability (how technology makes higher levels and more mathematics available for investigation for greater numbers of more and more diverse students.</li></ul>



# Mini-Lesson: Elementary

**Technology:** Geometer's Sketchpad (GSP)

**Pedagogy:** Whole group directed instruction, small group discussion, and individual exploration

**Content Knowledge:** Models of Multiplication (Jumping, Grouping, and Area)



# Mini-Lesson: Middle Grades

**Technology:** Excel

**Pedagogy:** Whole group data collection and individual exploration

**Content Knowledge:** Statistics (measures of central tendency and data displays)



# Mini-Lesson: High School

**Technology:** GeoGebra (GGB)

**Pedagogy:** Whole group directed instruction, small group discussion, and individual exploration

**Content Knowledge:** Exploring Transformations (reflections, rotations, translations, glide-reflections)

Available at: <http://www.maa.org/publications/periodicals/loci/resources/exploring-geometric-transformations-in-a-dynamic-environment-activity-1-exploring-reflections>

# Additional Technology Resources

**Trimble (formerly Google) Sketch Up:**

<http://www.sketchup.com/download>

**Google Earth Download:**

<http://www.google.com/earth/index.html>

**National Library of Virtual Manipulatives**

<http://nlvm.usu.edu/>

**Shodor Interactivate**

<http://www.shodor.org/interactivate/>

**National Council of Teachers of Mathematics (NCTM) Illuminations**

<http://illuminations.nctm.org/>



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# Additional Technology Resources

## **Texas Instruction (TI) Education Activities Exchange**

[http://education.ti.com/educationportal/activityexchange/activity\\_list.do?cid=us](http://education.ti.com/educationportal/activityexchange/activity_list.do?cid=us)

## **TI-Nspire Document Player**

<http://education.ti.com/calculators/products/US/document-player/>

## **Grapher Software**

<http://www.padowan.dk/>

## **When Will I Use Math? We Use Math.org**

<http://weusemath.org/>

## **Get the Math**

<http://www.thirteen.org/get-the-math/>



# Additional Technology Resources

## **Mathematics Assessment Project**

<http://www.map.mathshell.org/materials/index.php>

## **PhET Interactive Simulations**

<http://phet.colorado.edu/en/simulations/category/math>

## **Wolfram CDF Player – Demonstrations Project**

Download for CDF Player: <http://www.wolfram.com/cdf-player/>

Demonstrations Project: <http://demonstrations.wolfram.com/>

## **Illustrative Mathematics**

<https://www.illustrativemathematics.org/>





# Free Apps for Number & Operations

## Basic Math



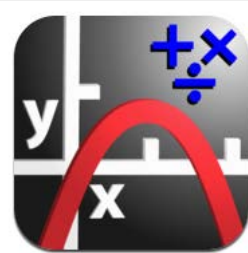
### TouchCalc



### Math Ninja



## Free GraCalc



### Math Drills Lite



### King of Math



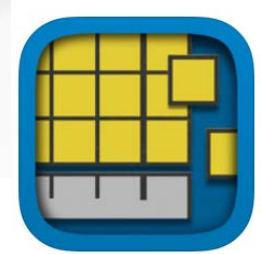
## Pocket CAS Lite



### Number Line



### Number Pieces



# Free Apps for Algebraic Thinking

**Point Plotter**



**Quick Graph**



**Formulas Free**



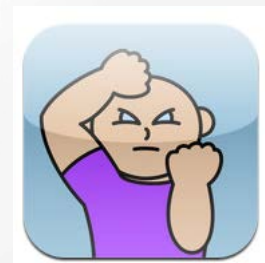
**Equation Solver**



**Trinomial Factoring**



**Algebra Champ**



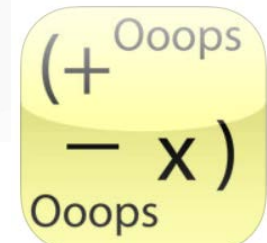
**7<sup>th</sup> Grade Math**



**Exponents**



**Ooops**



# Free Apps for Geometry

**iFormulas**



**Units**



**Fast Fractals**



**tangram!**



**Geoboard**



**Geometry Pad**



**Isosceles: Geo Sketchpad**



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# References

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- Niess, M. L., et.al (2009). Mathematics teacher TPACK standards and development model. *Contemporary Issues in Technology and Teacher Education*, 9(1). Retrieved from <http://www.citejournal.org/vol9/iss1/mathematics/article1.cfm>



# Contact Information

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