3. Find \( x \)

Here it is...
Or, As it is Sometimes Called:
The Hardest & Most Frustrating Part Of My Day...

3. Find x

Here it is...
Michael J. Kennedy, Ph.D.
Assistant Professor of Special Education
MKKennedy@Virginia.edu
Twitter: KManXC

MSI; June 2014
They say this thing is gonna close.

They say when?
We are Told/Asked to Differentiate
What Precisely Do You Mean By That?
Example of RTI

- TIER 1: Universal Screening & Benchmarking of All Students
- TIER 2: Identifying Specific Strengths & Weaknesses & Progress Monitoring
- TIER 3: Diagnostic Testing & Intensive Progress Monitoring
TIER 1
Universal Screening & Benchmarking of All Students

TIER 2
Identifying Specific Strengths & Weaknesses & Progress Monitoring

TIER 3
Diagnostic Testing & Intensive Progress Monitoring

RESPONSE TO INTERVENTION (RTI)
Building UDL into Instruction

(Abruzzini & Dalton, 2010)
Building UDL into Instruction

(Abruzzini & Dalton, 2010)
How Must They Feel?
Roadmap of Foreign Country in Foreign Language
And Then...
Find 123 Falschung Street, Apartment C
Without an Interpreter, or Enough Money
There’s No One Practice or Approach that Will Work 100% Of the Time With 100% of Students
Practices That Have Worked For Some Students Under Certain Circumstances
Teaching Vocabulary Terms & Concepts
In Math & Science
There are Countless Concepts & Terms that are Essential for Understanding & Applying Advanced Content
Although a strong Vocabulary is not Sufficient for Success, it is A Necessary Prerequisite to Accompany & Underwrite Higher Order Skills...
Practice
Select The “Right” Words to Teach
Not Enough Time
Massive Amount of Vocabulary to Learn!
Target

Strategy
Carefully Select Terms/Concepts
Select Terms That Are “Powerful”
Used Regularly, Specifically Included in Standards, Needed to Understand Other Content
Terms students have a hard time learning,
Abstract Meanings
Some Terms 8th Grade Science Teachers Told Me Were Essential

- Hypothesis
- Independent Variable
- Dependent Variable
- Control Group
- Constant
- Cell
- Theory
- Nucleus
- Mitochondria
- Photosynthesis
- Cell Division
- Ecosystem
- Ribosome
- Inertia
- Chemical Property/Change
- Acceleration
- Force
- Velocity
Quiz Yourself:

• Biodegradable
• Burette
• Botany
• Biology
• Beaker
Take a Minute

Pick a Term That is Essential To Your Teaching

You Will Use This Term for an Activity, so Make it a Good One!
Practice
Provide Explicit, Student-Friendly Definition of Term(s)
Facilitate Conversations with Students Using Vocab Terms
Help Students Elaborate on Word Meanings & Discuss in and out of Context
“I like the way you are reasoning mathematically...”
Use Examples & Non-Examples
Take a Minute

What is the Student-Friendly Definition for the Term?

Provide an Example And Non-Example
Practice
Realize Many Struggling Students Lack Essential Background Knowledge
Make it Concrete

“Anchor”
Photosynthesis

• Process plans use to convert the sun’s light into glucose (energy) used to create processes related to life.
Photosynthesis

• Process plans use to convert the sun’s light into glucose (energy) used to create processes related to life.

Not Very Concrete!!!
Start Simple
Visualizations Are Essential!
Anchor: People Grow When We Eat Food
Calories, Nutrients, etc., Converted to Energy for Life
<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Math</strong></td>
<td><strong>Calculations and Computations</strong></td>
</tr>
<tr>
<td><strong>Algebra</strong></td>
<td>Symbols, patterns, changes, variables and quantitative relationships!</td>
</tr>
<tr>
<td><strong>Data Analysis</strong></td>
<td>Graphs and statistics! More fun than it sounds.</td>
</tr>
<tr>
<td><strong>Geometry &amp; Measurement</strong></td>
<td>Modeling space using math</td>
</tr>
<tr>
<td><strong>Numbers &amp; Operations</strong></td>
<td>Numbers and their meaning; and how to work with them!</td>
</tr>
<tr>
<td><strong>Probability</strong></td>
<td>Understanding chance and statistics</td>
</tr>
<tr>
<td><strong>Ratio, Proportion, &amp; Percent</strong></td>
<td>Seeing numbers in relation to one another</td>
</tr>
<tr>
<td><strong>Free Movies</strong></td>
<td>Check out our free math movies!</td>
</tr>
<tr>
<td><strong>See All Math Movies</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Help</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Free</strong></td>
<td></td>
</tr>
<tr>
<td><strong>BrainPOP Educators</strong></td>
<td></td>
</tr>
</tbody>
</table>
Be Careful About Complexity & Accuracy of Internet Videos (e.g., Khan Academy, You Tube)
Force

Need to Worry About Misconceptions Based on Background Experiences...
MAY THE FORCE BE WITH US
Force Someone to do Something
Simple Version of Concept + Visualization
Apply Knowledge in Context (Adding Scaffolding)
Forge Connections
To Other Areas

General Thrust Equation

\[
F = \frac{[mV]_2 - [mV]_1}{(t_2 - t_1)}
\]

Thrust is a force.

Force = change in momentum with time

\[
\dot{m} = \text{mass flow rate} = \text{mass/time}
\]

\[
\dot{m} = \rho \times V \times A
\]

where \( \rho = \text{density} \), \( V = \text{velocity} \), \( A = \text{area} \)

If \( p_e \neq p_o \):

\[
F = \dot{m}_e V_e - \dot{m}_o V_0 + (p_e - p_0) A_e
\]

If \( p_e = p_o \):

\[
F = \dot{m}_e V_e - \dot{m}_o V_0
\]
Take a Minute

What Background Knowledge is Needed to Understand this Term? How Could You Teach This Info? What Anchor Would Be Relevant for Students?

Find At Least One Visual to Represent the Term
Practice
Teach Terms with Useful Morphological Parts
Biodegradable
Bio / de / grad / able
Sample Terms with Useful Morphological Parts

• Photosynthesis
• Biodiversity
• Renewable
• Prediction
• Bioluminescence
• Compression
• Decomposition
• Hydrocarbon
• Interference
Sample Terms with Useful Morphological Parts

- Photo / synthesis
- Bio / divers / ity
- Re / new / able
- Pre / dic / tion
- Bio/ lumin / escence
- Com / press / ion
- De / compos / ition
- Hydro / carbon
- Interfere / nce
Set Aside Time to Explicitly Teach Word Parts

Bio Means Life
Explicit Instruction in Prefix & Suffix Meaning

Explicit Instruction in Prefix & Suffix Meaning

An Approach to Word Learning Using Content Acquisition Podcasts (CAPs)

Michael J. Kennedy, Ph.D.
University of Virginia
Jade Wexler, Ph.D.
University of Maryland

https://vimeo.com/37764041
An Approach to Word Learning Using Content Acquisition Podcasts (CAPs)

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Take a Minute

Break Your Term into Morphemes You can Teach.

How will you Teach These Meanings? Do You Need to Augment Plans for Background Knowledge?
STRATEGY → EXECUTION → SUCCESS
## Semantic Feature Analysis (SFA)

<table>
<thead>
<tr>
<th>Terms</th>
<th>Convex</th>
<th>Equilateral</th>
<th>Equiangular</th>
<th>4-sided</th>
<th>3-sided</th>
<th>Opposite sides are parallel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<td>Rectangle</td>
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<td></td>
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<tr>
<td>Polygon</td>
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<td>Equiangular Polygon</td>
<td>Parallel Sides</td>
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<td>Triangle</td>
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<tr>
<td>Pentagon</td>
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</tr>
<tr>
<td>Circle</td>
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<td>Polygon</td>
<td>Equilateral Polygon</td>
<td>Equiangular Polygon</td>
<td>Parallel Sides</td>
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<td>Polygon</td>
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<tr>
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<td>+</td>
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</tr>
<tr>
<td><img src="image" alt="Triangle" /></td>
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<td>-</td>
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<td></td>
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<tr>
<td><img src="image" alt="Pentagon" /></td>
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<tr>
<td>Polygon</td>
<td>Equilateral Polygon</td>
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<td><img src="image3.png" alt="Image" /></td>
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<tr>
<td>Polygon</td>
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</tr>
<tr>
<td><img src="image1.png" alt="Polygon" /></td>
<td>+ (irregular)</td>
<td>-</td>
<td>-</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><img src="image2.png" alt="Polygon" /></td>
<td>+ (irregular)</td>
<td>-</td>
<td>-</td>
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<tr>
<td><img src="image3.png" alt="Polygon" /></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Using the Keyword Mnemonic Strategy to Learn Vocabulary Terms

Michael J. Kennedy, Ph.D.
University of Virginia

Jade Wexler, Ph.D.
University of Maryland
Take a Minute

Create a SFA Table for Your Term,

And/Or,

Brainstorm a Keyword & Find an Image & Remembering Story for Using this Strategy
Practice
Content Enhancement
CONCEPT DIAGRAM

1. CONVEY CONCEPT
2. OFFER OVERALL CONCEPT
3. NOTE KEY WORDS
4. CLASSIFY CHARACTERISTICS:
   Always Present
   Sometimes Present
   Never Present

5. EXPLORE EXAMPLES

   Examples:

   Non-Examples:

6. PRACTICE WITH NEW EXAMPLE

7. TIE DOWN A DEFINITION

Adapted from The Concept Diagram Routine. Copyrights for the template are held by the authors of The Concept Diagram Routine.
The cell membrane is a thin, flexible covering composed of a phospholipid bilayer & proteins. It acts as a boundary and barrier, regulating the transport of substances in and out of plant and animal cells. It is never rigid or impactive, and is non-restrictive. Examples: plasma membrane, membranes around cell organelles. Nonexamples: cell wall, small intestine.
# Anchoring Table

<table>
<thead>
<tr>
<th>Unit</th>
<th>Name:</th>
<th>Date:</th>
</tr>
</thead>
</table>

**Known Information**

<table>
<thead>
<tr>
<th>Known Concept</th>
<th>New Concept</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Characteristics of Known Concept</th>
<th>Characteristics Shared</th>
<th>Characteristics of New Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
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<td></td>
</tr>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**Understanding of the New Concept:**

---

ANCHORS

**Linking Steps:**

1. Announce the New Concept
2. Name Known Concept
3. Collect Known Information
4. Highlight Characteristics of Known Concept
5. Observe Characteristics of New Concept
6. Reveal Characteristics Shared
7. State Understanding of New Concept

---

Adapted from The Concept Anchoring Routine. Copyrights for the template are held by the authors of The Concept Anchoring Routine.
### Anchoring Table

<table>
<thead>
<tr>
<th>Known Concept</th>
<th>New Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Stages of Development</td>
<td>United States' Relationship with England</td>
</tr>
<tr>
<td>Infancy</td>
<td>Initial Colonization</td>
</tr>
<tr>
<td>Childhood</td>
<td>Established Colonies</td>
</tr>
<tr>
<td>Adolescence/Independence</td>
<td>Rebellion/Revolution</td>
</tr>
<tr>
<td>Adulthood</td>
<td>Independent Nation: United States</td>
</tr>
</tbody>
</table>

#### Characteristics of Known Concept
- Infancy: Total Dependency/supplies, sustenance
- Childhood: Exclusive Relationship/guidance, nurturing, trading
- Adolescence/Independence: Establish Own Identity/excessive rules, taxes, control, boycott
- Adulthood: Normalized Relations/respect, peace, alliance

#### Characteristics Shared
- Birth:  
- Old Age:  
- Death:  
- Puberty:  
- Middle Age:  
- Conception:  

#### Understanding of the New Concept:
The United States' relationship with England encompassed many stages including its infancy (initial colonization), childhood (establish colonies), adolescence (rebellion), and adulthood (independence - new nation).
Take a Minute

Using the Concept Diagram Organizer and Anchoring Organizer, What Further Insights Can You Learn About How you Might Teach This Term?
Practice
Ensure Proper Dosage of Meaningful, Repeated Exposures
Practice
Make Explicit Connections to Other Content Areas
Take a Minute

How does your Term Connect To Other Subject Areas?

How will you help Students keep it all Straight?
Practice
Pull It All Together Using Multimedia
Process plants use sunlight oxygen carbon dioxide water
A Few Practices for The Naughty List...
I am writing down everything I could possibly say about this slide

Resulting in me reading all the text out loud
- But hey, that also means I do not have to make any contact whatsoever with my audience.
  - Yippeee!
  - Shit, is my fly open? I feel a breeze
- Why is that guy yawning over there?
- I just love the Arial font, don’t you?
- I’m glad my secretary found this standard background, it is just so pretty to look at.

Could this possible get more lame?
- No, probably not
- I should insert a joke, but I wouldn’t know where to find one on the internet
- If I bore everyone long enough, there will be no room for questions
  - The idea of interaction just made me pee in my pants

I hope no one notices I actually wish I was dead
I’ve just forgotten my name...
Oh well, only 50 more minutes of this
Only...
Don’t Forget to Make Time for Vocab Instruction
I Know You’re Busy and Have a Lot to Cover!
Summary
Pick the “Right” Words to Teach
Provide Explicit, Student-Friendly Definitions
Use Examples & Non-Examples & Get Kids Talking About the Terms
Background Knowledge Should Not be Assumed Or Overlooked
Always be Thinking About Anchors for Students
Teach Students To Attack Words With Morphological Strategies
Use & Teach Strategies like SFA & KMS
Dedicated Time for Vocabulary Instruction & Ensure Multiple Exposures To Terms/Concepts
Make Explicit Connections To Other Content Areas
Find Ways to Pull It All Together, Technology Is One Possible Solution
MKennedy@Virginia.edu

Twitter: KManXC

THANK YOU!