Building Mathematical Brilliance: The 411 of ELLs

Andrea Kotowski, NBCT
Learning Services Educator
a_kotowski@origomath.com

PROFESSIONAL LEARNING
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Learning Goals

Participants will understand that…

- all learners, especially English language learners (ELLs), need to develop the Standards for Mathematical Practice to be successful in the mathematics classroom
- supporting ELLs in the mathematics classroom requires an understanding of language development
- student discourse plays an integral role in developing social and academic language

Participants will know…

- Standards for Mathematical Practice 1 and 3
- the 7 Talk Moves of student discourse
- the 5 Guiding Principles for supporting ELLs in the mathematics classroom

Participants will be able to…

- plan and modify an *ORIGO Stepping Stones* module to better meet the needs of ELLs in the mathematics classroom

What do you hope to learn as a result of this professional learning session? Write a learning goal.

_____

_____

_____

_____

_____

Guiding Principles

Principle 1: Give ELLs many opportunities to **read**, to **write**, to **listen** to, and to **discuss** oral and written English and mathematics texts expressed in a variety of ways.

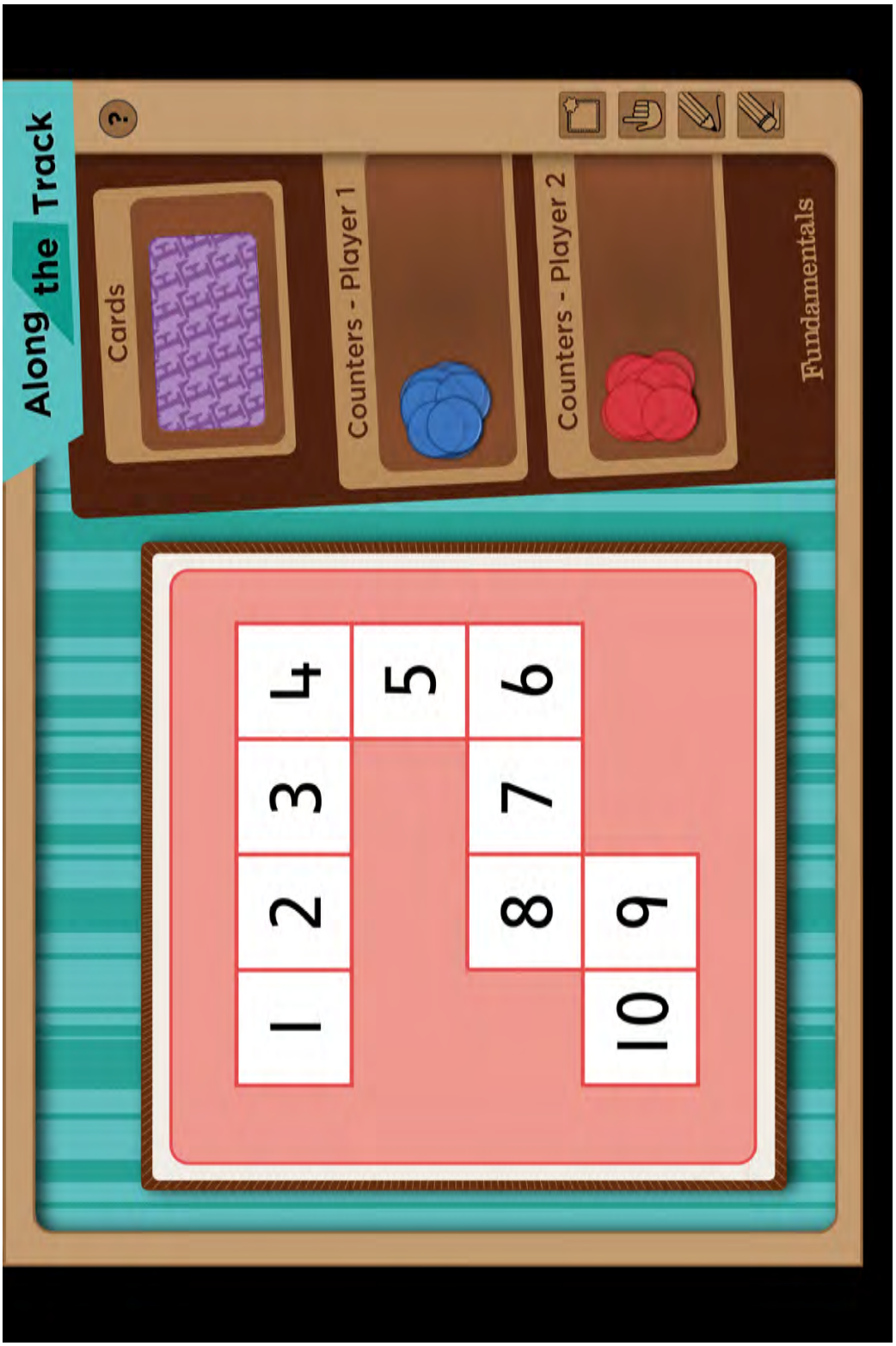
Principle 2: Draw attention to **patterns** in English and mathematics **language structure**.

Principle 3: Give ELLs **classroom time** to use their English productively while learning mathematics.

Principle 4: Give ELLs opportunities to **notice their errors** and to **correct their English** while learning mathematics.

Principle 5: Construct activities that maximize opportunities for ELLs to **interact with others** in English.

Along the Track

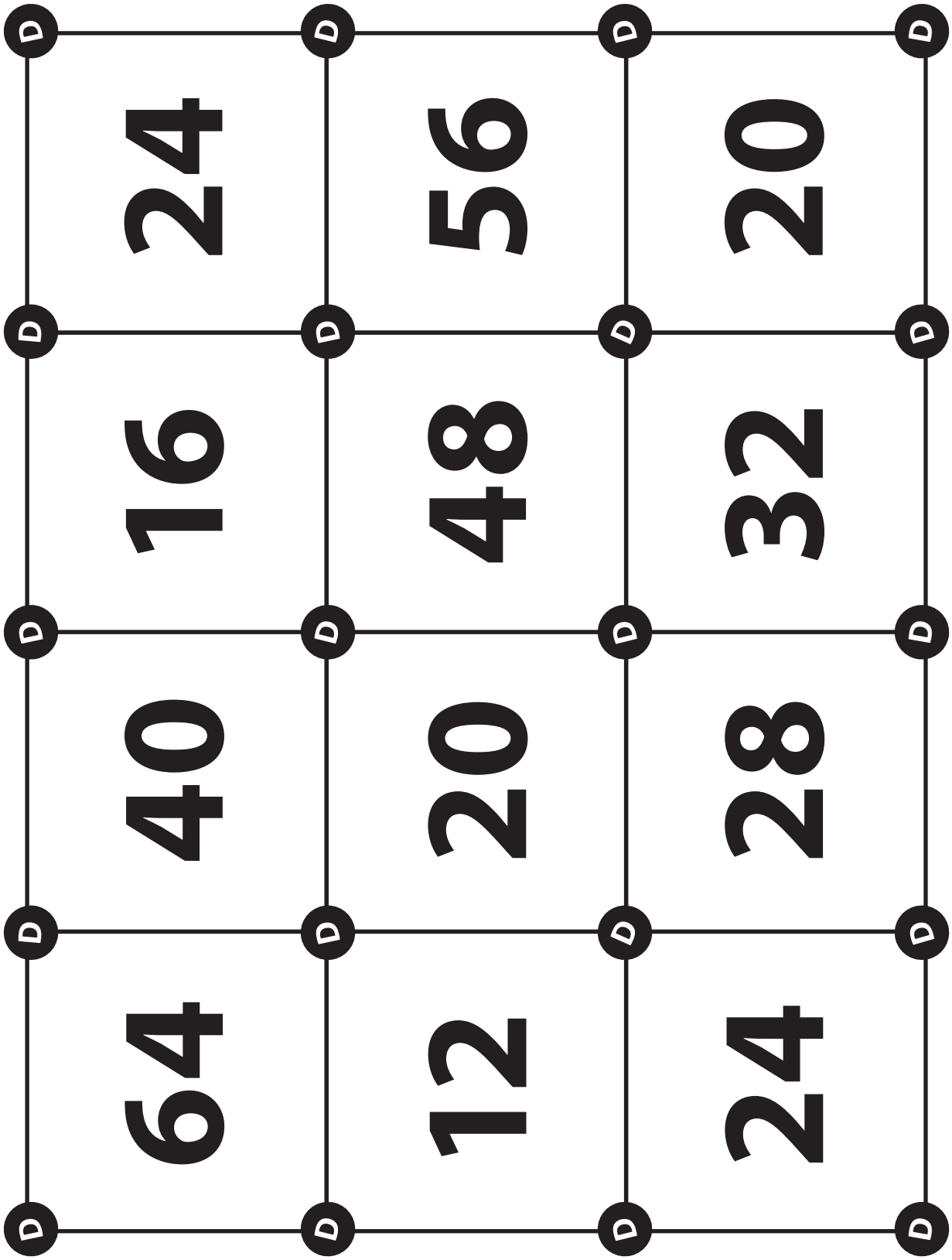


To access gameboard:

www.origoslate.com

Channels>>Fundamentals >>Start >>Titles>> Search “Along the Track

Do the Ds

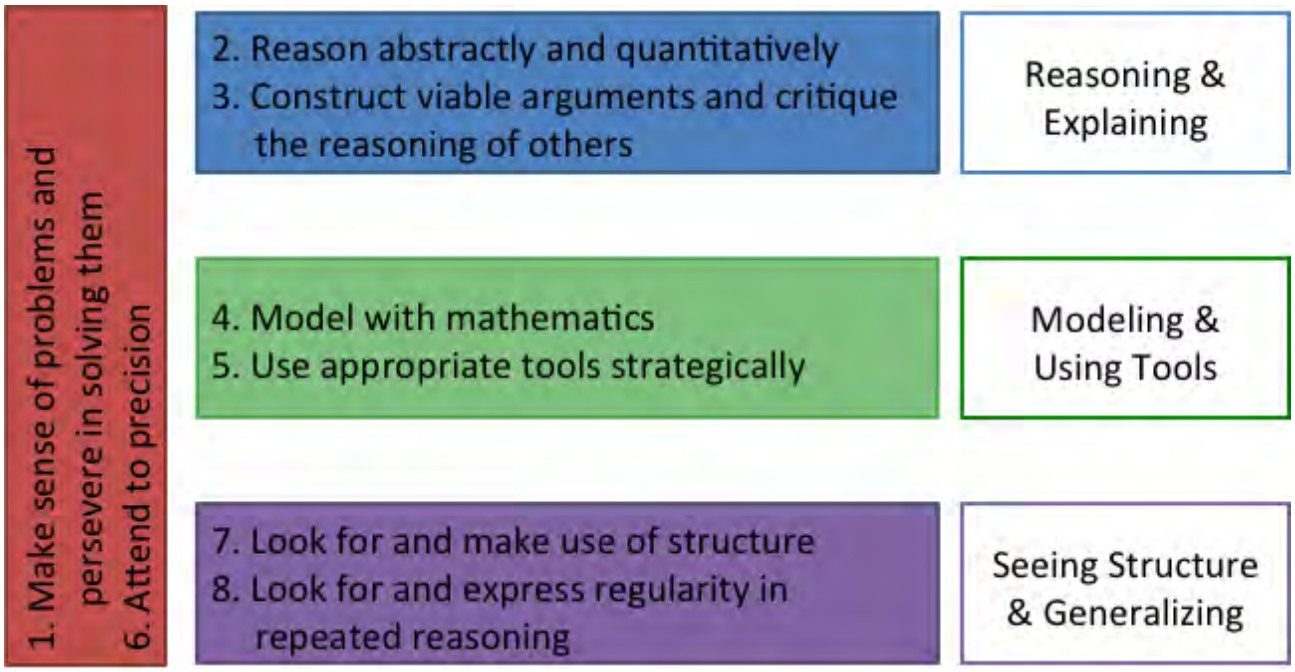


Cube 1: DD, DD, DD, DDD, DDD, DDD

Cube 2: 3, 4, 5, 6, 7, 8

8 Mathematical Standards for Practice

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.



How many different ways can you make 40¢ with quarters, dimes and nickels?

*This is a framework.

A Question or a Problem

"What do I know?"

"What am I trying to figure out?"

Proving/Explaining

Tinkering

"Let me try…"

"I think I know where I can start…"

Aha!

"I think this will work!"

"I understand what to do next!"

"I got it!"

Stumped!

"I don't get it!"

"Do I understand the question?"

"Argh! I want to give up!"

Models/Tools

"Can I do this mentally?"

"Do I need to draw it out or use a model?"

"Do I need some other tool to show my thinking?"

Systematic Tinkering

"Now that I've seen a pattern, let me keep trying… "

Pattern Sniffing/ Observations

"Hmmm… I notice…"

"I wonder if…"

C. Charney and J. Maxfield

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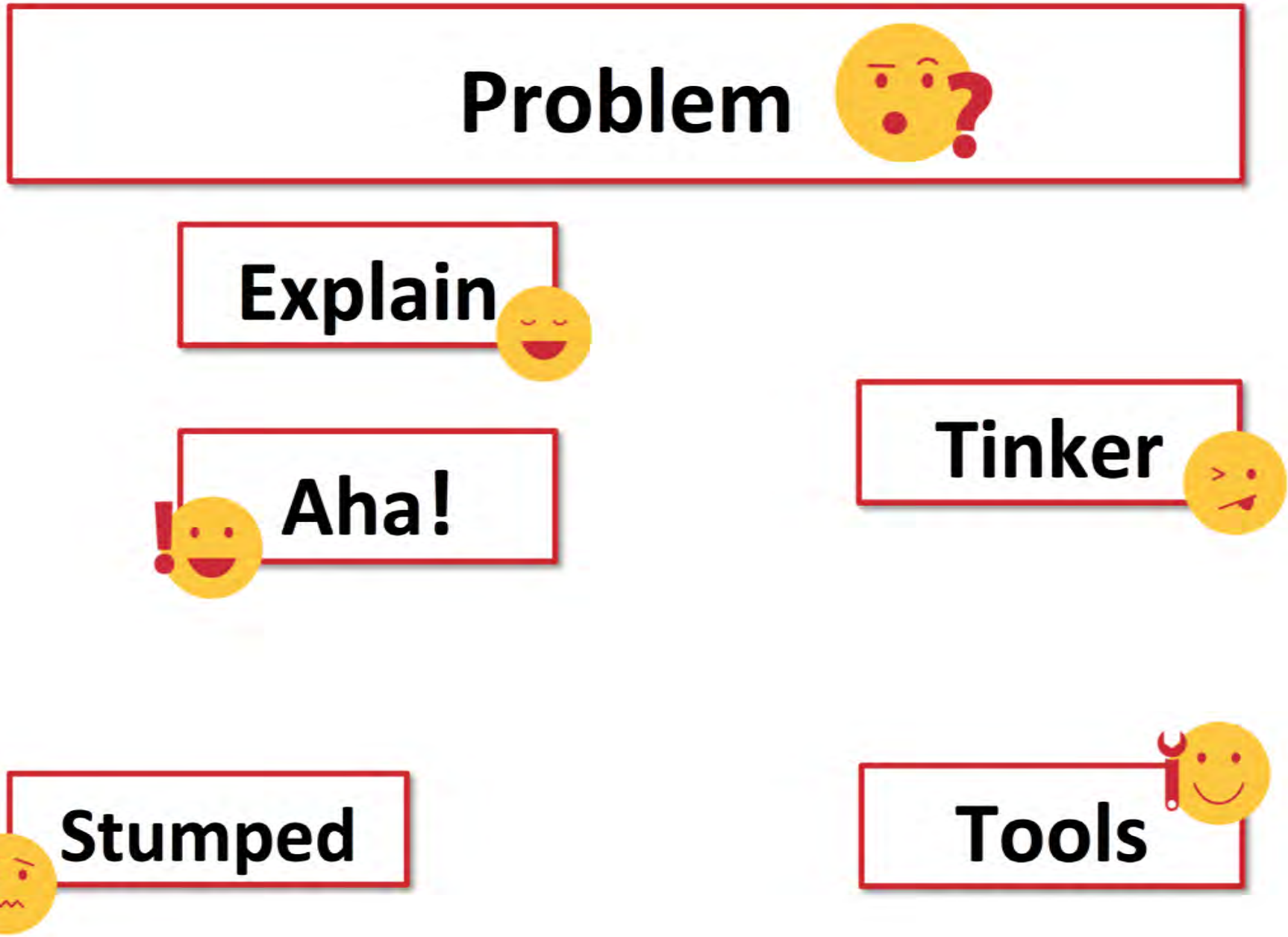
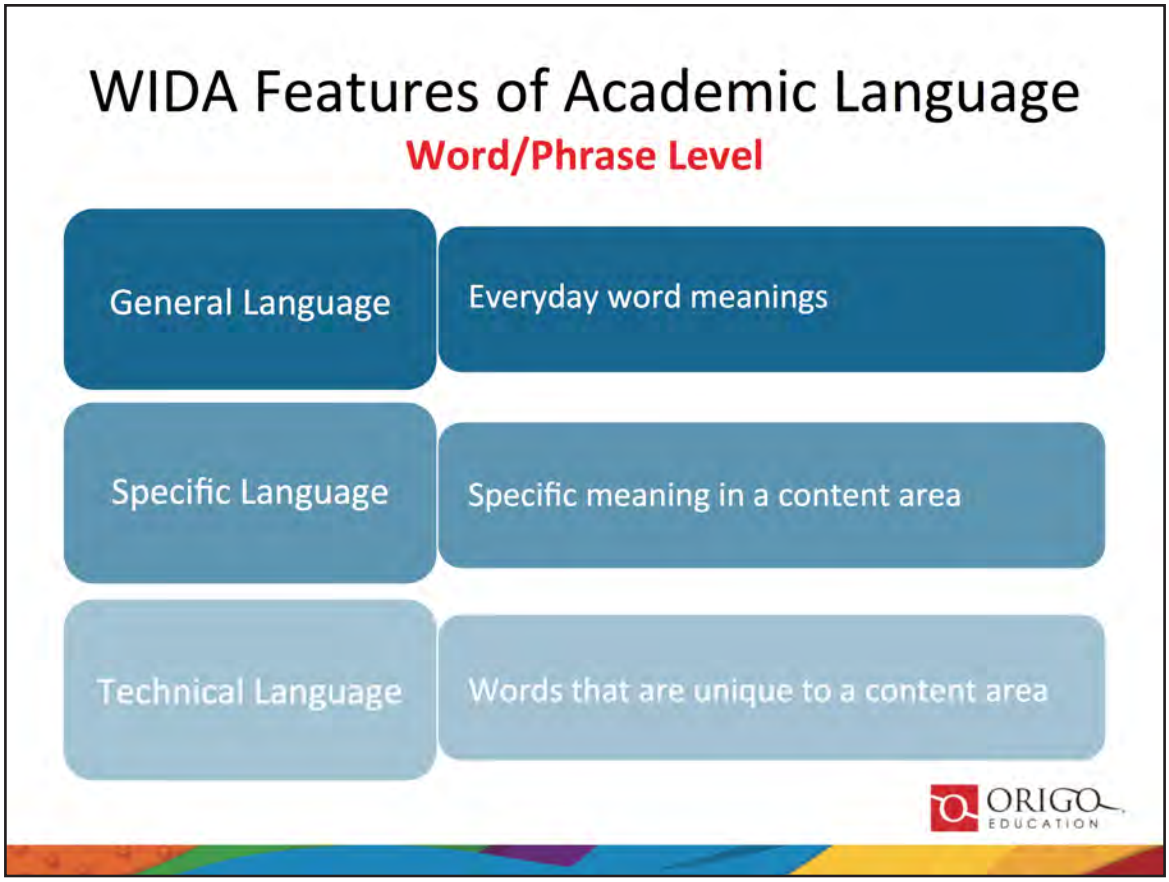


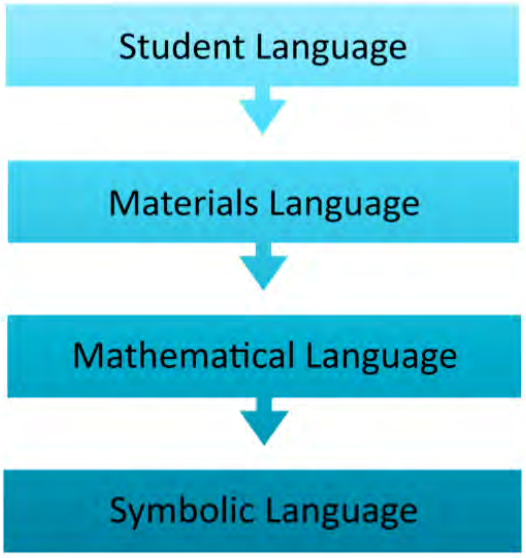
C. Charney and J. Maxfield

WIDA Features of Academic Development

	Performance Criteria	Features
Discourse Level	Linguistic Complexity *Quantity and variety of oral and written text*	Amount of speech/written text Structure of speech/written text Density of speech/written text Organization and cohesion of ideas Variety of sentence types
Sentence Level	Language Forms and Conventions *Types, array, and use of language structures*	Types and variety of grammatical structures Conventions, mechanics, and fluency Match of language forms to purpose/perspective
Word/Phrase Level	Vocabulary Usage *Specificity of word or phrase choice*	General, specific, and technical language Multiple meanings of words and phrases Formulaic and idiomatic expressions Nuances and shades of meaning Collocations



Language Ranging from Words to Symbols



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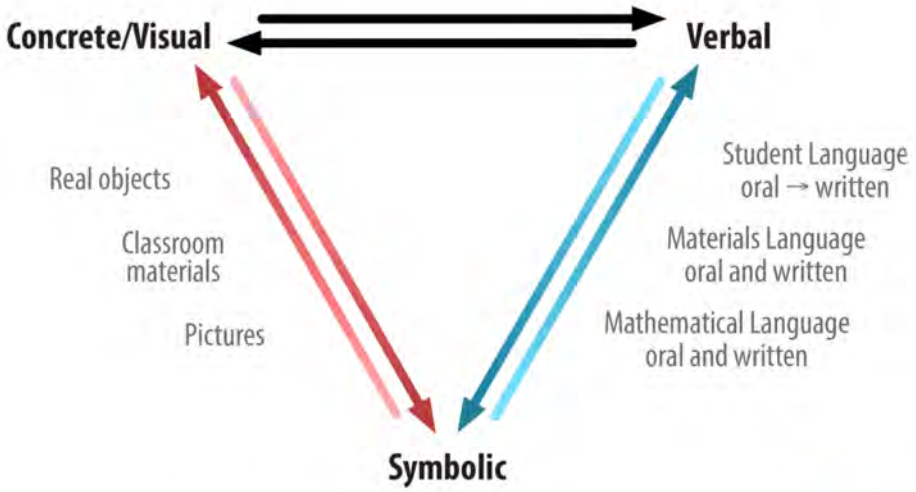
ORIGO's Teaching Model*



*Adapted from Ed Rathmell and Joseph Payne.

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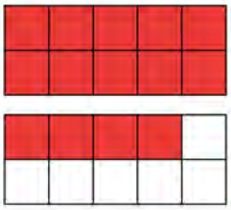
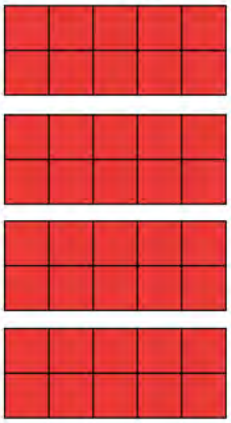
Language Stages

Addition	
Student Language	
Materials Language	
Mathematical Langauge	
Symbolic Language	

Student Language	
Materials Language	
Mathematical Langauge	
Symbolic Language	

Some	Sum
	$4 + 5 = 9$

Mean	Mean
	$\frac{3 + 5 + 9}{3}$

14 Fourteen	40 Forty
	

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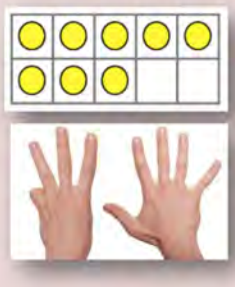
Clarifying Terms

Everyday	Math
	8 
Ate	Eight

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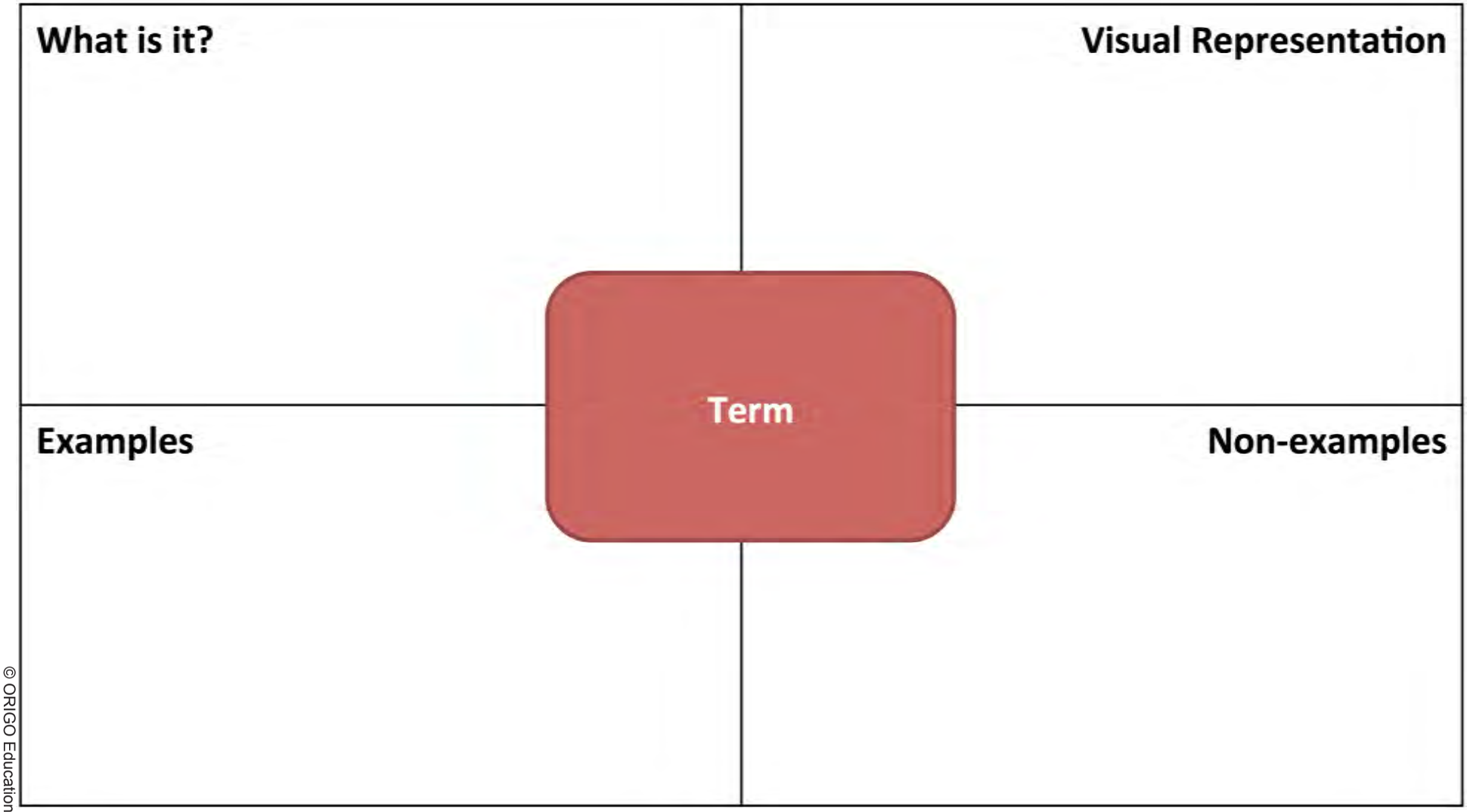
Frayer Model



Talk Moves

Talk Moves to Support Classroom Discussions	
Revoicing *"So you're saying…"*	• Repeat some or all of what the student has said, then ask the student to respond and verify whether or not the revoicing is correct. Revoicing can be used to clarify, amplify, or highlight an idea.
Repeating *"Can you repeat what she said in your own words?"*	• Ask a student to repeat or rephrase what another student said. • Restate important parts of complex idea in order to slow conversation down and dwell on important ideas.
Reasoning *"Do you agree or disagree, and why?"* *"Why does that make sense?"*	• After students have had time to process a classmate's claim, ask students to compare their own reasoning. • Allow students to engage with each other's ideas. • Student: "I respectfully disagree with that idea because…"; "This idea makes sense to me because…"
Adding On *"Would someone like to add on to this?"*	• Prompt students, inviting them to participate in the conversation or to clarify their own thinking. • Student: "I'd like to add on…"
Wait Time *"Take your time…"*	• Wait after asking a question before calling on a student. • Wait after a student has been called on to give the student time to organize his or her thoughts.
Turn-and-Talk *"Turn and talk to your neighbor…"*	• Circulate and listen to partner talk. Use this information to choose whom to call on. • Allow students to clarify and share ideas. • Allow students to orient themselves to each other's thinking.
Revise *"Has anyone's thinking changed?"* *"Would you like to revise your thinking?"*	• Allow students to revise their thinking as they have new insights. • Student: "I thought…But now I think…because…" "I'd like to revise my thinking".

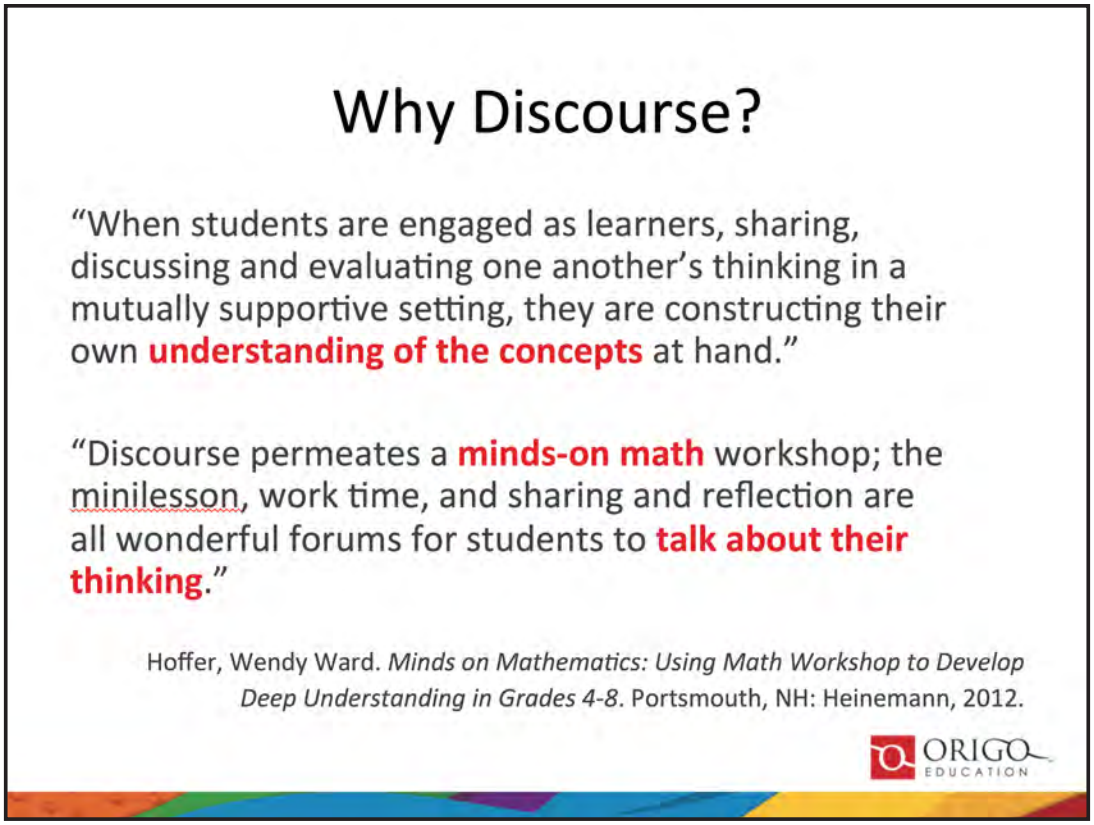
Classroom Discussions: Using Math Talk to Help Students Learn, 2009

Intentional Talk: How to Structure and Lead Productive Mathematical Discussions, 2014

A road rally began at 8 a.m. The first car finished the race in 2 ½ hours. The last car crossed the finish line ¾ of an hour later. What time did the last car finish the race?

Talk Moves	ELL Support
☐ Revoicing	
☐ Repeating	
☐ Reasoning	
☐ Adding On	
☐ Wait Time	
☐ Turn-and-Talk	
☐ Revise	

Why Discourse?



Equitable Participation

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Practices to Improve Equitable Participation

- Give time to think.
- Give time to practice.
- Randomly assign speakers to report out for a group.
- Encourage students to self-monitor their participation.
- Offer a "token to talk."
- Use the technique "one of three."

Chapin, Suzanne H., Nancy Canavan. Anderson, and Mary Catherine. O'Connor. *Classroom Discussions in Math: A Teacher's Guide for Using Talk Moves to Support the Common Core and More*. Sausalito, CA: Math Solutions Publications, 2013.

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Representations Ranging from Real Objects to Symbols

Real Objects

↓

Classroom Materials

↓

Pictures

↓

Symbols

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Activate Prior Knowledge

What is a double?

Before	After
	

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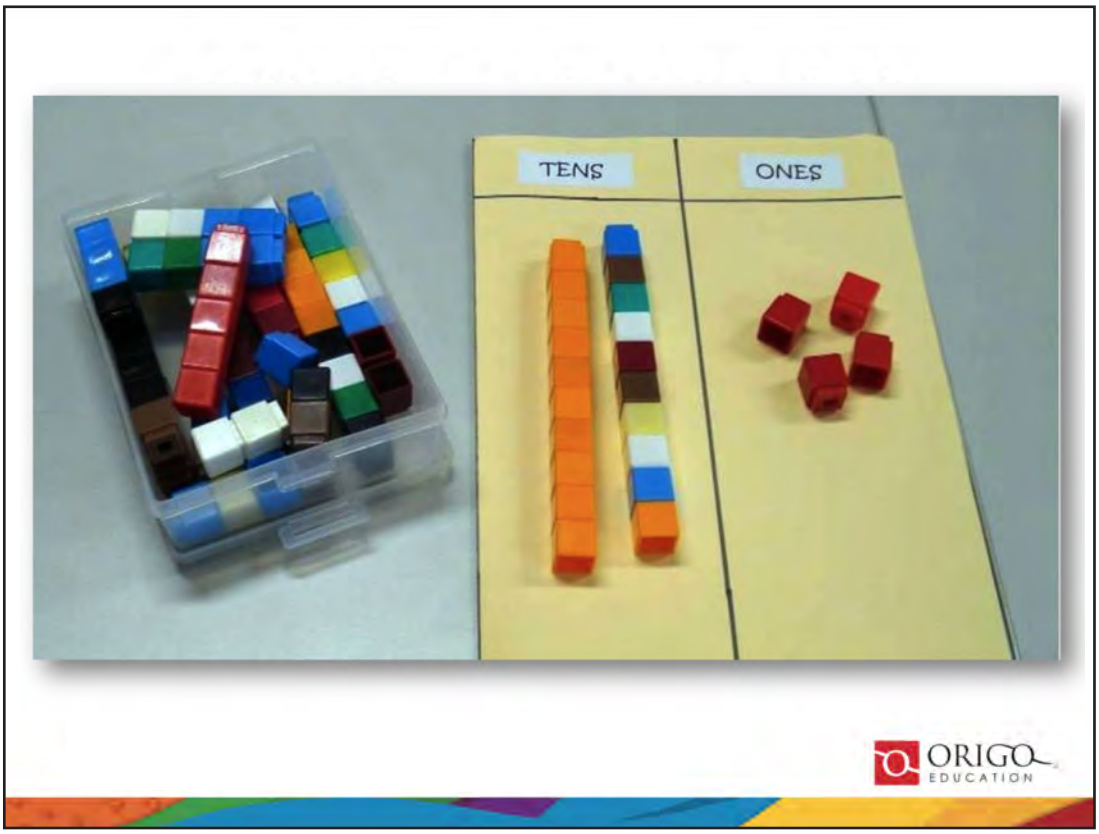
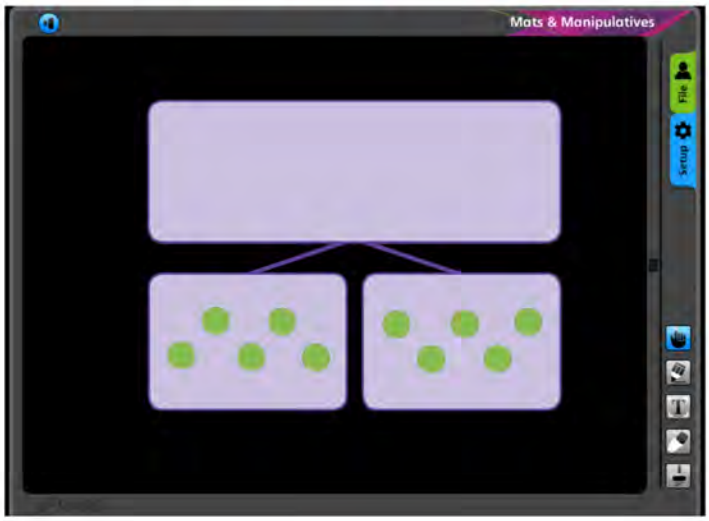


Flare

Virtual Manipulatives



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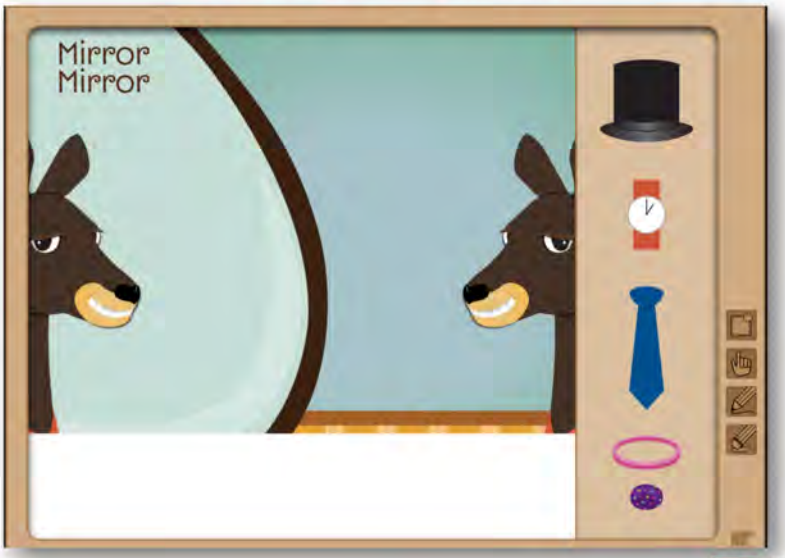
Big Book Tools

Pictures ➔ Symbols



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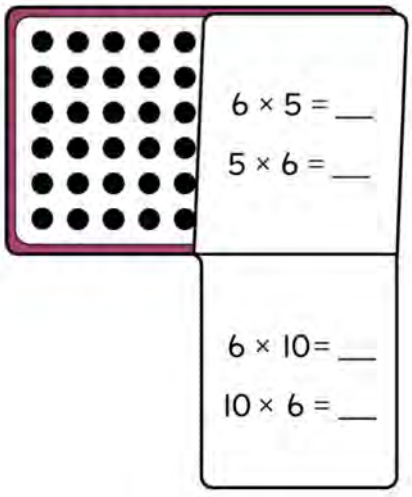
Picture Cards to Represent Symbolic



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Sentence Frames

- Discussion support
- Contextualizes and gives meaning to vocabulary
- Gives structure for language skills
- Scaffolds to help students express their mathematical thinking in speaking and writing

Sentence Frames

Language Support

Beginning	A _____ has _____.
Intermediate/ Advanced	A _____ has _____, _____, and _____. My shape has _____, _____, and _____.

Preparing for a Module

Focus	Included Supports
Possible ELL Supports	
Notes	

Language Planning Document

Lesson Learning Target(s)	Language Goal(s)
Key Vocabulary:	
Additional Materials:	

Support	Purpose	Listening	Speaking	Reading	Writing

Sentence Frame(s)	Beginning	Intermediate	Advance

Works Cited

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Principles of Engagement		Session Activities
Principle 1	Give ELL many opportunities to read, write, to listen to, and to discuss oral and written English and mathematics texts expressed in a variety of ways.	
Principle 2	Draw attention to patterns in English and mathematics language structure.	
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