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Stories & Technology: Gateways to Mathematics for All

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MATSOL Annual Conference
Framingham, MA
May 31, 2018

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Introduction Activity

- Listen to the following [story...](#)
- Consider:
 - What kind of mathematics is being explored?
 - How is the language being addressed?
 - Why might the story medium be considered helpful?

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Agenda

- A sample story
- Our Guiding Framework: Universal Design for Learning
- Why use stories in mathematics?
- Why use technology in mathematics?
- Technology demonstrations
- Your turn!
- Q&A

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Universal Design for Learning

- Teachers can offer feedback to students in a ubiquitous way beyond time and space constraints through use of technologies.
- Teachers can manage multiple means for representation and expression using multimedia resources
- Teachers can provide multiple means of engagement through use of technologies
- Teachers can design culturally relevant teaching for multilingual learners by addressing students' funds of knowledge

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The Universal Design for Learning Guidelines

	Provide multiple means of Engagement	Provide multiple means of Representation	Provide multiple means of Action & Expression
Engagement	Offer choices in the "what" of learning	Recognize learners' "the what" of learning	Design choices in the "what" of learning
Access	Provide options for Recruiting Interest <ul style="list-style-type: none"> Optimize individual choice and autonomy Optimize relevance, value, and authenticity Minimize threats and distractions 	Provide options for Perceiving <ul style="list-style-type: none"> Offer ways of customizing the display of information Offer alternatives for auditory information Offer alternatives for visual information 	Provide options for Physical Action <ul style="list-style-type: none"> Vary the methods for response and navigation Optimize access to tools and assistive technologies
Build	Provide options for Sustaining Effort & Persistence <ul style="list-style-type: none"> Highlight salience of goals and objectives Vary demands and resources to optimize challenge Enable collaboration and community Increase mastery-oriented feedback 	Provide options for Languages & Symbols <ul style="list-style-type: none"> Clarify vocabulary and symbols Clarify syntax and structure Support developing fluency, automaticity of concepts, and symbols Provide understanding across languages Structure through multiple media 	Provide options for Expression & Communication <ul style="list-style-type: none"> Use multiple tools for communication Use multiple tools for construction and composition Build fluency with graduated levels of support for practice and performance
Intentionality	Provide options for Self Regulation <ul style="list-style-type: none"> Provide expectations, models, and explicit instruction Facilitate personal coping skills and strategies Develop self-assessment and reflection 	Provide options for Comprehension <ul style="list-style-type: none"> Activate or supply background knowledge Highlight patterns, critical features, big ideas, and relationships Guide information processing and assimilation Maximize transfer and generalization 	Provide options for Executive Functions <ul style="list-style-type: none"> Make appropriate goal setting Support planning and strategic development Facilitate managing information and resources Enhance capacity for monitoring progress
Goal	Expert learners who are... Purposeful & Motivated	Resourceful & Knowledgeable	Strategic & Goal-Directed

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The Features of Academic Language in WIDA's Standards

The Features of Academic Language operate within sociocultural contexts for language use.

Discourse Level	Performance Criteria	Features	Example:
	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	Justifying, describing, compare/contrasting... Stories, e.g. "Miguel's Party Planning" and no more than 13
Sentence Level	Language Forms and Conventions (Types, forms, and use of language structures)	Types and variety of grammatical structures Conventions, mechanics, and fluency Match of language forms to purpose/speaking	"Expressions, equations, and inequalities are similar in that they all use variables and numbers."
Word/Phrase Level	Vocabulary Usage (Specificity of word or phrase choice)	General, specific, and technical language Multiple meanings of words and phrases Formal and idiomatic expressions Nuances and shades of meaning Collocations	Hypotenuse, parallelogram Mean, product, or odd Sum, add, total, or plus

The sociocultural contexts for language use involve the interaction between the student and the language environment, encompassing the...

- Register
- Genre/Text type
- Topic
- Talk/Situation
- Participant/Identity and social roles

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Why use stories in mathematics?

- “Mathematicians use language to make meanings and to share understandings.” (Marks & Mousley, 1990, p.118)
- “Language gives students the means to talk about mathematics, record mathematical sentences, and clarify their feelings about mathematics... Literature is natural way to introduce a new concept.” (Nevin, 1992, p.142)

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Why use technology?

NCTM Position Statement (October 2011)

“It is essential that teachers and students have regular access to technologies that support and advance mathematical sense making, reasoning, problem solving, and communication. Effective teachers optimize the potential of technology to develop students’ understanding, stimulate their interest, and increase their proficiency in mathematics. When teachers use technology strategically, they can provide greater access to mathematics for all students.”

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Why use technology?

WIDA Focus on Technology in the Classroom (2014)

“Well-selected tools can provide avenues for creation, expression, and the kinds of meaningful activities that facilitate academic language development, as well as frame various learner identities for ELLs. Different kinds of media afford different kinds of activity and interaction. Teachers can take advantage of different forms of media within a learning ecology, from traditional books to digital tools like creation apps, games, and interactive stories.”

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How can common technologies provide access?

- Text can be easily translated, summarized, highlighted, and converted to speech (Rao & Torres, 2017)
- Teachers are able to connect students with digital content through “smart supports,” such as hyperlinks, graphics and animations, sequenced supports, and tools for expression and organization (Hitchcock, et al., 2002)

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How can common technologies provide access?

- Instructional technology tools can reinforce higher-order thinking skills and constructivist learning environment (Schoenfeld, 1992)
- Integrating technologies in mathematics education develops students’ motivation, higher-order thinking, researching skills, and communication among the peers and their school community (NCTM, 2000)

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Technology Demonstrations

- Story: “Miguel’s Party Planning”
- Platforms:
 - [PowerPoint](#)
 - [UDL BookBuilder by CAST](#) (bookbuilder.cast.org)

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Your turn...

- Brainstorm with your group
- Complete story outline
 - Goformative.com
 - "Join Code"
 - NMNHUQ**
- Share out!!!

Possible topics:

- Classification of triangles
- Linear equations or inequalities
- Quadratic functions
- Perimeter or area of polygons
- Special right triangles
- Systems of equations or inequalities
- Volume

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Next steps...

- For you:
 - Complete our exit slip (GoFormative: **YAZANY**)
 - Upload and use your stories
 - Even have your students create their own! ☺
 - Share your stories and experiences!!!
- For us:
 - Incorporate your feedback
 - Continue to research

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Q&A

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Resources

- Hitchcock, C., Mayer, A., Rose, D., & Jackson, R. (2002). Providing new access to the general curriculum: UDL. *Teaching exceptional children*, 17, 1-17.
- Marks, G. & Mousley, J. (1990). Mathematics education and genre: Dare we make the process writing mistake again? *Language and Education*, 4(2), 117-130.
- National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.
- National Council of Teachers of Mathematics. (2011). *Technology in Teaching and Learning Mathematics: A Position of the National Council of Teachers of Mathematics*. Reston, VA: Author.
- Nevin, M.L. (1992, November). A language arts approach to mathematics. *The Arithmetic Teacher*, 40(3), 142-146.
- Rao, K. & Torres, C. (2017). Supporting Academic and Affective Learning Processes for English Language Learners with Universal Design for Learning. *TESOL Quarterly*, 51(2), 460-472.
- Schoenfeld, A.H. (1992). Learning to think mathematically: Problem solving, metacognition, and sense-making in mathematics. In D. Grouws (Ed.), *Handbook for Research on Mathematics* (pp. 334-370). New York: MacMillan.

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A framework for exploring Language Development

Criteria	1	2	3	EVIDENCE/Examples
Language: Vocabulary Level				
Language: Sentence Level				
Language: Discourse Level				
Cognitive Demand				

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