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# PROMOTE A DEEPER UNDERSTANDING OF MATHEMATICS WITH ASL LITERACY

DeafTEC Math Conference 2019

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Jeni Jackerson  
Nancy McAnlis



# ABOUT US



## JENI JACKERSON

- ASL Specialist at Rocky Mountain Deaf School (RMDS)
- 7 years as Elementary Teacher
- Co-authored RMDS ASL curriculum
- Certified ASL assessor and trainer by The National ASL and English Bilingual Consortium for Early Childhood Education



## NANCY MCANLIS

- Middle School & High School Mathematics Teacher at Rocky Mountain Deaf School (RMDS)
- Middle School Math Competition Coach
- High School Academic Bowl Coach

# AGENDA



1. Missing Links
2. Social vs. Academic Languages
3. Current Challenges
4. ASL Standards in Mathematics
5. Digital Technology and Resources
6. ASL Literacy Skills

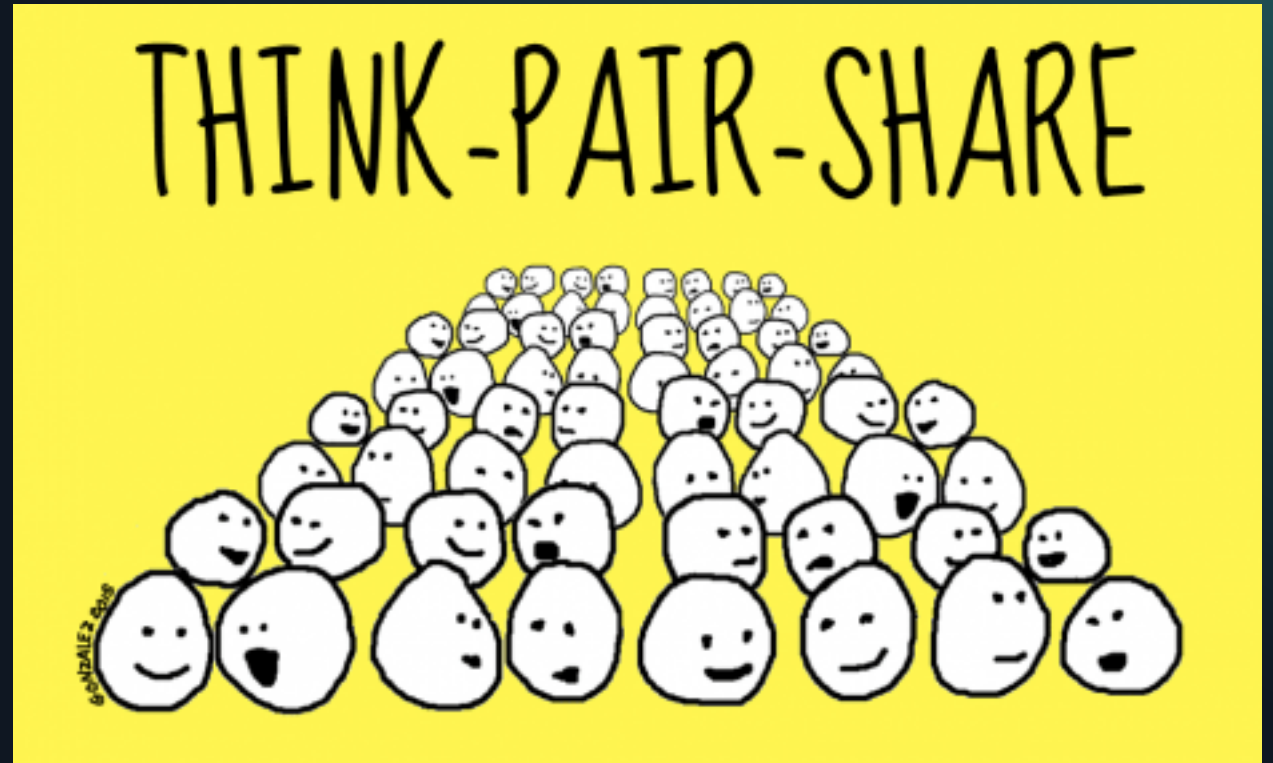



**MATH IS HARD**



## WARM UP

1. What is mathematics ASL Literacy?
2. What makes an ASL literacy rich mathematics classroom?





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**HOW CAN WE INCOPORATE  
BIINGUAL LITERACY SKILLS  
INTO MATHHMATICS FOR OUR  
STUDENTS TO BE MATH  
LITERATE?**

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# MISSING LINKS

WHAT ARE MISSING FROM OUR STUDENTS BEING MATH LITERATE?

1

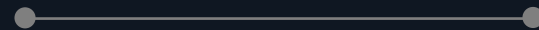
**REAL LIFE  
APPLICATIONS**

2

**VIEW AND  
RESPOND TO  
MATH  
LITERACY IN  
ASL**

3

**THE USE OF  
BILINGUAL  
STRATEGIES**



**ASL AND ENGLISH**  
**SOCIAL AND ACADEMIC**  
**LANGUAGES**





# ASL/ENGLISH BILINGUAL GROWTH

Our Deaf and Hard of Hearing students' language growth in academics

- Primary and/or native language
- Mode: Signacy
- Receptive Skills: viewing/attending
- Expressive/Productive Skills: signing

## SOCIAL ASL



## SOCIAL ENGLISH

- Secondary language
- Mode: Literacy
- Receptive Skills: reading
- Expressive/Productive Skills: writing



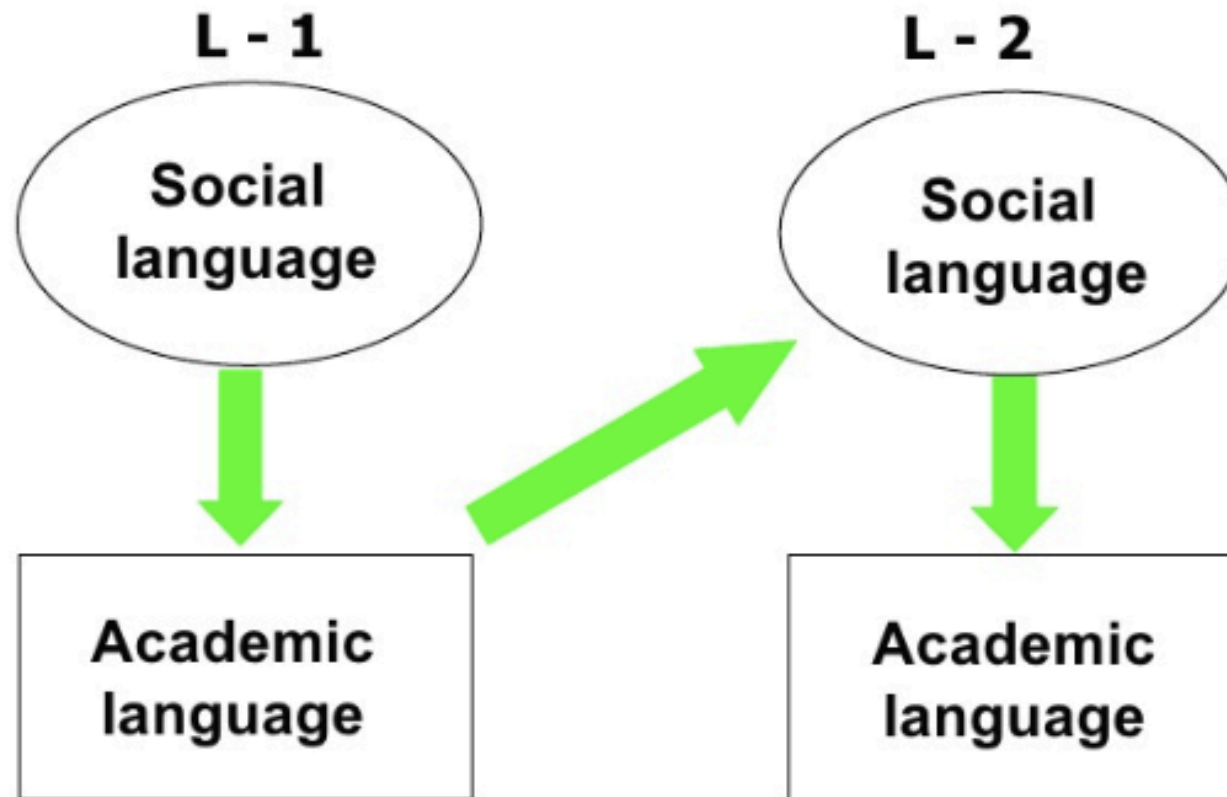
## ACADEMIC ASL & ENGLISH

- Growth
- Signacy and Literacy
- Viewing and reading
- Signing and writing



# ASL/ENGLISH BILINGUAL GROWTH

## Route to Bilingualism



# ASL/ENGLISH BILINGUAL GROWTH

Typical Language Development for  
Deaf and Hard of Hearing (HOH) Children

**L - 1**

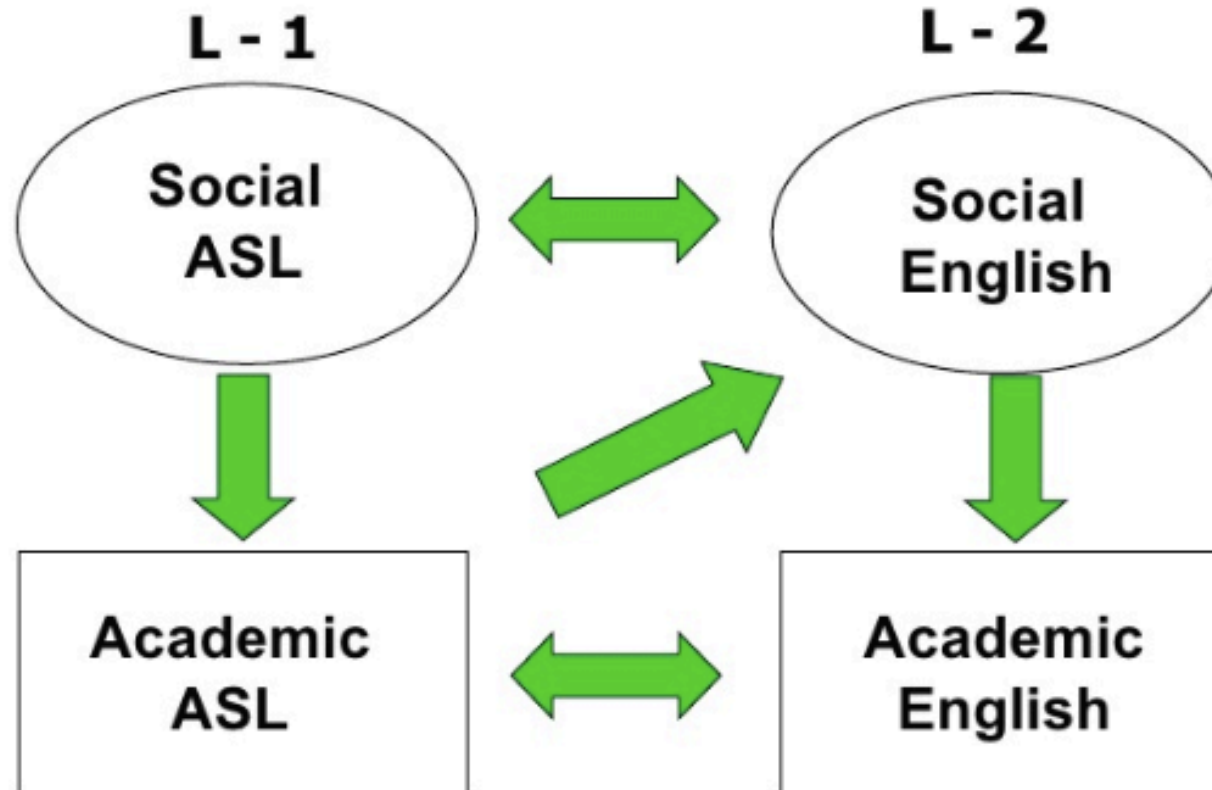


**L - 2**



# ASL/ENGLISH BILINGUAL GROWTH

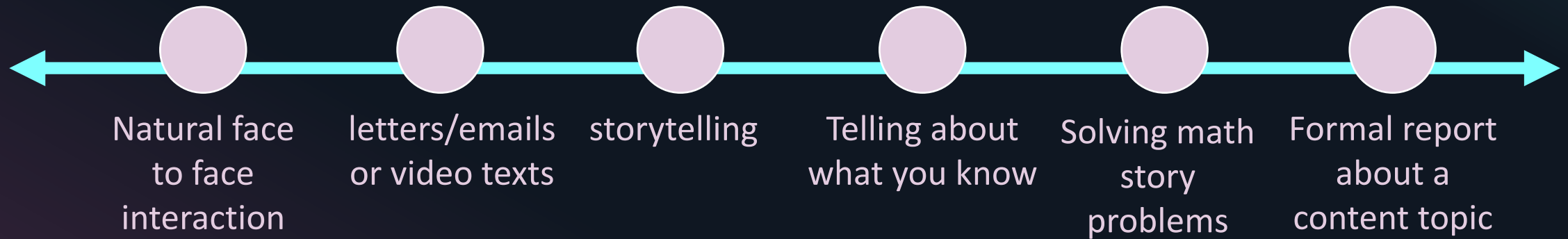
Bilingual Approach to Language Development  
for Deaf and HOH Children



# SOCIAL VS. ACADEMIC LANGUAGE

**SOCIAL  
LANGUAGE**

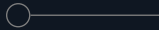
**ACADEMIC  
LANGUAGE**





# CHALLENGES

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- **STATE TESTING**
    - Math ASL signs
    - Viewing skills - Academic ASL
  - **NATIONAL COMMON CORE MATH STANDARDS**
    - Academic English
  - **MATH CURRICULUM**
    - Grade level text
    - Response Text
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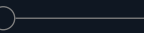

**HOW TO BUILD OUR  
STUDENTS' SOCIAL AND  
ACADEMIC LANGUAGES?**

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# WHAT IS BILINGUAL EDUCATION?



**Supports the acquisition and development of both languages (ASL and English).**





# ASL/ENGLISH BILINGUAL STRATEGIES

## ASL and Content Development

**The use of ASL videos as the source of instructional material is increasing in bilingual classrooms. Both interactive viewing, which is led by the teacher, and independent or self-directed viewing, promote the use of ASL for academic purposes and functions, deepen students' conceptual and linguistic foundations in ASL, and provide examples of language separation. The use of interactive ASL videos promotes engagement behaviors, which are linked to comprehension.**

# ASL/ENGLISH BILINGUAL STRATEGIES

## Bridging ASL and English

**ASL/English bilingual teachers practice bridging strategies to help deaf students understand the similarities and differences between their two languages. Some teachers explicitly compare and contrast ASL and English structures to develop linguistic awareness in both languages. Teachers engage in free translation during story-signing and story-reading to access the meaning of the text and do a follow up using literal translation to analyze the structure of written passages.**

# ASL/ENGLISH BILINGUAL STRATEGIES

## Code-Switching

**Chaining and sandwiching strategies--where the teacher directly links signs to printed information, objects, concepts, and definitions are forms of code-switching that emphasize concept development in both languages at the word level. The use of both fingerspelling and lexicalized fingerspelling, a morphological process that brings new signs into ASL from their fingerspelled form, have been used to introduce and teach new English vocabulary and to facilitate English decoding; positive correlations have been found between the use of these two techniques and vocabulary recall and reading comprehension.**



# ASL CONTENT STANDARDS

## KINDERGARTEN-GRADE 12

### Viewing Standards for Literature

The following standards offer a focus for instruction each year and help ensure that students gain adequate exposure to a range of texts and tasks. Rigor is also infused through the requirement that students view increasingly complex texts through the grades.

#### Grade 6 Students

#### Grade 7 Students

#### Grade 8 Students

#### Key Ideas and Details

1. Cite textual evidence to support analysis of what the **text** says explicitly as well as inferences drawn from the text.
2. Determine a theme or central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.
3. Describe how a particular story's or drama's plot unfolds in a series of episodes as well as how the characters respond or change as the plot moves toward a resolution.

1. Cite several pieces of textual evidence to support analysis of what the **text** says explicitly as well as inferences drawn from the text.
2. Determine a theme or central idea of a text and analyze its development over the course of the text; provide an objective summary of the text.
3. Analyze how particular elements of a story or drama interact (e.g., how setting shapes the characters or plot).

1. Cite the textual evidence that most strongly supports an analysis of what the **text** says explicitly as well as inferences drawn from the text.
2. Determine a theme or central idea of a text and analyze its development over the course of the text, including its relationship to the characters, setting, and plot; provide an objective summary of the text.
3. Analyze how particular elements of dialogue or incidents in a story or drama propel the action, reveal aspects of a character, or provoke a decision.

# ASL CONTENT STANDARDS

## Viewing Standards

The Viewing Standards offer a focus for instruction each year and help ensure students gain adequate exposure to a range of texts and tasks. Rigor is infused through the requirement that students view increasingly complex texts through the grades. Students advancing through the grades are expected to meet each year's grade-level standards and retain or further develop skills and understandings mastered in preceding grades.

# ASL CONTENT STANDARDS

## Published Signing

The Published Signing Standards offer a focus for instruction to help ensure students gain mastery of a range of skills and applications in developing published ASL, including students' understanding and working knowledge on text types and purposes (e.g., argumentative, informative, explanatory, narrative), production of published signing (e.g., organization, appropriate to task, purpose, audience; drafting process; use of technology to publish, interact with, and collaborate with others), and research to build and present knowledge.

# ASL CONTENT STANDARDS

## Discourse & Presentation

The Discourse and Presentation Standards focus on fostering students' understanding and working knowledge to prepare and present knowledge and ideas effectively through findings and supporting evidence appropriate to task, purpose, and audience. These standards promote strategic use of digital media and visual displays of data, develop appropriate linguistic register for both presenting and to analyze other presenters' point of view, reasoning, and use of evidence and rhetoric. They also include preparation for and participation in a range of conversations and collaborations with different audiences.

# ASL CONTENT STANDARDS

## Language


The Language Standards offer a focus for instruction each year on fostering students' understanding and working knowledge of the structures of ASL, knowledge of language, and vocabulary acquisition and use. These standards are designed to foster student knowledge of standard ASL grammar, usage, and mechanics, and to facilitate their learning different ways to use language.



# ASL CONTENT STANDARDS

## Fingerspelling & Fingerreading

The Fingerspelling and Fingerreading Standards offer a focus for instruction each year to foster students' understanding and knowledge of fingerspelling, including initialized and lexicalized forms of fingerspelling and fingerreading, vocabulary acquisition, and use. These standards are designed for students to develop an understanding of fingerspelling and fingerreading, including usage of fingerspelling in isolation and in context.



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BIINGUAL LITERACY SKILLS  
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LITERATE?**

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# **DIGITAL TECHNOLOGY**

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STORYTELLING

RHYTHMS/RHYMES

INTERACTIVE  
STORYTELLING

SONGS

Adventure of Sir  
Circumference  
and  
Dragon Pi

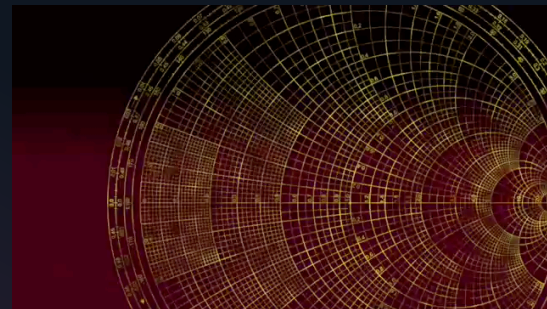
# MATH ASL TEXTS

RIDDLES

JOKES

VOCABULARY

WORD PROBLEMS



# ELEMENTS IN MATH ASL TEXTS



**VOCABULARY**



**REAL LIFE  
APPLICATIONS**



**MATH  
NUMERICALS AND  
CONCEPTS**



**IMPACT**



**INDIRECT  
LEARNING**



**NATIVE/PRIMARY  
LANGUAGE**

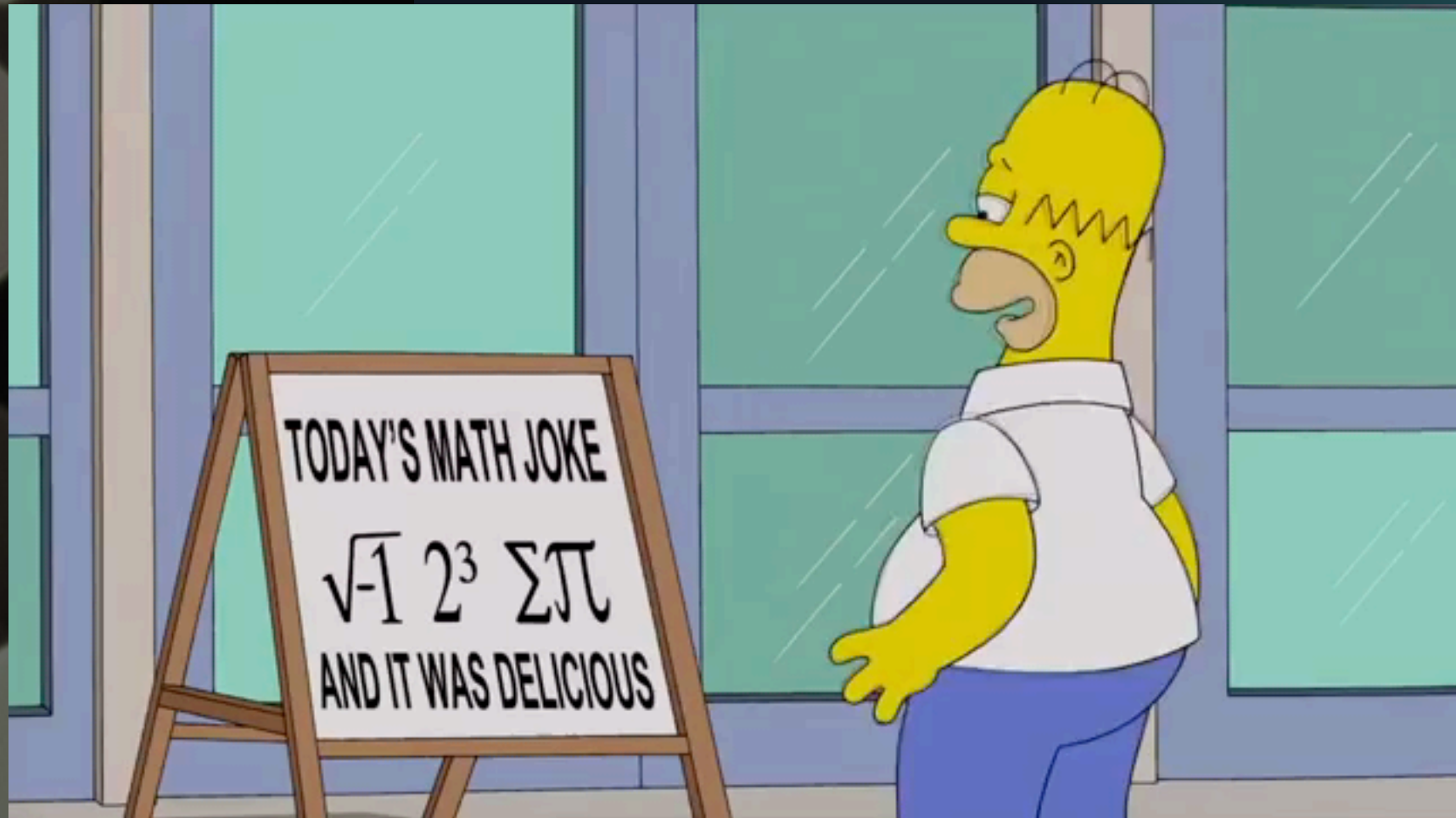


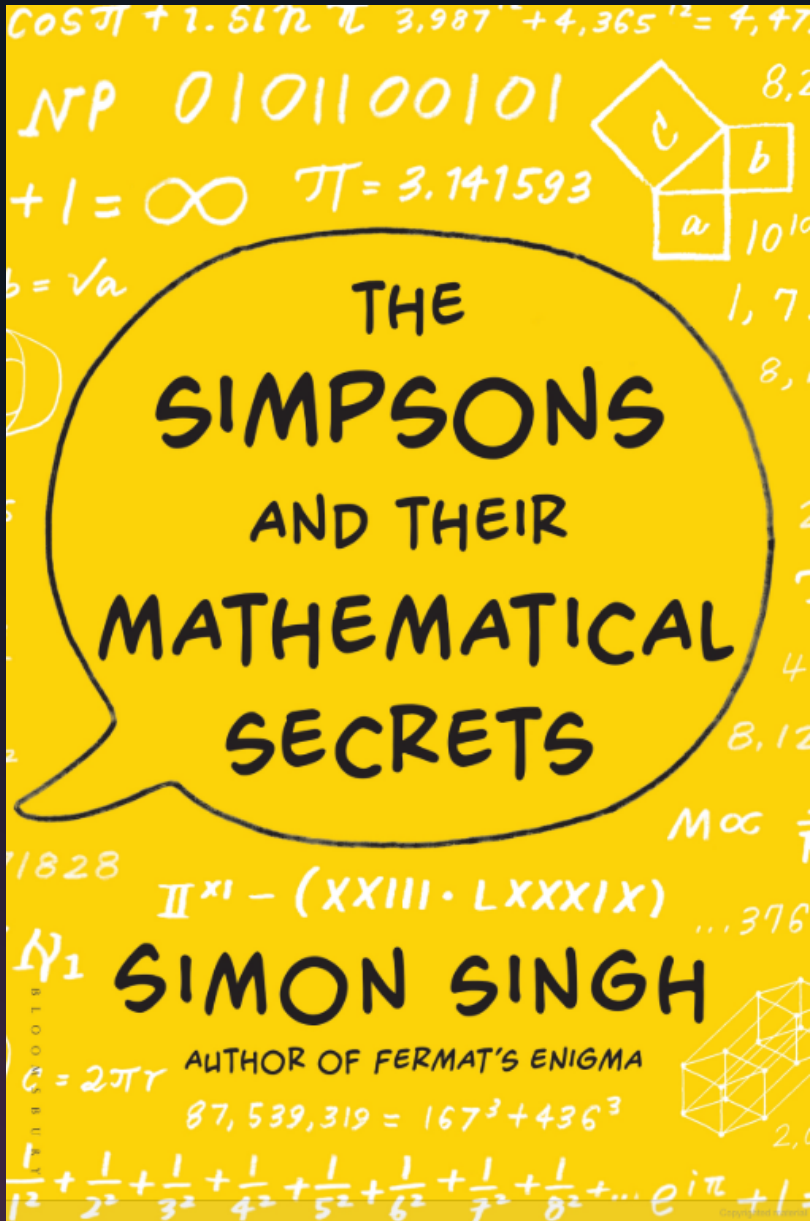
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# **MATH LITERATURE**

**SOCIAL OR ACADEMIC LANGUAGE?**

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## Writers:

Burns:

Clausen:

Cohen:

Jean:

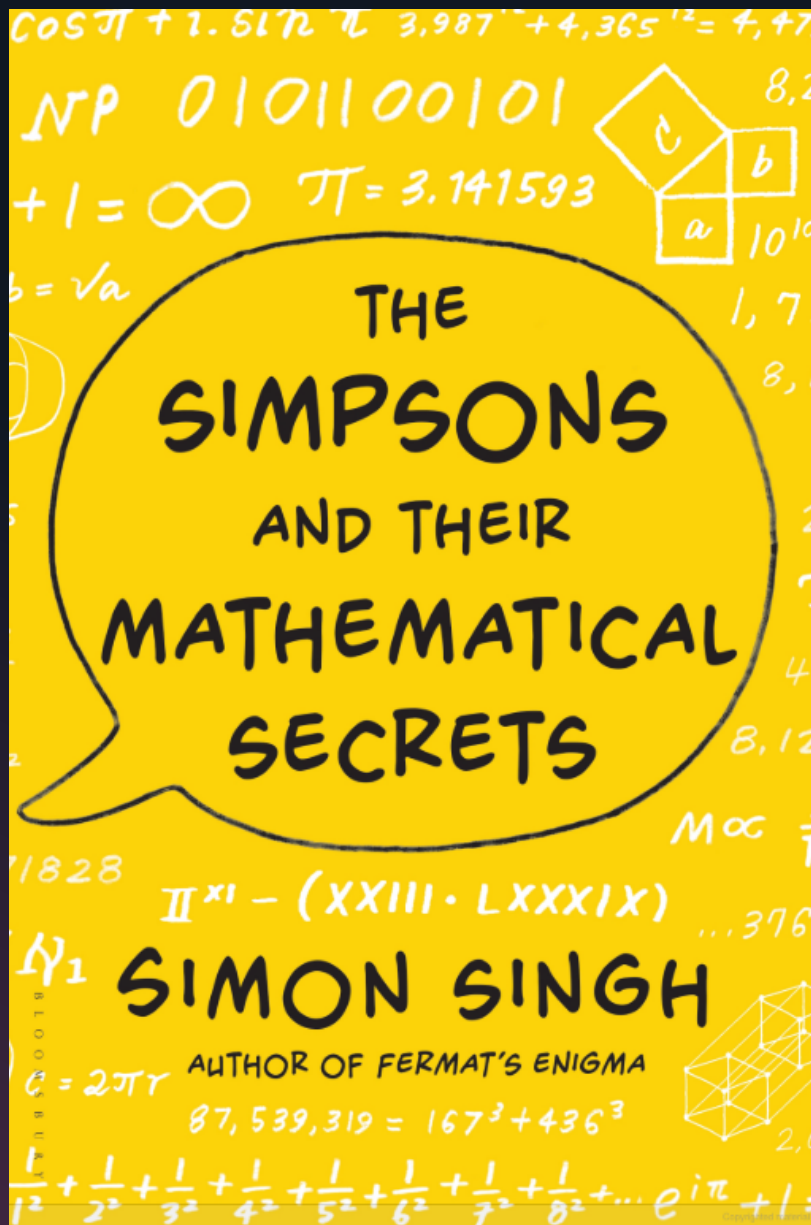
Keeler:

Odenkirk :

Warburton:

Westbrook:





## Writers:

**Burns:** BS in Mathematics from Harvard University

**Clausen:** Mechanical Engineering Major

**Cohen:** BS in Physics from Harvard University

MS in Computer Science from UC Berkeley

**Jean:** BS in Mathematics from Harvard University

**Keeler:** BS in Applied Mathematics from Harvard University

PhD in applied Math

**Odenkirk :** PhD inorganic Chemistry from University of Chicago

**Warburton:** BS in cognitive neuroscience from Harvard University

**Westbrook:** Majored in physics and history of science at Harvard University

PhD in computer science from Princeton University

<https://cs.appstate.edu/~sjg/simpsonsmath/degrees.html>

# PICTURE BOOKS

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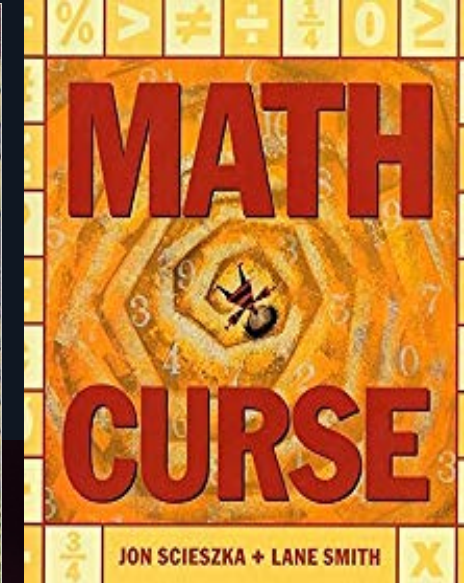
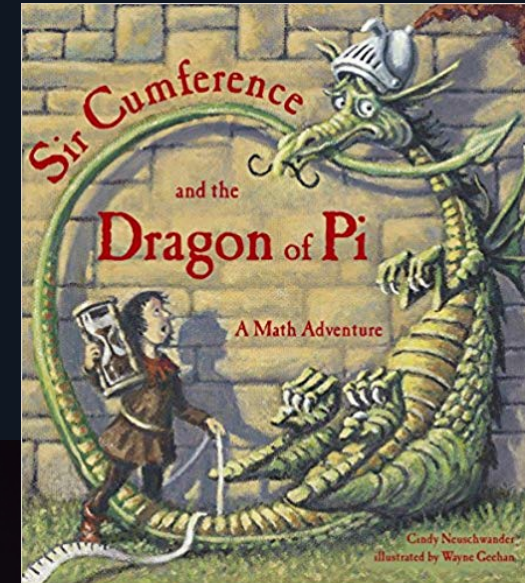
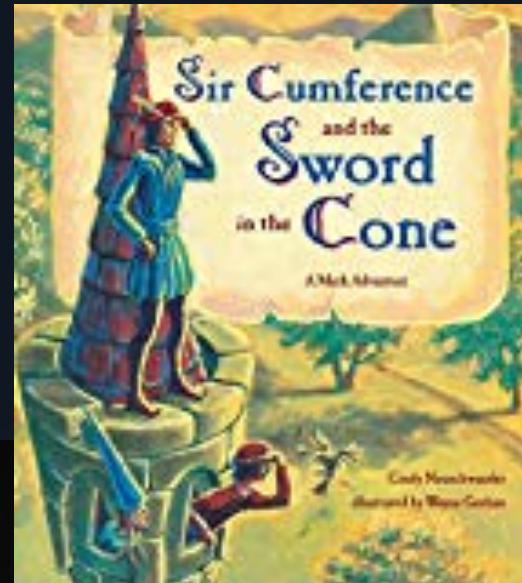
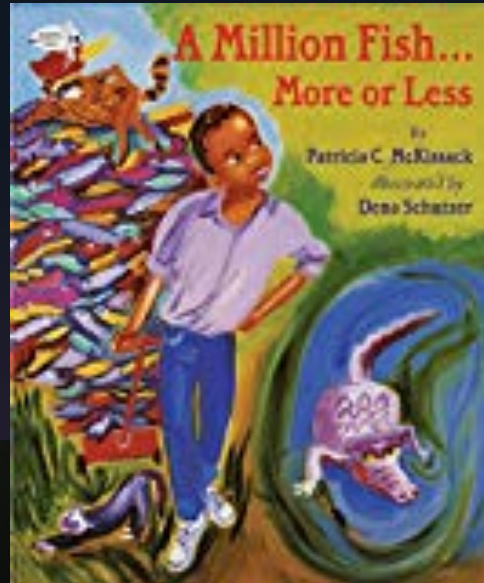
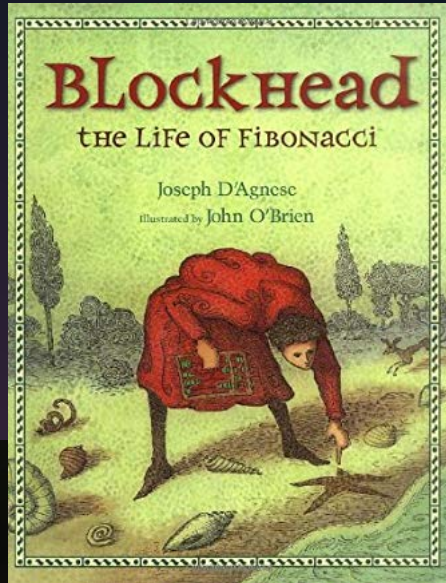
Sometimes when kids see numbers, they start to get confused. If we take out those numbers for a brief moment, they're reading it as a story and they're getting that understanding. It's no longer just about math.



**TRANSLATING  
MATH INTO WORDS,  
AND BACK INTO  
NUMBERS**

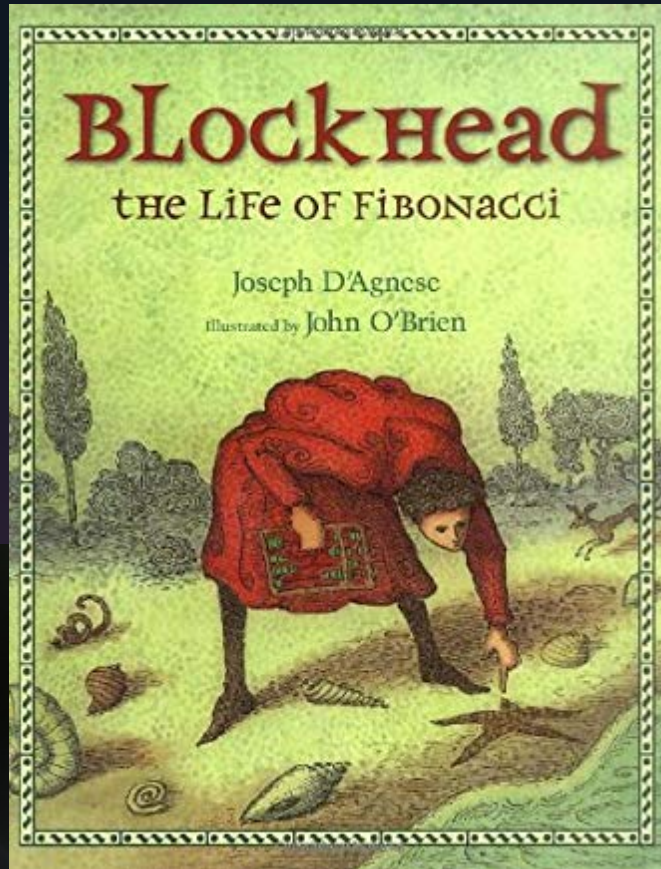
# PICTURE BOOKS

## SECONDARY STUDENTS



# PICTURE BOOKS

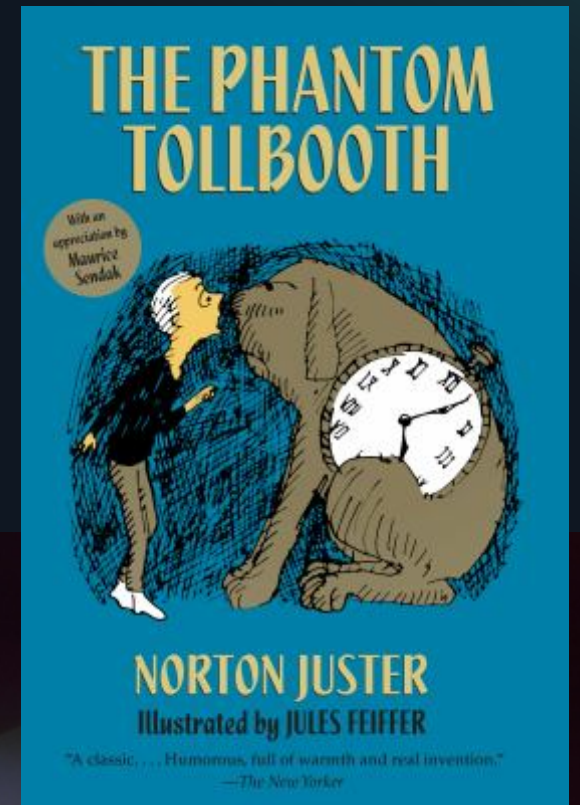
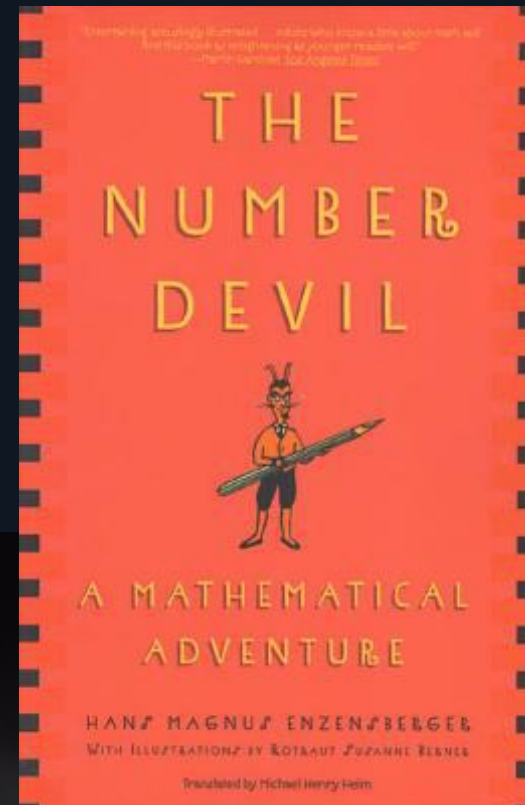
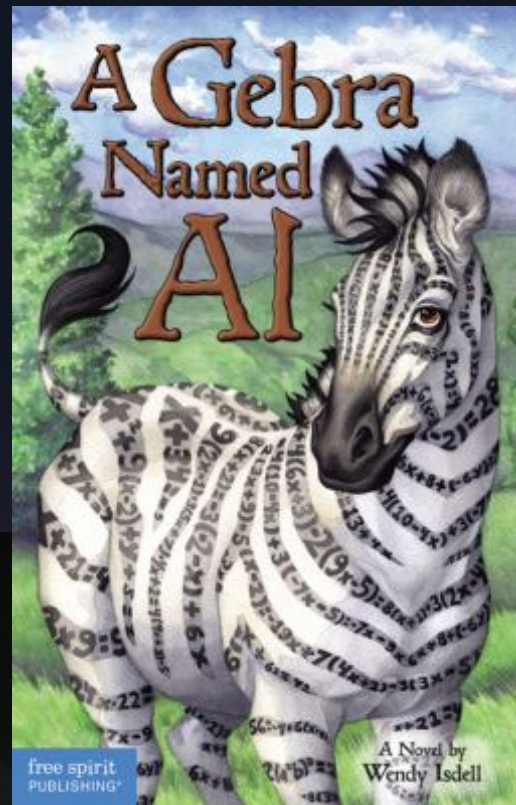
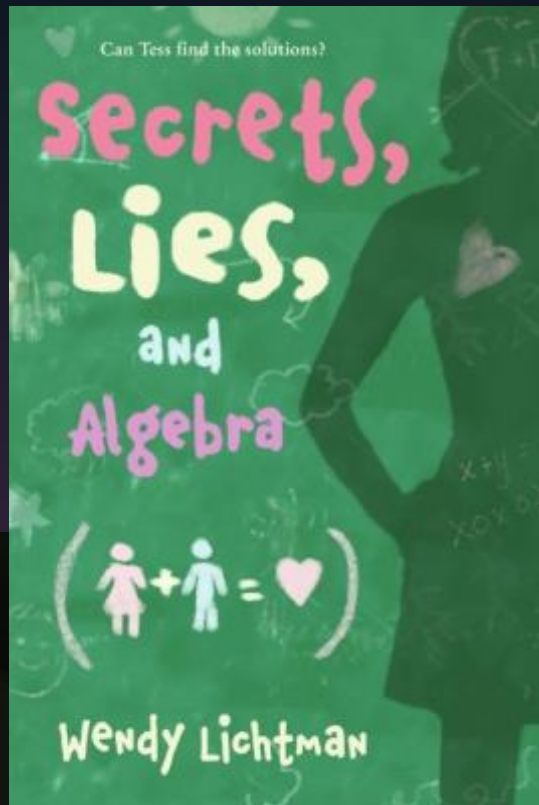
## SECONDARY STUDENTS



A YouTube video player interface showing a woman in a purple shirt signing the equation  $1 \text{ pair} + 1 \text{ pair} = 2 \text{ pairs}$ . The background is a green field with many rabbits. The video player includes a search bar, a play button, a progress bar, and a video title: "Blockhead, the Life of Fibonacci": ASL Mathematics Storytelling. The video has 135 views and was uploaded on Nov 3, 2019. The interface also shows a like button (4 likes), a dislike button (0 dislikes), and a share button.

# CHAPTER BOOKS

## SECONDARY STUDENTS



# CHAPTER BOOKS

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## SECONDARY STUDENTS

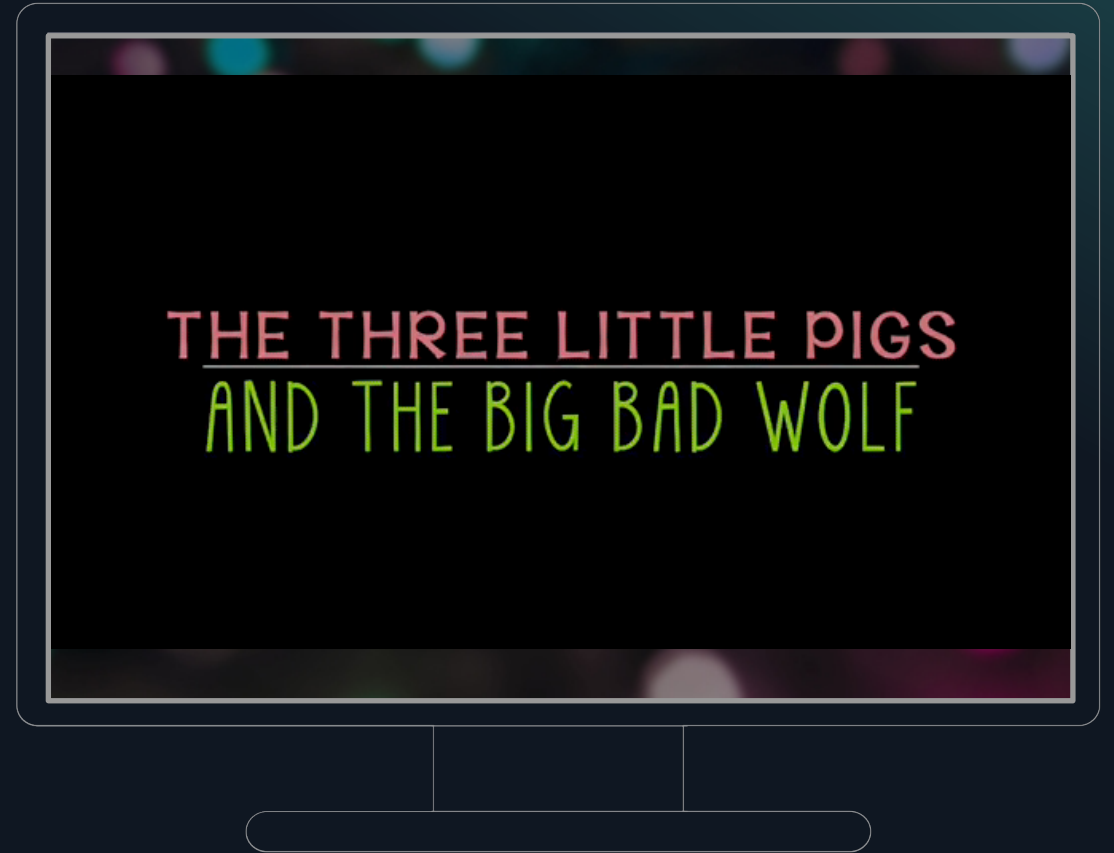
one chapter per class – warm up

# CLASSICS

GOLDDILOCKS AND THE  
THREE BEARS

THE THREE LITTLE PIGS

LITTLE RED RIDING HOOD



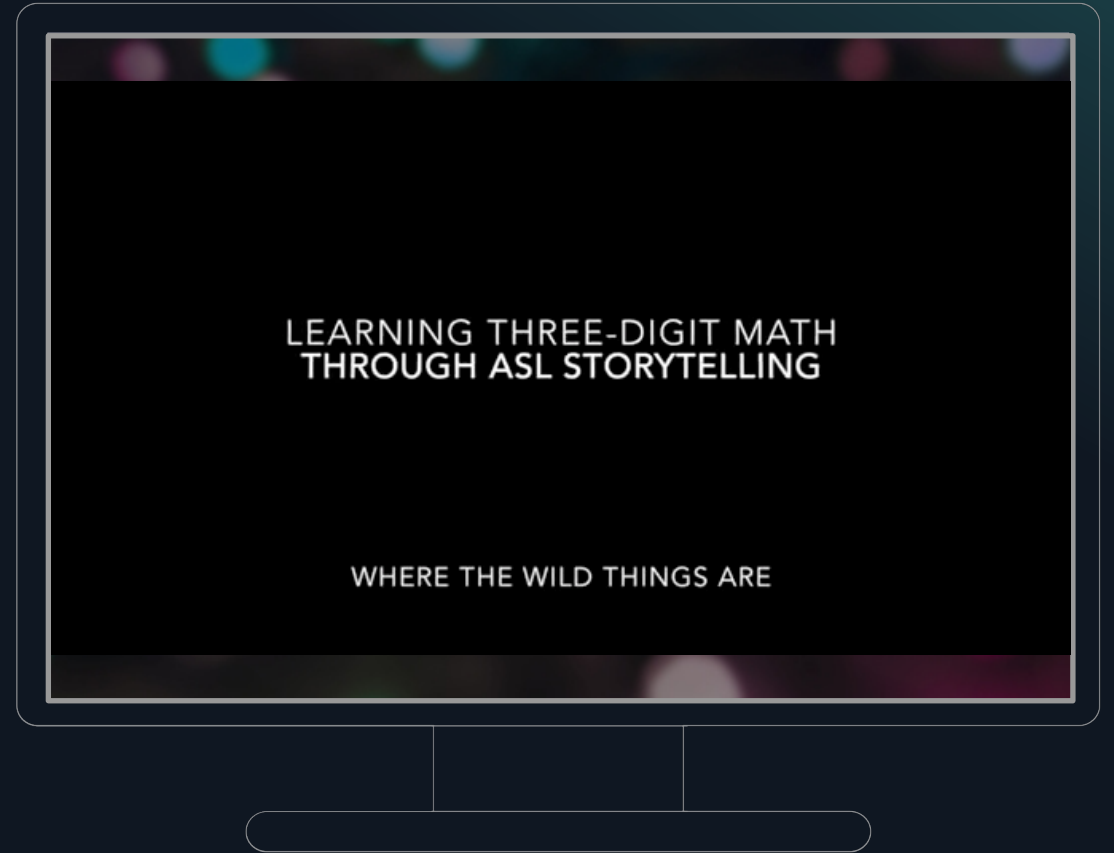


# CLASSICS

WHERE THE WILD THINGS ARE

FAIRY TALES

HANSEL & GRETEL

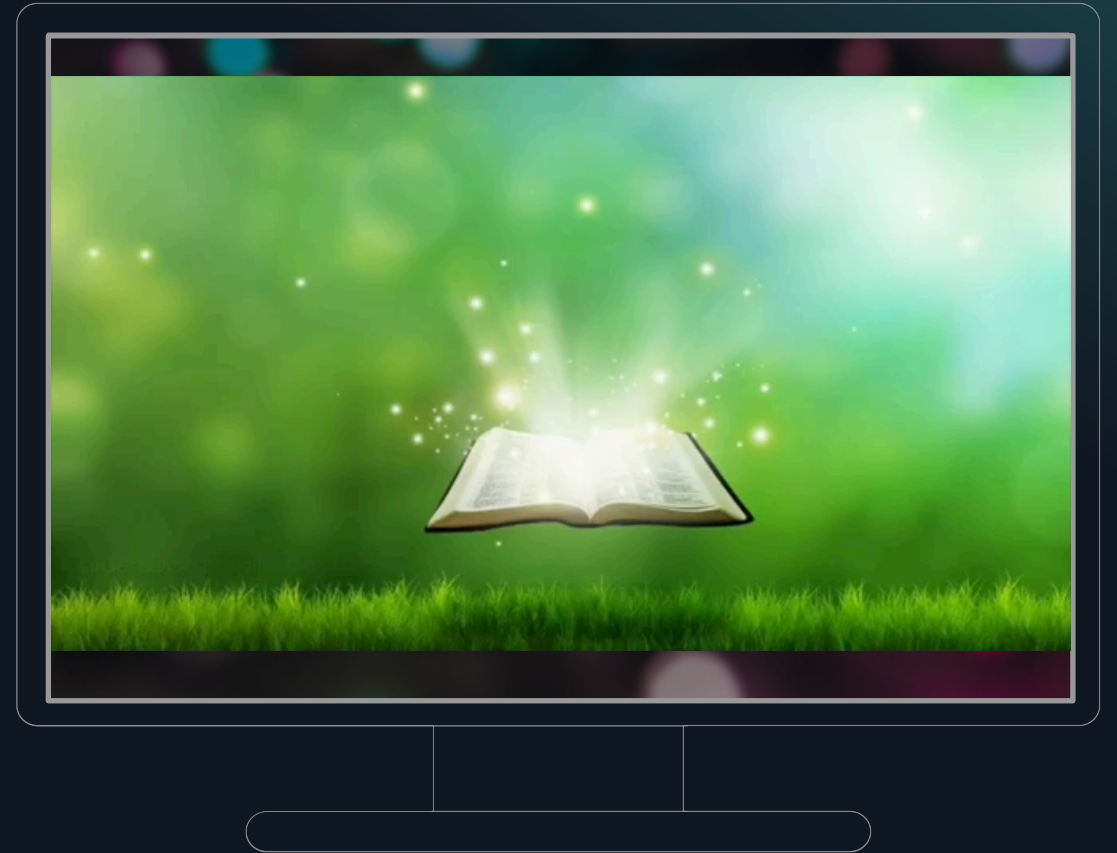


# CLASSICS

WHERE THE WILD THINGS ARE

FAIRY TALES

HANSEL & GRETEL



# STUDENT ASL TEXT

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## ALGEBRA 1

EXPLAINING THE STEPS OF  
SOLVING AN EQUATION IN ASL



# REAL WORLD EXAMPLES

- Students can apply math skills to solve real world problems while telling their story.
- Teachers can use digital storytelling to engage students when applying math to real world problems.
- Students can write their own math story or solve one provided by their teacher or classmate
- Students can apply math concepts when retelling an historical event.
- Teachers can show the historical applications for math.

# REVIEW MATH SKILLS

- Teachers can use storytelling to review skills and concepts.
- Students can develop peer tutorials to help classmates and deepen their personal understanding of math concepts.
- Teachers and students could make “think aloud” stories to generate and share problem solving strategies.

# MATH VOCABULARY

- Students can develop stories that incorporate math vocabulary.
- Students can create math riddles that use math vocabulary.

**BILINGUAL  
TECNOLOGY  
RESOURCES**

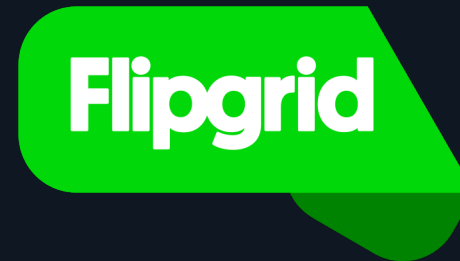
YOUTUBE



KAHOOT



FLIPGRID



GOOGLE  
CLASSROOM





# STUDENT PROJECTS

**Rubrics: ASL Literacy and Mathematics  
Math Digital Portfolio**







# MATHEMATICAL DISCOURSE IN ASL

- What strategy did you use?
- Do you agree?
- Do you disagree?
- Would someone like to share \_\_\_?
- What do others think about what (student) said?
- Can someone retell or restate (student's) explanation?
- Did anyone get different answer?

- Is this a reasonable answer?
- Does that make sense?
- Why do you think that?
- Why is that true?
- How did you reach that conclusion?
- Does anyone want to revise his/her answer?
- How were you sure your answer was right?

# MATH + LITERACY = SKILLS

- Vocabulary
- Discussion & dialogue
- Supporting claims with evidence
- Allow ample time for viewing, interpretation and discussion
- Extrinsic motivation
- Call attention to a void of students knowledge
- Show a sequential achievement
- Discovering a pattern
- Present a challenge
- Indicate the usefulness of a topic
- Use recreational mathematics
- Tell a story of historical event



**MATH IS HARD**



A large, bold red 'X' is superimposed over the word 'HARD' in the text 'MATH IS HARD'.

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# THANK YOU!

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YouTube Channel:

RMDS CO

Instagram:

RMDS MATH

Website:

[www.RMDS.co](http://www.RMDS.co)



**Nancy McAnlis**  
**Nmcanlis@RMDS.co**

**Jeni Jackerson**  
**JJackerson@RMDS.co**