PROMOTE A DEEPER UNDERSTANDING OF MATHEMATICS WITH ASL LITERACY

DeafTEC Math Conference 2019

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ABOUT US

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• 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?
HOW CAN WE INCORPORATE BILINGUAL LITERACY SKILLS INTO MATHEMATICS FOR OUR STUDENTS TO BE MATH LITERATE?
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

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

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

L - 1
Social language
Academic language

L - 2
Social language
Academic language
ASL/ENGLISH BILINGUAL GROWTH

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

L - 1
Social ASL

L - 2
Social English

Academic ASL

Academic English
Bilingual Approach to Language Development for Deaf and HOH Children

L - 1
Social ASL

Academic ASL

L - 2
Social English

Academic English
SOCIAL VS. ACADEMIC LANGUAGE

SOCIAL LANGUAGE
- Natural face to face interaction
- Letters/emails or video texts
- Storytelling
- Telling about what you know

ACADEMIC LANGUAGE
- Solving math story problems
- Formal report about a content topic
CHALLENGES

- STATE TESTING
  - Math ASL signs
  - Viewing skills - Academic ASL

- NATIONAL COMMON CORE MATH STANDARDS
  - Academic English

- MATH CURRICULUM
  - Grade level text
  - Response Text
HOW TO BUILD OUR STUDENTS’ SOCIAL AND ACADEMIC LANGUAGES?
WHAT IS BILINGUAL EDUCATION?

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

<table>
<thead>
<tr>
<th>Grade 6 Students</th>
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<tbody>
<tr>
<td><strong>Key Ideas and Details</strong></td>
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<tr>
<td>1. Cite textual evidence to support analysis of what the text says explicitly as</td>
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<td>well as inferences drawn from the text.</td>
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<tr>
<td>2. Determine a theme or central idea of a text and how it is conveyed through</td>
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<td>particular details; provide a summary of the text distinct from personal opinions</td>
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<td>or judgments.</td>
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<td>3. Describe how a particular story’s or drama’s plot unfolds in a series of</td>
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<td>episodes as well as how the characters respond or change as the plot moves</td>
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<td>toward a resolution.</td>
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<th>Grade 7 Students</th>
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<tr>
<td><strong>Key Ideas and Details</strong></td>
</tr>
<tr>
<td>1. Cite several pieces of textual evidence to support analysis of what the text</td>
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<td>says explicitly as well as inferences drawn from the text.</td>
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<tr>
<td>2. Determine a theme or central idea of a text and analyze its development over</td>
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<td>the course of the text; provide an objective summary of the text.</td>
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<tr>
<td>3. Analyze how particular elements of a story or drama interact (e.g., how setting</td>
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<td>shapes the characters or plot).</td>
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<th>Grade 8 Students</th>
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<tr>
<td><strong>Key Ideas and Details</strong></td>
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<tr>
<td>1. Cite the textual evidence that most strongly supports an analysis of what the</td>
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<td>text says explicitly as well as inferences drawn from the text.</td>
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<tr>
<td>2. Determine a theme or central idea of a text and analyze its development over</td>
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<td>the course of the text, including its relationship to the characters, setting,</td>
</tr>
<tr>
<td>and plot; provide an objective summary of the text.</td>
</tr>
<tr>
<td>3. Analyze how particular elements of dialogue or incidents in a story or drama</td>
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<tr>
<td>propel the action, reveal aspects of a character, or provoke a decision.</td>
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</table>
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.
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.
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.
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.
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.
HOW CAN WE INCORPORATE BILINGUAL LITERACY SKILLS INTO MATHEMATICS FOR OUR STUDENTS TO BE MATH LITERATE?
DIGITAL TECHNOLOGY
MATH
ASL TEXTS

STORYTELLING

RHYTHMS/RHYMES

INTERACTIVE STORYTELLING

SONGS

Adventure of Sir Circumference and Dragon Pi

RIDDLES

JOKES

VOCABULARY

WORD PROBLEMS
ELEMENTS IN MATH ASL TEXTS

- VOCABULARY
- REAL LIFE APPLICATIONS
- MATH NUMERICALS AND CONCEPTS
- IMPACT
- INDIRECT LEARNING
- NATIVE/PRIMARY LANGUAGE
MATH LITERATURE

SOCIAL OR ACADEMIC LANGUAGE?
TODAY'S MATH JOKE
\[ \sqrt{-1} 2^3 \sum \pi \]
AND IT WAS DELICIOUS
Writers:

Burns:
Clausen:
Cohen:
Jean:
Keeler:
Odenkirk:
Warburton:
Westbrook:

https://cs.appstate.edu/~sjg/simpsonsmath/degrees.html
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/~sig/simpsonsmath/degrees.html
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
CHAPTER BOOKS
SECONDARY STUDENTS

1. Secrets, Lies, and Algebra
   Author: Wendy Lichtman

2. A Gebra Named AI
   Author: Wendy Isbell

3. The Phantom Tollbooth
   Author: Norton Juster
   Illustrated by Jules Feiffer

4. The Number Devil
   Author: Hans Magnus Enzensberger
   Illustrated by Michael Rems
CHAPTER BOOKS

SECONDARY STUDENTS

one chapter per class – warm up
CLASSICS

GOLDILOCKS AND THE THREE BEARS

THE THREE LITTLE PIGS

LITTLE RED RIDING HOOD

THE THREE LITTLE PIGS
AND THE BIG BAD WOLF
CLASSICS

WHERE THE WILD THINGS ARE

FAIRY TALES

HANSEL & GRETEL
CLASSICS

WHERE THE WILD THINGS ARE

FAIRY TALES

HANSEL & GRETEL
STUDENT ASL TEXT

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.
• Students can develop stories that incorporate math vocabulary.
• Students can create math riddles that use math vocabulary.
YouTube
Kahoot!
Flipgrid
Google Classroom
BILINGUAL TECHNOLOGY RESOURCES
STUDENT PROJECTS

Rubrics: ASL Literacy and Mathematics
Math Digital Portfolio
TALK ABOUT MATH IN ASL

• Visual vs. hands-on learners
• Peer interaction
• Math language
• Modeling
• Organization
• Understanding problems
• Supporting science
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
THANK YOU!

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