Utilizing Translanguaging pedagogy to foster STEM sensemaking for deaf and hard of hearing students

Scott Cohen, Jessica Scott, Patrick Enderle,
Brianne Weber & Chris Black

NRSC and DeafTEC Math and Science Conference 2026
October 26-28
Rochester Institute of Technology, Rochester, NY

Department of Deaf Studies and Deaf Education, **Lamar University**
Department of Middle and Secondary Education & Department of Learning Science, **Georgia State University**



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Current challenge on scientific communication with deaf students

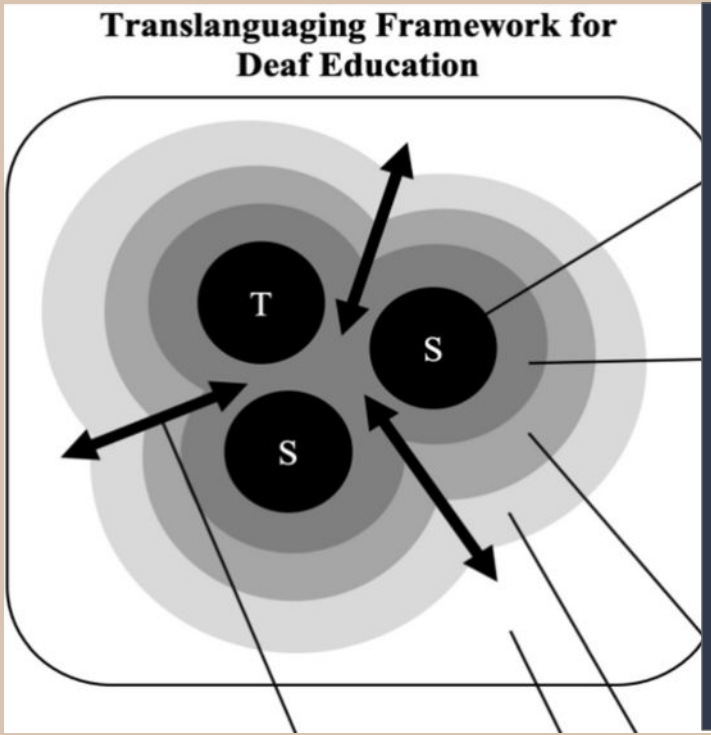
- Lack of academic ASL in STEM content (Enderle et al., 2020; Enderle et al., 2023)
  - Majority of STEM terms are signed in lay term concepts
    - I.e: hypothesis, theory, and law
- Deaf students underachieving in math and science (Marschark & Knoors, 2012)
  - Limited opportunity to enroll advanced math/science classes
- Limited studies in informal science education with deaf students (Dawson, 2014)
  - Exemplar: Classroom of the Sea (Hupper et al., 2000)

Translanguaging as tool to promote STEM sensemaking for deaf students

Engaging in the practice of doing science to make sense of STEM content within contexts

- Leveraging students' communication and language capacity to produce meaningful dialogue in STEM-rich learning space
- Moving away from language separation ideology of bilingual to multilingual approach valuing the learners' cultural and linguistic assets
- Centered students as epistemic agent to drive their STEM sensemaking experience

TFDE (Wolbers et al., 2023)



- Individual Ideolects
- Come to shared understanding
- Metalinguistic Awareness
- Share with external audience
- Critical analysis on the social context

Translanguaging activity #1

Winter is coming and people are complaining that hand warmers are bulky and do not keep their fingers warm.

Your team need to design a new hand warmer that fits the hand like a glove and warms the entire hand

- Restriction
  - You cannot use formal language
    - No signing
    - No speaking
    - No writing
- Allowance
  - You can gesture, draw, use phone to show visual images such as picture of a chemical compound or a materials (no writing on the phone!)
- Debrief
  - What strategies emerged to facilitate communication?
  - What frustrated you because you couldn't use language?
  - What helped your group to communicate?

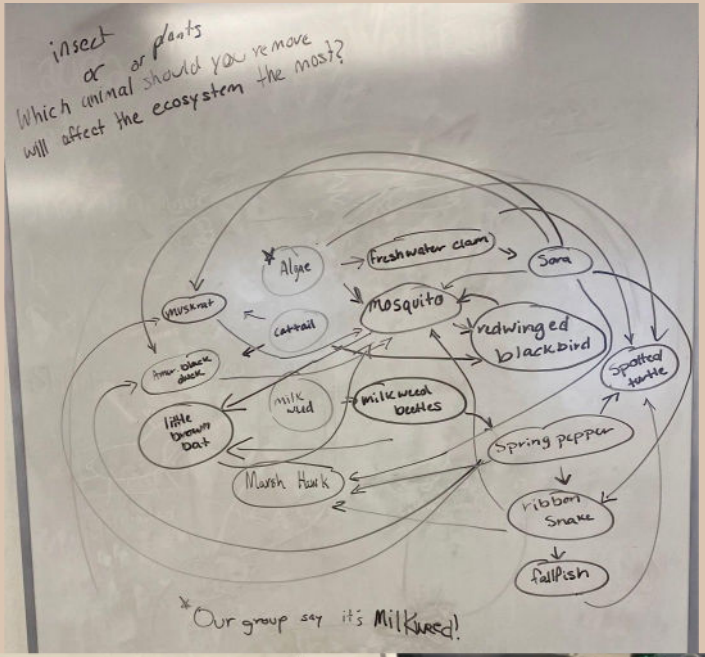
STEM Hands: Summer STEM Camp for deaf students

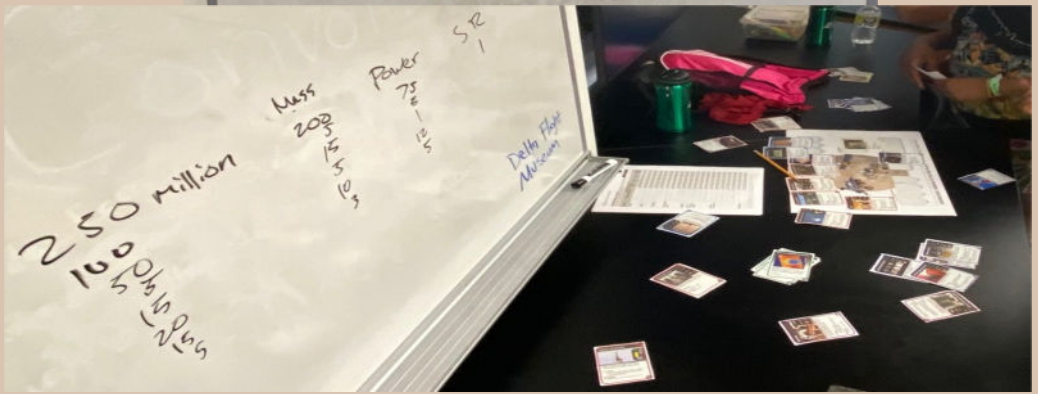
- 10 campers: 7 boys; 3 girls
- Most communicated in ASL, few could speak English, and 1 non-signer
- Residential camp hosted at university to give high school students a taste of college life
- Engaged in various STEM learning activities on and off-sites



STEM Challenges

- Challenge #1: Creating a Marsh Ecosystem Food Web of to identify which species removed from the web have devastating effect to the ecosystem
- Challenge #2: Design a base yard in Mars for human to live in and develop a research mission to conduct study on potential Mars colony





Vignette 1 - Individual Ideolects

Students used multiple resources simultaneously when given large collection of communication resources working on the challenges

- Whiteboard
- Computer
- Phone/tablet
- Handouts & pencils

Group two had three students, one who did not know sign language, but utilizing gesture and fingerspelling to construct their food web

Vignette 2 - Coming to a Shared Understanding

Building the Mars baseyard:

Student looked up for the definition on microbial, a new scientific term. Definition informed the risk and harm on not monitoring microbials connecting to their understanding of human health and ventilation system

Designing Mission on Mars:

Each group was building a rocket to collect data but had constraints to work around: mass, power, money, and stars.

“HEAVY ROCKET CAN’T TAKE-OFF”
- Group 1
“HEAVY ROCKET CAN’T LAND”
- Group 3

Marsh Ecosystem Food Web & Mission to Mars

Tangible products: whiteboard, computer, phone/tablet, papers and handouts, (Durable)

Translanguaging

Intangible processes: Signing, speaking, gesturing, fingerspelling, writing, reading (Ephemeral)



Students' Intra- & interpersonal interactions with peers and adults

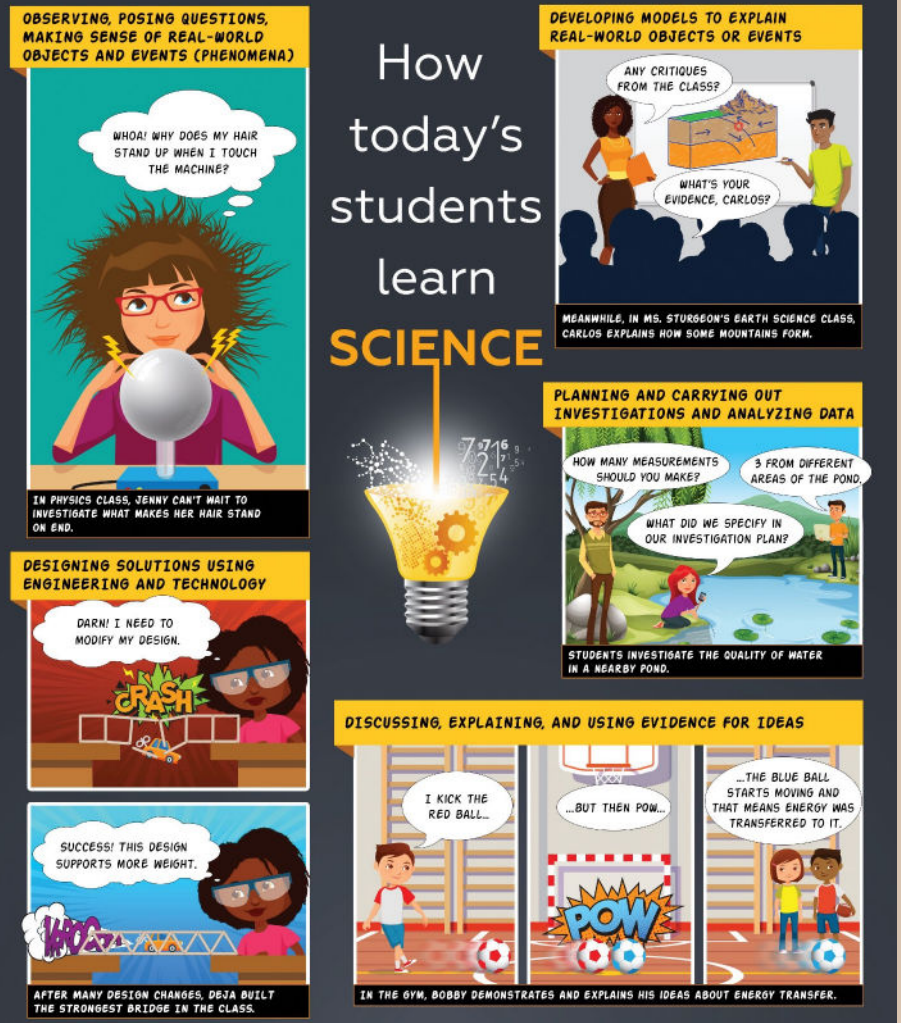
STEM Sensemaking

Translanguaging activity #2

- You will need to establish a base yard on Mars by sorting the cards on the gameboard
  - The base yard need to have
    - Power system
    - Food system
    - Water system
    - Oxygen system
    - Communication system
    - Science Labs
    - Rover
    - Extra system
- 4 people in a group
  - Person A will gesture only
  - Person B will draw only
  - Person C will use phone only
  - Person D will sign/write only

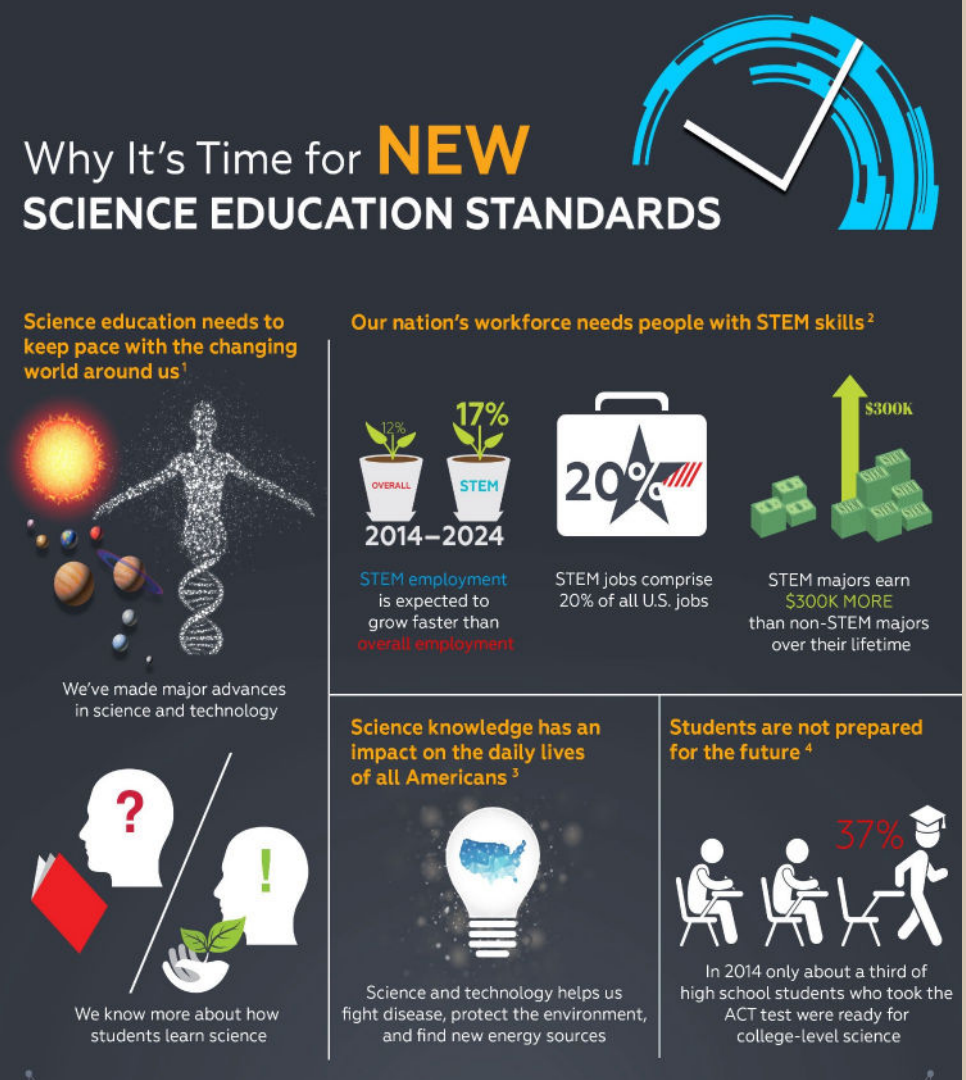
(Vivify, 2019)

- You will have 2 minutes to decide the role and 5 minutes to sort the card the base yard
- Debrief
  - In what ways did the communication breakdown or become richer?
  - What was the biggest barrier on communicating with your team?
  - What evidence of learning did you experience?
  - How can you apply this activity with your students?



Languaging and Science Learning Standards

- Help students build cohesive understanding of science (NGSS Lead States, 2013)
- Based on the Framework of K-12 Science Education (National Research Council, 2012)
- The three dimensions are
  - Disciplinary Core Ideas (DCI)
  - Science & Engineering Practices (SEP)
  - Crosscutting Concepts (CCC)



TAKEAWAY

- Describe, not prescribe translanguaging in your classroom
  - Reinforcing students' conceptual understanding with translanguaging
  - Modeling communication usage with non-linguistic and linguistic resources
  - Opportunity to deepen their conceptual understanding as they use translanguaging to expand their linguistic repertoire



Thank you for coming to this presentation

Scohen1@lamar.edu

