

SLICE Your Way Through Chemistry: How Embodied Cognition Can Increase Learning Comprehension



Rochester Institute of Technology

National Technical Institute for the Deaf

Sign Language Incorporation in Chemistry Education (SLICE) Team Member

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Outline

1. Background information and statistics
2. My job at RIT/NTID
3. My partner for organic chemistry
4. The language barrier problem
5. Development of organic chemistry workshops
6. ASLCore
7. SLICE
8. Results
9. Closing and questions

Activity – Part 1

List One:

1. APPLY
2. JUMPY
3. FIELD
4. JUICY
5. CRUST

List Two:

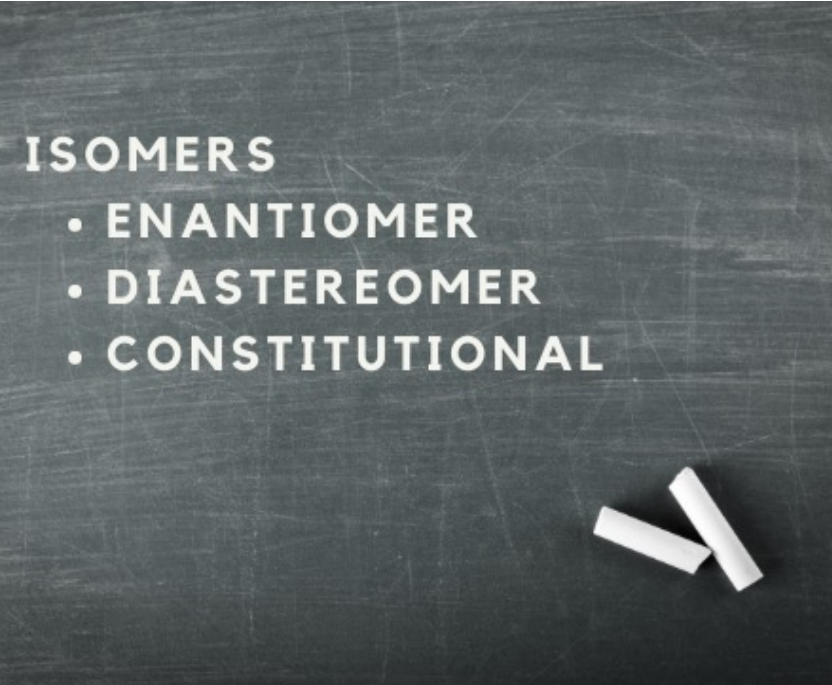
1. BEN__
2. BLI__
3. CLO__
4. STU__
5. WHI__

Read list one. For list two, think of a word that matches the given word with blanks.

The Problem with the Traditional Classroom

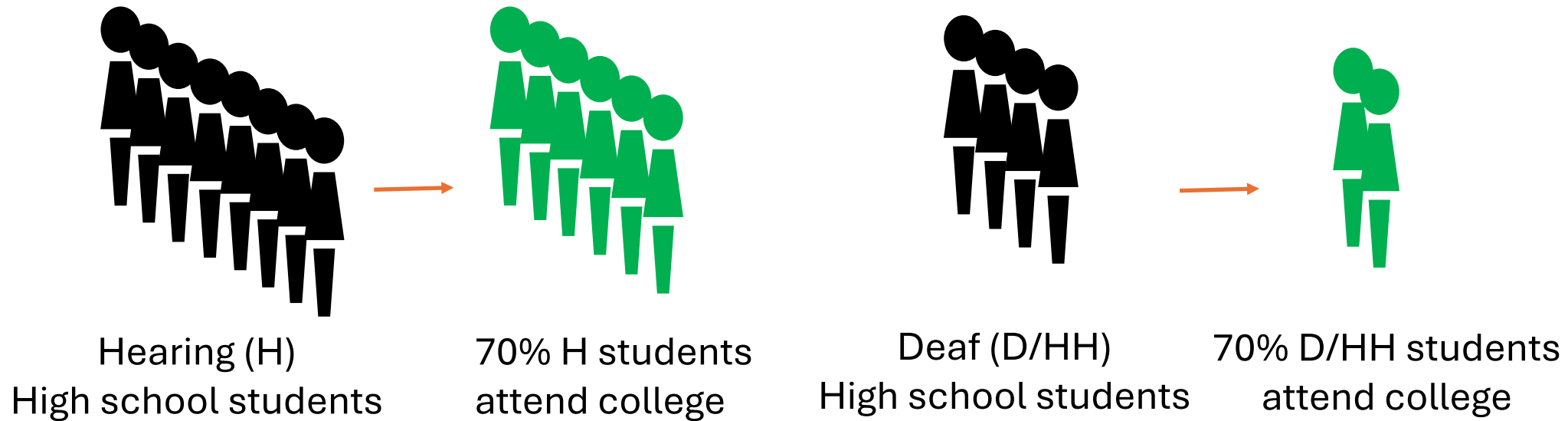
Traditional teaching methods unintentionally favor auditory learners

Technical vocabulary is used



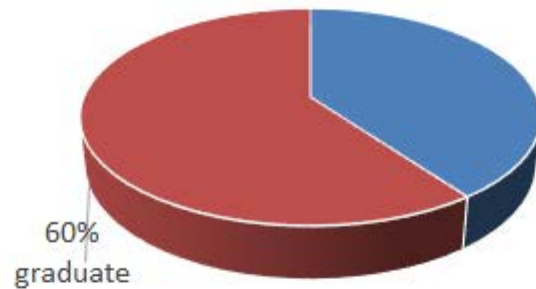
What is the state of Deaf students pursuing STEM degrees?

- The percentage of students who enroll in college is the same for D/HH students as for hearing students.

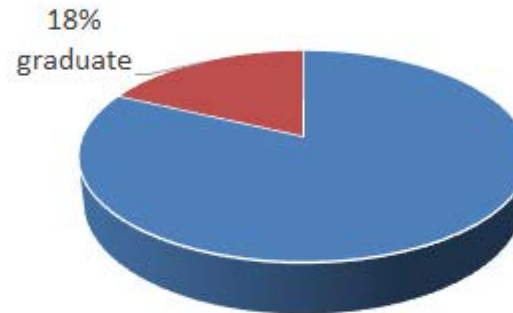


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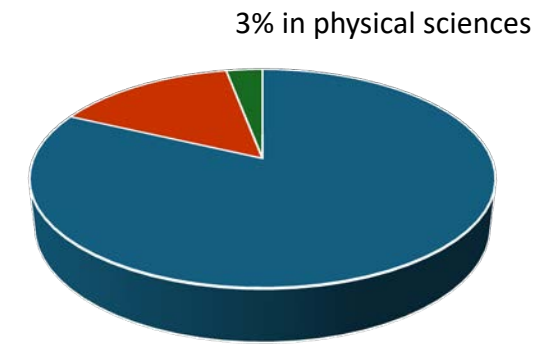
- A survey by the U.S. Department of Education (2019) reported that only 18% of D/HH students completed their bachelor's degree
- Of these degrees, few are in STEM-related fields especially in the physical sciences (3% enrolled).



6-year average graduation rate for hearing students



6-year average graduation rate for D/HH students



My Job at RIT/NTID

- Tutoring support for D/HH students in chemistry courses
- Ensuring D/HH students have proper access in their chemistry lecture and lab courses
- Coordinating D/HH workshops and D/HH Teaching Assistants (TAs) for organic chemistry – first group on campus to do this!
- SLICE team member



My Partner in Organic Chemistry

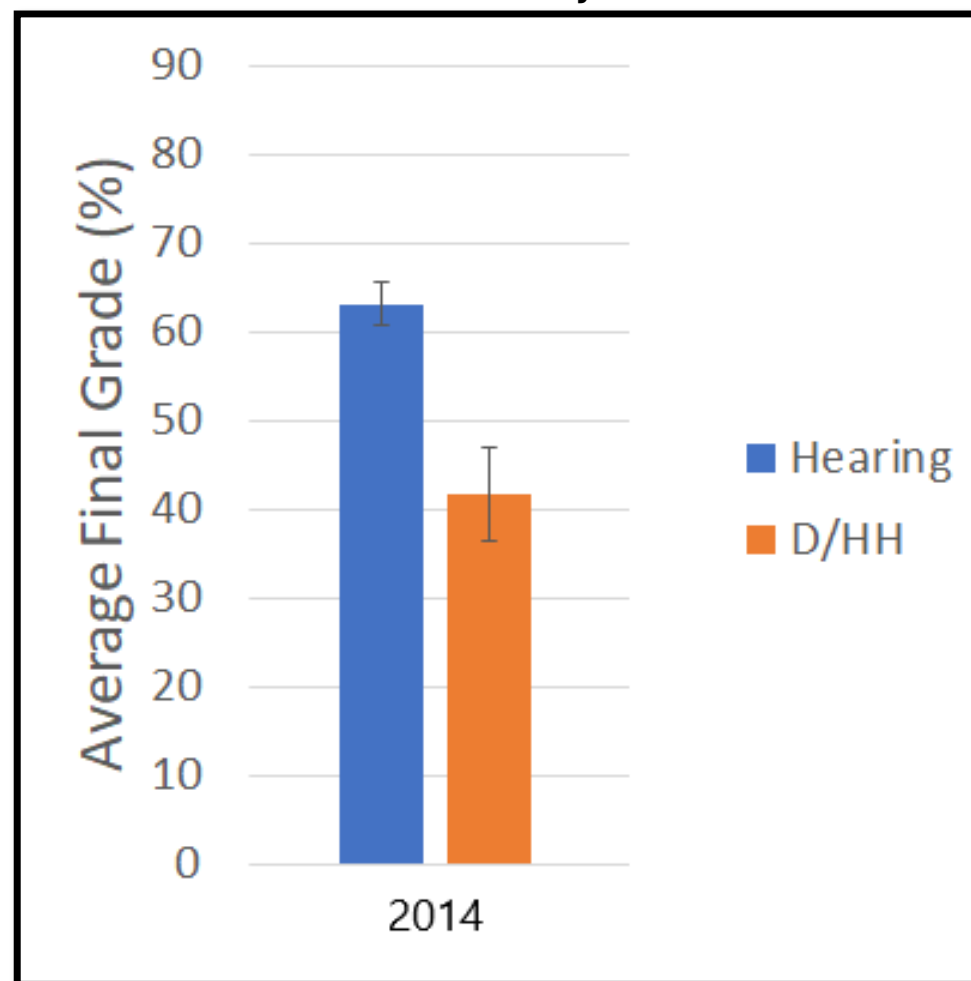
- Tina Goudreau Collison
- Professor
- School of Chemistry and Material Science in the College of Science
- Organic chemistry lecture instructor
- SLICE Founder



Recognizing the Language Barrier

- 2013-2014 AY D/HH students underperformed compared to their hearing peers (organic chemistry)
- Biggest differences in alkene/alkyne chemistry content (exam 4)
- First exam where things get complicated in organic chemistry

Exam 4 – Alkenes /Alkynes content



Strategizing to Solve the Language Barrier

- Sat in on the lecture course and listened to interpreter and instructor
- Majority of terms were fingerspelled
- Not many developed signs for the content
- No lecture workshops met D/HH student communication needs

Goal: Implement interventions that would improve D/HH student performance to meet average of the class

Criteria to Become a Teaching Assistant (TA) for Organic Chemistry

- Minimum grade of B in organic chemistry I to be a TA for organic chemistry I
- Minimum grade of B in organic chemistry II to be a TA for organic chemistry II
- Ability to communicate with D/HH students
- Attend weekly TA meetings with coordinator (me)
- Run weekly organic chemistry workshops for D/HH students
- One credit hour of teaching experience on transcript and formal letter grade

The Pioneer TAs



First two D/HH TAs for organic chemistry workshops

Amie Sankoh (first Black, Deaf PhD in STEM in the world)

Deanna Phillips (graduated with BS in Biomedical Sciences)

The Pioneer Teaching Assistants (TAs)



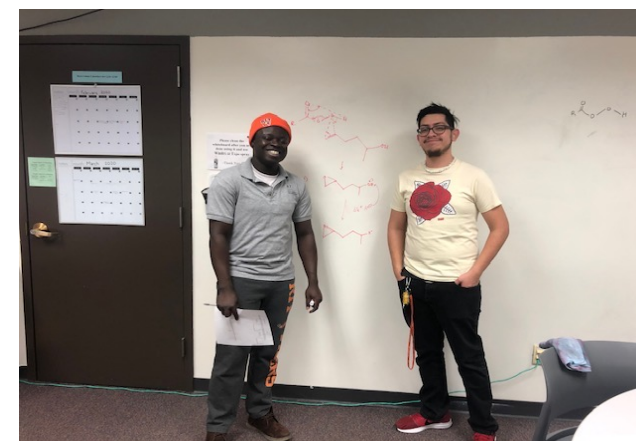
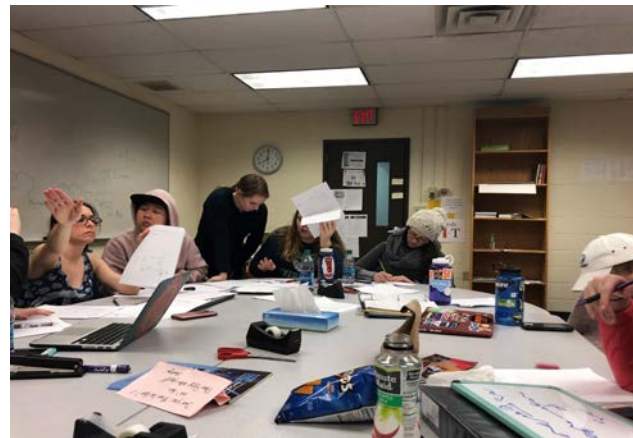
Emmanuel Perrodin-Njoku
BS degree
Biomedical Sciences
Currently working for Gallaudet
University

First TAs to start developing and begin propagating organic chemistry signs in workshops, lecture courses and with interpreters.



Franly Ulerio-Nunez
BS degree
Biochemistry
Currently pursuing MS in Biochemistry

Organic Chemistry Workshops



Strategizing to Solve the Language Barrier Problem

- Frequent meetings with Tina Goudreau Collison to strategize
- Picking team of students
- Development of term bank from lecture and lab
- Sorting terms into categories:
 1. Already has a sign that is good
 2. Already has a sign but is not chemistry specific
 3. Needs a sign developed
 4. Best fingerspelled

Weekly Meetings with Team of Students

- Explained each term from a chemistry standpoint
- Ensured proper recall of all information needed to adequately inform new sign production with chemical accuracy
- Students develop new sign – must unanimously agree
- Student show me new sign – I agree or disagree from a chemistry standpoint, if disagree, start process again
- Video document new sign

ASLCORE

- All signs reviewed for ASL merit by ASLCore reviewers
- Formally recorded signs
- Created expansion videos
- Uploaded to <https://aslcore.org/organicchemistry/>
- All work done with internal funding by RIT Provost Learning Innovation Grant (PLIG) and NTID Dodge grant



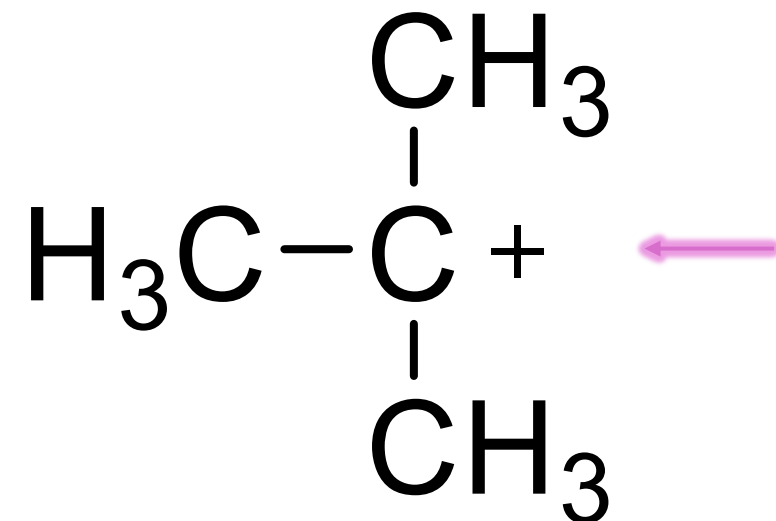
ASLCore Team



Carbocation Example

A carbocation is an ion with a positively charged carbon atom

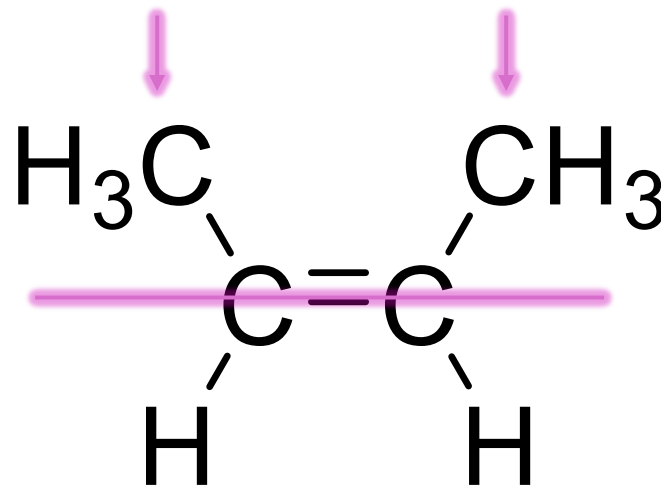
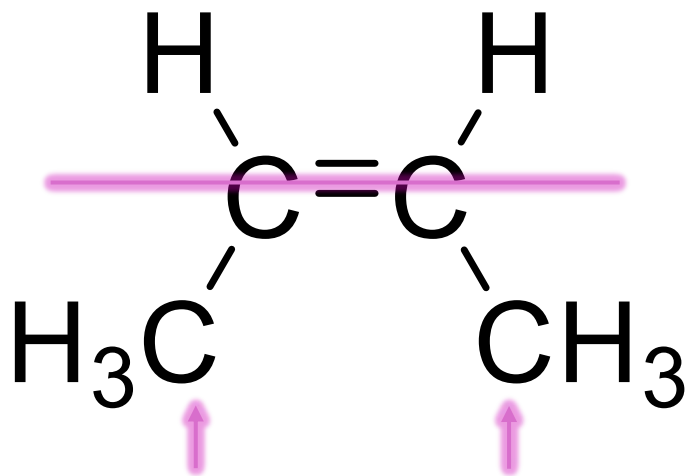
<https://aslc.org/organicchemistry/entries/?id=carbocation>



Cis Alkene Example

A cis alkene contains the two largest groups on the same side of the double bond

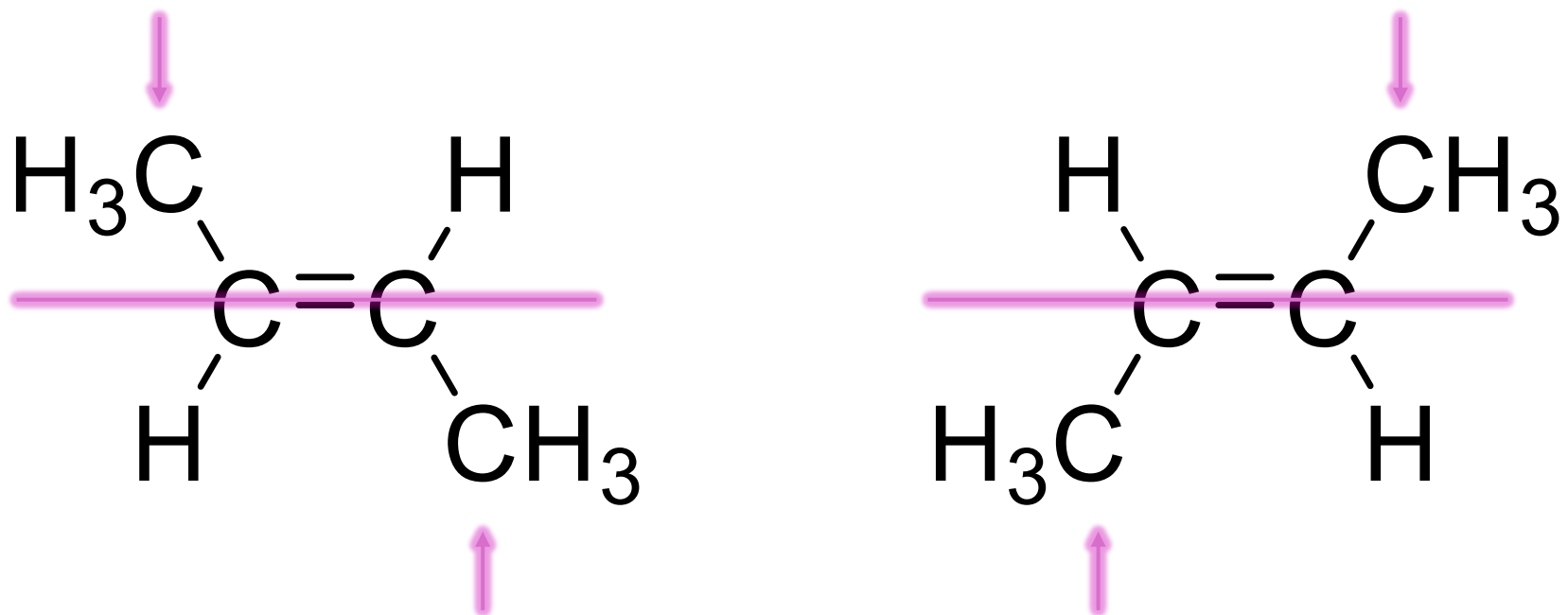
<https://ascore.org/organicchemistry/entries/?id=cis>



Trans Alkene Example

A trans alkene contains the two largest groups on opposite sides of the double bond

[Trans | ASLCORE Organic Chemistry](#)

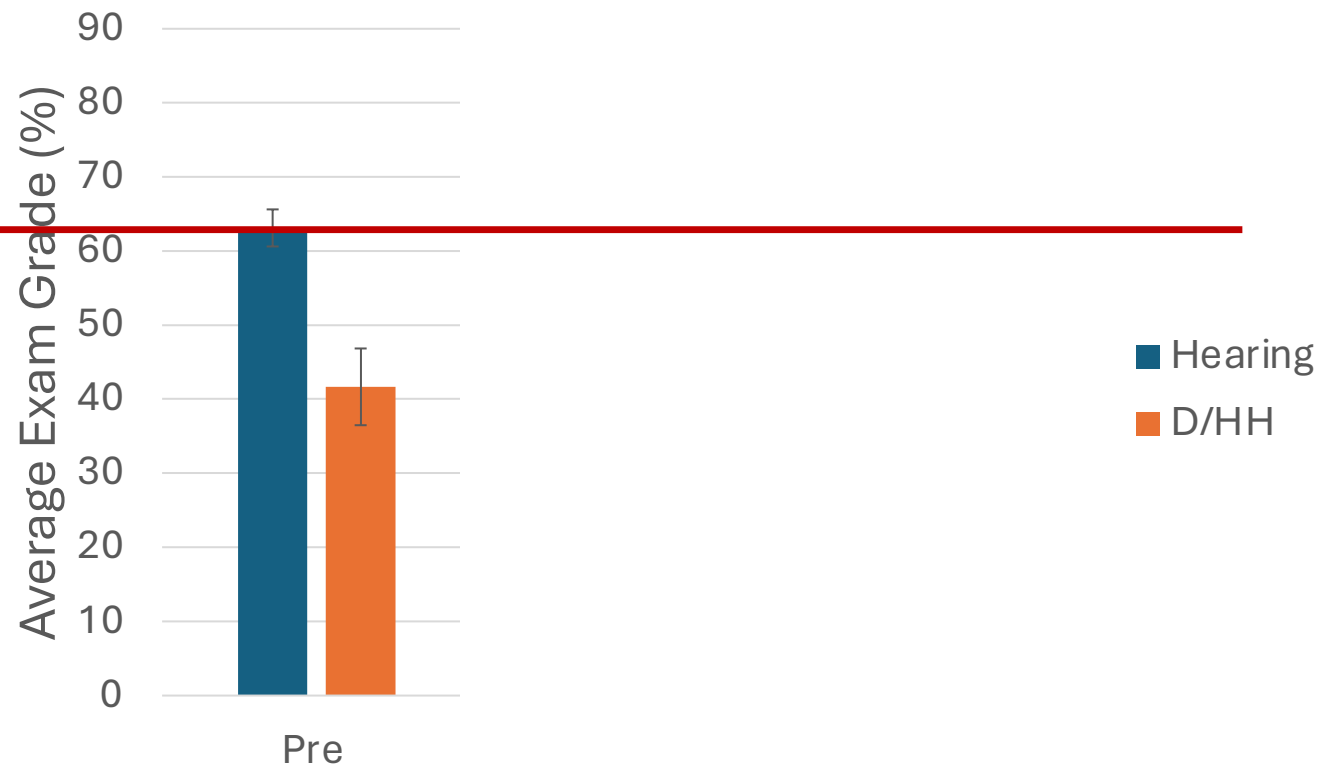


What is SLICE?

- Slice stands for **S**ign **L**anguage **I**ncorporation in **C**hemistry **E**ducation
- Group of scholars at RIT/NTID composed of students and faculty
- Focuses on embodied cognition in the classroom by having students use their hands to compliment their chemistry education
- Recipient of the Royal Society of Chemistry's Diversity and Inclusion Prize in 2022
- Recipient of NSF grant for \$453,000 to expand on our work to include developing more organic chemistry signs as well as general and biochemistry signs



What happened upon implementation?



Cohort	
(Ay year, D/HH students)	
Pre	(2014, n=4)
Mid	(2015, n=3)
Post	(2016-2019, n=18)

Activity – Part 2

List One:

- 1.
- 2.
- 3.
- 4.
- 5.

List Two:

- 1.
- 2.
- 3.
- 4.
- 5.

Try to remember list one and two now. How many words did you remember? Which list did you remember the most words from?

Closing

- There is still much work that needs to be done
- NSF grant runs for next three years
- Work will focus on:
 1. Expanding on what we already have for organic chemistry
 2. Vocabulary and expansion videos for general chemistry
 3. Vocabulary and expansion videos for biochemistry
 4. Building new ASLCore website under RIT/NTID umbrella

Questions?



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SLICE and REActivities website: <https://www.reactivities.org/slice>