Evaluation Report

# *Increasing Undergraduate Student Interpreters' Fluency and Accuracy in Interpreting STEM Content*

(Award #2313816)

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## I. Evaluation Protocols

PI Vesel from TERC, Co-PI Clark from Lamar, and Co-PI Hill from EKU collaborated throughout the evaluation. The Lamar team, under the leadership of Co-PI Clark, had primary responsibility for guiding Co-PI Hill in implementing the evaluation at Eastern Kentucky University (EKU). Co-PI Clark, with input from Hill and Vesel, had primary responsibility for preparation and analysis of data. PI Vesel oversaw the entire evaluation and had primary responsibility for documentation and reporting.

The evaluation began with a Zoom meeting, led by Clark to introduce faculty to the components of the research process. This included four members of EKU's Department of American Sign Language and Interpreter Education (ASLIE) who had responded to solicitations from Hill for faculty to lead groups of students in use of the project materials. It also included Department Chair Roush and Hill. At the end of the meeting, attendees were given links to the materials (SBD, Signing Bioscience Lexicon [SBL] and Fingerspelling Videos to review. As a follow-up, two Lamar team members visited EKU to meet face-to-face with those who had attended the Zoom meeting and an additional faculty member who volunteered afterwards to serve as a group leader. The time was spent discussing their plans for use of the materials with students, reviewing the data collection process, and clarifying issues and concerns.

Recruitment of students began shortly thereafter. It was accomplished as follows. Students were made aware of the opportunity through announcements in their classes, postings throughout the department, and online messaging. After an initial solicitation period, students were invited to an informational meeting to learn more about the purpose of the project and what they would be doing. At the end of the meeting, those students who were interested in participating remained and were randomly divided into groups to complete EKU's requirements for working with human subjects. This involved reading and signing a consent form. They also completed a Participant Information Form that provided information such as ASL course and sign proficiency levels for use during analysis. Students who were unable to attend the meeting or could not remain had an opportunity to join afterwards and complete these tasks. This process resulted in 21 students. Prior to beginning the evaluation, they were randomly divided into six groups of 3-5 students per group. Although seven faculty had volunteered to be leaders, two had decided to lead a group together. IRB approval for the study was subsequently obtained for each student from TERC, Lamar, and EKU.

The evaluation followed. It consisted of each of the six groups completing four 60-minute stand-alone sessions. These sessions were conducted outside of class time. During the first session, students who had not done so previously read and signed a consent form and completed the Participant Information Form. The remainder of the session involved them in completing a Signing Vocabulary Pre-test and a Pre-Interpreting Sample. The Pre-test consisted of students signing and interpreting the meaning of the 52 terms listed in the Heredity and Genetics category of both the SBD and SBL. For the test, leaders asked the student to sign the first term and specify its meaning. They recorded "yes" if the sign was correct and "no" if it was incorrect or if the student did not know the sign for the term. They did the same for ability to specify the meaning of the term. After having completed this process for all 52 terms, leaders tallied the number of terms the student was able to sign and the number for which the student was able to provide the meaning. This provided baseline information about students' vocabulary knowledge prior to using the project materials.

For the Pre-Interpreting Sample, students were asked to interpret content from a model Heredity and Genetics spoken language lecture presentation using the same pre-recorded video

as was used for the evaluation at Lamar (https://sign-sci.s3.amazonaws.com/publications/SBD_Interpreters_Year_2_Evaluation_Report.pdf. The interpretation was video recorded for use during analysis. Scores provided baseline information about the student's ability to interpret material that incorporated the Heredity and Genetics terms prior to using the project materials.

Session 2 began with leaders demonstrating use of the materials. Distribution of vocabulary and study sheets with the Heredity and Genetics terms and online access to the SBD, SBL and Fingerspelling Videos followed. For the remainder of the session, students used the resources and made notes on their study sheets about how to sign and specify the meaning of the various terms. Leaders circulated among students as they worked and answered their questions. They also made notes on an Observation Form about what students did and said as they worked.

During Session 4 students completed a Signing Vocabulary Post-test, and a Post-Interpreting Sample. These materials were the same as those used during the first session. Scores provided information about change in students' ability to sign and provide the meaning of the Heredity and Genetics terms and interpret spoken material that incorporated these terms.

After having completed their work with students, each leader participated in an interview via Zoom about their experiences. Their responses were recorded for use during analysis.

Upon completion of the above, members of the Lamar team in collaboration with Co-PI Hill and PI Vesel, prepared the data for analysis. Co-PI Clark, with input from Hill and Vesel, then completed the analysis.

Section VI provides examples of the Signing Vocabulary Test Form, Student Study Sheets, Observation Form, Leader Interview Questions, and Interpreting Sample.

## II. Participant Demographics

### Students

| PARTICIPANT | | | | | | | |
|---|---|---|---|---|---|---|---|
| NUMBER | INITIALS | ETHNICITY | GENDER | YEAR | LANGUAGE or SIGN SYSTEM | ASL LEVEL | ASL FLUENCY |
| **NH1** | SR | Caucasian/White | Non-binary | 2nd Year | Spoken English, ASL | 2 | Intermediate |
| **NH2** | KH | Caucasian/White | Female | 1st Year | Spoken English, ASL, | 4 | Intermediate |
| **NH3** | EK | Caucasian/White | Female | 2nd Year | Spoken English, ASL, | 4 | Intermediate |
| **NH4** | AT | Caucasian/White | Female | 2nd Year | Spoken English, | 4 | Intermediate |
| **NH5** | EA | Caucasian/White | Non-binary | 3rd Year | Spoken English, | 6 | Intermediate |
| **ER1** | JW | Caucasian/White | Female | 3rd Year | Spoken English, ASL, | 6 | Intermediate |
| **ER2** | KK | Caucasian/White | Female | 3rd Year | Spoken English, ASL, | 6 | Intermediate |
| **ER3** | MM | Caucasian/White | Transgender | 3rd Year | Spoken English, ASL, | 6 | Intermediate |
| **ER4** | IT | Caucasian/White | Female | 2nd Year | ASL, Spoken English, | 4 | Survival |
| **ER5** | LK | Caucasian/White | Male | 2nd Year | ASL, Spoken English, | 3 | Survival |
| **HJ1** | MR | Asian American | Female | 3rd Year | ASL, Spoken English | 6 | Intermediate |
| **HJ2** | BH | **Caucasian/White** | Female | 2nd Year | Spoken English | 4 | Intermediate |
| **HJ3** | SM | Caucasian/White | Female | 4th Year | Fingerspelling, ASL, | 6 | Intermediate |
| **DR1** | MM | Caucasian/White | Female | 3rd Year | Spoken English, ASL, | 6 | Intermediate |
| **DR2** | SW | Caucasian/White | Female | 3rd Year | Spoken English, ASL | 6 | Survival |
| **DR3** | TM | African American/Black | Female | 3rd Year | Spoken English, ASL | 4 | Intermediate |
| **SC1** | MD | Caucasian/White | Female | 2nd Year | Spoken English, ASL, | | Survival |
| **SC2** | KM | Caucasian/White | Female | 2nd Year | Spoken English, ASL, | | Survival |
| **KS1** | AL | Caucasian/White | Female | 2nd Year | Spoken English, ASL | 4 | Intermediate |
| **KS2** | ES | Caucasian/White | Female | 3rd Year | ASL, Other | 6 | Advanced |
| **KS3** | KH | Caucasian/White | Female | 3rd Year | Spoken English, ASL | 6 | Advanced |

## Faculty Member/Leaders

| Number | Initials | Gender | Age | Highest Degree | First Langauge | Hearing Status | Title |
|---|---|---|---|---|---|---|---|
| 1 | NH | female | 36-40 | Masters Degree | English | Hearing | Assistant Professor |
| 2 | ER | female | 46-50 | Masters Degree | English | Deaf | Assistant Professor |
| 3 | SC | non-binary | 25-30 | Masters Degree | English | Hard of Hearing | Assistant Professor |
| 4 | DR | male | 51-55 | PhD or EdD | ASL | Hard of Hearing | Department Chair /Professor |
| 5 | KS | female | 36-40 | Masters Degree | ASL | Deaf | Assistant Professor |
| 6 | JN | female | 51-55 | High School Graduate | ASL | Deaf | Lab assistant manager |
| 7 | HB | female | 31-35 | Bachelors Degree | English | Deaf | Visiting Assistant Professor |

## III. Results

### Change in Vocabulary Knowledge (Ability to Sign Terms)

**Paired Samples Statistics**

| | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | V14 | 13.06 | 18 | 12.134 | 2.860 |
| | V17 | 20.33 | 18 | 11.272 | 2.657 |

**Paired Samples Correlations**

| | | N | Correlation | Significance One-Sided p | Significance Two-Sided p |
|---|---|---|---|---|---|
| Pair 1 | V14 & V17 | 18 | .689 | <.001 | .002 |

**Paired Samples Test**

| | | Paired Differences | | | | | t | df | Significance One-Sided p | Significance Two-Sided p |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference Lower | Upper | | | | |
| Pair 1 | V14 - V17 | -7.278 | 9.266 | 2.184 | -11.886 | -2.670 | -3.332 | 17 | .002 | .004 |

**Paired Samples Effect Sizes**

| | | | Standardizer[a] | Point Estimate | 95% Confidence Interval Lower | 95% Confidence Interval Upper |
|---|---|---|---|---|---|---|
| Pair 1 | V14 - V17 | Cohen's d | 9.266 | -.785 | -1.308 | -.246 |
| | | Hedges' correction | 9.702 | -.750 | -1.249 | -.235 |

[a]—Cohen's d uses the sample standard deviation of the mean difference for the denominator used in estimating effect sizes. Hedges correction uses the sample standard deviation of the mean difference, plus a correction factor.

## Change in Vocabulary Knowledge (Ability to Explain Meanings)

### Paired Samples Statistics

| | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | Total | 23.89 | 18 | 12.034 | 2.836 |
| | V16 | 40.00 | 18 | 8.630 | 2.034 |

### Paired Samples Correlations

| | | N | Correlation | Significance One-Sided p | Significance Two-Sided p |
|---|---|---|---|---|---|
| Pair 1 | Total & V16 | 18 | .579 | .006 | .012 |

### Paired Samples Test

| | | Paired Differences | | | | | | | Significance | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference Lower | Upper | t | df | One-Sided p | Two-Sided p |
| Pair 1 | Total - V16 | -16.111 | 9.946 | 2.344 | -21.057 | -11.165 | -6.872 | 17 | <.001 | <.001 |

### Paired Samples Effect Sizes

| | | | Standardizer[a] | Point Estimate | 95% Confidence Interval Lower | Upper |
|---|---|---|---|---|---|---|
| Pair 1 | TOTAL - V16 | Cohen's d | 9.946 | -1.620 | -2.320 | -.899 |
| | | Hedges' correction | 10.414 | -1.547 | -2.216 | -.859 |

[a]—Cohen's d uses the sample standard deviation of the mean difference for the denominator used in estimating effect sizes. Hedges correction uses the sample standard deviation of the mean difference, plus a correction factor.

## Change in Fingerspelling Skills

### Paired Samples Statistics

| | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | fingerspelling pre | 15.78 | 18 | 8.762 | 2.065 |
| | fingerspelling post | 21.72 | 18 | 5.177 | 1.220 |

### Paired Samples Correlations

| | | N | Correlation | Significance One-Sided p | Significance Two-Sided p |
|---|---|---|---|---|---|
| Pair 1 | fingerspelling pre & post | 18 | .486 | .020 | .041 |

### Paired Samples Test

| | | Paired Differences | | | | | t | df | Significance One-Sided p | Significance Two-Sided p |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference Lower | Upper | | | | |
| Pair 1 | fingerspelling pre - post fingerspelling | -5.944 | 7.712 | 1.818 | -9.779 | -2.110 | -3.270 | 17 | .002 | .005 |

### Paired Samples Effect Sizes

| | | | Standardizer[a] | Point Estimate | 95% Confidence Interval Lower | 95% Confidence Interval Upper |
|---|---|---|---|---|---|---|
| Pair 1 | fingerspelling pre - post fingerspelling | Cohen's d | 7.712 | -.771 | -1.291 | -.234 |
| | | Hedges' correction | 8.074 | -.736 | -1.233 | -.223 |

[a]—Cohen's d uses the sample standard deviation of the mean difference for the denominator used in estimating effect sizes. Hedges correction uses the sample standard deviation of the mean difference, plus a correction factor.

**Change in Interpreting Ability**

**Paired Samples Statistics**

| | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | interpreting pre | 12.86 | 14 | 3.110 | .831 |
| | interpreting post | 13.64 | 14 | 2.872 | .768 |

**Paired Samples Test**

| | | Paired Differences | | | | | | | Significance | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 95% Confidence Interval of the Difference | | | | | |
| | | Mean | Std. Deviation | Std. Error Mean | Lower | Upper | t | df | One-Sided p | Two-Sided p |
| Pair 1 | interpreting pre interpreting post | -.786 | 1.718 | .459 | -1.777 | .206 | -1.712 | 13 | .055 | .111 |

**Paired Samples Effect Sizes**

| | | | Standardizer[a] | Point Estimate | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| Pair 1 | intepreting pre interpreting post | Cohen's d | 1.718 | -.457 | -1.002 | .102 |
| | | Hedges' correction | 1.825 | -.430 | -.942 | .096 |

[a]—Cohen's d uses the sample standard deviation of the mean difference for the denominator used in estimating effect sizes. Hedges correction uses the sample standard deviation of the mean difference, plus a correction factor.

## IV. Key Findings

Results were organized around four research questions: 1) How effective are the SBD and SBL in increasing the ASL bioscience vocabulary of EKU's ITP students? 2) How effective are the fingerspelling videos in increasing the ASL bioscience fingerspelling skills of EKU's interpreting students? 3) How effective are the SBL and fingerspelling videos in increasing the capacity of EKU's interpreting students to interpret a typical undergraduate bioscience lecture accurately and fluently? 4) How do teachers and students use the SBD, SBL, and videos, and what additions and/or changes would make them more effective?

Research Question 1 — Participants' ability to sign the bioscience terms included in the Genes & Heredity category were significantly improved following use of the SBD and videos (mean pretest=13.06 and mean posttest=20.33). Participants' ability to explain

the meaning of the bioscience terms included in the Genes & Heredity category were significantly improved following use of the SBD and videos (mean pretest=23.89 and mean posttest=40.00).

Research Question 2 — Students' fingerspelling skills increased significantly with use of the videos and SBD (mean pre-use = 15.78 and mean post-use = 21.72).

Research Question 3 — Comparison of the pre- and post-videos of students' interpretations showed no significant improvement in fluency or accuracy after having used the materials (mean pre = 12.86 and mean post = 13.64).

Research Question 4—Post-use leader interview responses and their observations of students using the material revealed that the teacher leaders needed more support in use of the materials with students. Even after participating in-person and online training, they did not know how to integrate them into their teaching. For example, rather than use the SBL which incorporates human signers and the fingerspelling principles explained in the videos to improve the accuracy and fluency of their signing, they had students use the SBD which incorporates avatars as signers and a typewriter approach to fingerspelling. This resulted in criticisms of the use of avatars that were addressed with development of the SBL. This increase in fingerspelling abilities is a new finding which can be strengthen by more effective training for the dissemination of these techniques.

**V. Implications**

To ensure effective dissemination, the fingerspelling videos need to be divided into smaller segments that include detailed strategies for implementation and specifics about their order as well as the amount of time required to practice each principle and demonstrate understanding. Information about when and for what purpose the SBD and SBL are to be used need to be provided throughout. Ongoing trainings and check-ins also need to be included.

## VI. Examples of the Signing Vocabulary Test Form, Student Study Sheet, Observation and Leader Interview Questions, and Interpreting Sample

### Signing Vocabulary Test Form

| A. Do you know how to sign this word?<br>B. How would you interpret this word? | | |
|---|---|---|
| **Vocabulary** | **A. Sign** | **B. Interpret** |
| 1. chromosome | CHROMOSOME | SEPARATE BODY UNIT. FIND IN CELL. LOOK-LIKE EXACT GROUP FS-GENES. IN LONG FS-DNA PROTEIN. BEST SEE PROCESS MITOSIS MEIOSIS |
| 2. clone | COPY | ONE ANCESTOR-PERSON THEIR GENE, CELL, LIVE-THING, STOLE COPY |
| 3. deoxyribonucleic acid | fs-DNA | PLAN INFO LOOK-LIKE CHROMOSOME NAMED DOUBLE FS-HELIX. IN LIVE-THING THEIR GENE. IN 3LIST FS-DEOXYRIBOSE, FS-PHOSPHATE GROUP, FS-BASE 4LIST FS-ADENINE, FS-GAUNINE, FS-CYTOSINE, FS-THYMINE |
| 4. gene | fs | IMPORTANT PART. DO 5LIST INFO GROUP PASS-DOWN. DESCRIBE INFO FOR SPECIFIC CHARACTERISTICS GENE. WHERE? CHROMOSOME THERE |

### Student Study Sheet

| Vocabulary | Notes |
|---|---|
| chromosome | |
| clone | |
| deoxyribonucleic acid | |
| gene | |
| genetics | |
| genome | |
| heredity | |
| mutation | |
| sex chromosome | |
| trait | |
| hybrid | |
| allele | |
| chromatin | |
| codon | |
| cytokinesis | |
| gamete | |
| gene expression | |
| genetic engineering | |

## Observation Form Questions

1. What term(s) was the student/students studying?
2. What tool was the student/students using? How was it being used?
3. What did you ask the student/students? What was the response?
4. Did the student students appear interested? Engaged? Why or why not?
5. How long did you observe the student?

## Leader Interview Questions

1. What are your thoughts about the video training at the beginning?
2. What are your thoughts about the face-to-face training?
3. Was one form of training more effective than the other? If so, why?
4. Did you use any other materials(s) to help you?
5. Would other forms of support in addition to the videos and face-to -face training have helped you? If so, what are they?
6. What can you tell us about leading this study and your involvement with your students?
7. How did your students respond to the training on the fingerspelling linguistics?
8. Does anything your students said about their experiences as they worked or afterwards come to mind? Please share a few of their comments.
9. Do you think that this type of training improved student's overall effectiveness with both expressive and receptive fingerspelling? If so, how?
10. Would you consider integrating these principles into your coursework? Why or why not?
11. Do you have anything else you would like to share?

## Interpreting Sample Page