# Speech Pathology Clinical Shadowing and Research Experiences for Undergraduate Engineers & Computer Scientists

**Todd J. Freeborn[a], Memorie Gosa[b], Debra McCallum[c], and Erika Steele[c]**
*The University of Alabama / [a]Department of Electrical and Computer Engineering, [b]Department of Communicative Disorders, [c]Institute for Social Science Research*

## Abstract

A recent Research Experience for Undergraduates (REU) program immersed undergraduate engineering and computer science students in research at the intersection of engineering and communicative disorders. In this first iteration, 9 students participated in research to support populations impacted by communication, voice, swallowing, and hearing disorders. Other features included clinical shadowing, mentoring by faculty from engineering/computer science, speech-language pathology, and audiology to provide technical and clinical perspectives. The REU experience culminated with presentation of the REU students' research at a local speech-language pathology conference. Based on focus group feedback about the program, the participants experienced high levels of satisfaction with the end-of-program conference presentations but lower levels of satisfaction with mentoring. Our aim for following years is to improve the mentor training and shadowing integration to enhance the experience for REU students in future iterations.

## Keywords

Research Experience for Undergraduates (REU), Engineering, Speech Pathology, Shadowing

## Introduction

Participating in undergraduate research is a high-impact practice for enhancing student success[1,2]. It is useful in promoting collaborative interdisciplinary research efforts[3], raising awareness of the societal context of research[4], engaging under-represented students[5,6] and improving graduate student recruitment[7]. To increase the number of undergraduate students exposed to research and immerse students in interdisciplinary problems, a Research Experiences for Undergraduates (REU) program at the University of Alabama (UA) is exploring activities at the intersection of engineering and communicative disorders. The field of communicative disorders represents the disciplines of audiology and speech-language pathology (SLP). Speech language pathology is an applied behavioral science that includes screening, assessment, treatment, and technology/instrumentation related to fluency, speech production, language, cognition, voice, resonance, feeding/swallowing, and auditory habilitation/rehabilitation[8]. In clinical practice, SLPs utilize a range of technologies including audio recording/acoustic analysis, electromyography, and video imaging/analysis. While tools are available for speech-language pathologists, their research needs in regard to the development of application-specific sensors, systems, and signal-processing methods are often under-served as a result of disconnects between SLP and engineering/computer science. This is evident in current training programs,

where undergraduate students in SLP and engineering never meet. This creates a barrier to collaboration to develop technologies that can support speech-language practice.

In the first iteration of this REU during the summer of 2019, nine students participated in a 10-week program with research to support populations impacted by communication, voice, and swallowing disorders. They also observed clinical SLP practice in 8 hours of shadowing experiences. Students contributed to projects such as the assessment of noise levels in mobile audiology clinics, image analysis to identify features of pediatric dysphagia from videofluoroscopy swallow studies, and assessment of surface electromyography data of oropharyngeal musculature collected during swallowing events. Each REU student was assigned two mentors, one from engineering/computer science and another from communicative disorders. This dual mentorship was meant to provide truly interdisciplinary experiences with strong technical and clinical perspectives.

On the last day of the program, REU students were invited to participate in an online survey assessing their opinions about participating in the REU. A sample of questions and distribution of responses regarding these experiences are detailed in Table 1. Generally, students were highly satisfied with mean ratings <2 for these specific questions.

**Table 1: How satisfied are you with the following aspects of your REU experience? (n=8)**

| | Extremely satisfied | Somewhat satisfied | Neutral | Somewhat dissatisfied | Extremely dissatisfied | Mean |
|---|---|---|---|---|---|---|
| **REU Site program overall** | 5 | 3 | 0 | 0 | 0 | 1.38 |
| **Development of technical skills** | 5 | 3 | 0 | 0 | 0 | 1.38 |
| **Research project topic** | 6 | 1 | 1 | 0 | 0 | 1.38 |
| **Research experience overall** | 7 | 0 | 0 | 1 | 0 | 1.38 |
| **Research mentoring** | 6 | 1 | 0 | 0 | 1 | 1.63 |
| **Shadowing experiences** | 5 | 1 | 2 | 0 | 0 | 1.63 |
| **Relevance to career** | 5 | 1 | 2 | 0 | 0 | 1.63 |

The REU students also attended a focus group discussion on final day of the program to share their experiences with the evaluation team. The following comments were captured:

- *"I think for me I learned more hands on what research is really about, the processes, the ups and downs that comes with it. Reading articles to find something that is already existing and then to change your project. I did it three times for my project. It showed me that it isn't just one simple step and then the next; it's going to take a while."*
- *"For me, I've never done research before, so this is really cool. I always thought research was really boring, but it's like you try to find answers; but you don't know how to find answers so you keep asking questions and try to figure it out."*
- *"Before I even began to collect data, it took me 7 weeks before I was even allowed to begin testing stuff in the lab. It prepared me enough so that when I actually did begin collecting data I knew enough to understand what was going on."*

From the focus group feedback, many of the students reported never doing research before and felt that they learned a lot about the process of research and the scientific method. On the mid-program survey which collected data approximately 4 weeks into the summer, some students felt that their research projects took a long time to get started. But during the focus group they

expressed understanding that research is not always linear and that "getting off to a slow start" was helping them to better understand what they needed to know. Several students commented on the large amount of reading they had to do before they could get started on their projects – books, journal articles, dissertations. Based on this feedback, future iterations of this REU will coordinate with the research mentors to send participants some of this reading ahead of time, with the aim of getting students research productive sooner and increasing their early feelings of engagement with their research.

## Clinical Shadowing

Based on the success of a previous pilot study[9], each REU participants observed 8-hours of clinical practice related to articulation, voice treatment, fluency, and motor speech. During these sessions, REU participants observed clinicians and student clinicians interact with patients and patient families during treatments. To prepare the students for these observations they were required to complete HIPPA training provided by a Speech and Hearing Center clinician to understand the requirements for data privacy and safeguarding medical information. The students were asked to rate the shadowing experiences during the survey of their experiences with their responses about how much they learned given in in Table 2.

**Table 2: The Shadowing Program Experiences (n=8)**

| | 1 Nothing | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 A lot | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **How much did you learn from the shadowing experiences?** | 0 | 2 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 2 | 6.0 |

The specific written feedback for the shadowing provides further insight into the student's ratings:

- *"I really liked getting to see exactly what the speech pathologists do in their careers. I also loved getting to see how much they help people."*
- *"Shadowing the clinicians was a good experience that helped provide background on the research topic."*
- *"The shadowing sessions taught me a lot on what methods are currently being used to provide therapy for people with disabilities. The reason as for not leaving an excellent rating is because the shadowing did not relate to my research project."*
- *"The shadowing program was nice overall, but it didn't contribute anything to the research project that I was working on. I enjoyed watching the different clients but again the shadowing program didn't have any effect on my project."*

The REU students noted that they thought the experiences were interesting and broadened their understanding of SLP, but they had expected those experiences to be more closely related to their research projects. Therefore, they felt it would be helpful to explain the reason for the shadowing experience and give more accurate expectations for it. This informs an area of improvement for future iterations of the program, which will provide greater structure to the experiences that provides further background on each type of therapy and the research related to those topics, guiding questions about each type of therapy and observation, and debriefing sessions for the group to discuss their observations, lessons learned, and how it could relate to their research. Overall, the first iteration of this program was a successful at creating an interdisciplinary environment to support research experiences for undergraduates.

**Acknowledgements:** The authors acknowledge NSF (EEC-1852161) for funding.

## References

1 Katkin, W., "The Boyer Commission Report and its Impact on Undergraduate Research," New. Dir. Teach. Learn., vol. 2003, no. 93, pp. 19-38, 2003.
2 Kuh, G., "High-impact educational practice: What they are, who has access to them, and why they matter," High-Impact Educational Practices, AAC&U, 2008.
3 Raicu, D.S., Furst, J.D. "Enhancing undergraduate education: A REU model for interdisciplinary research," Proc. SIGCSE '09, pp. 468-472, 2009.
4 West, M., Cross, W., Kellogg, S. Boysen, A., "A novel REU program to develop the skills of the engineer of 2020," Proceedings – Frontiers in Education Conference (FIE), 2011.
5 Kim, K.A., Fann, A.J. Misa-Escalante, K.O., "Engaging women in computer science and engineering," ACM Trans. Comput. Educ., vol. 11, no. 2, pp. 1-19, 2011.
6 Espinosa, L.L, "Pipelines and pathways: Women of color in undergraduate STEM majors and the college experiecnes that contribute to persistence," Harv. Educ. Rev., vol. 81, no. 2, pp. 209-240, 2011.
7 Pariyothorn, M, Autenrieth, R.L, "Strategic use of summer undergraduate research experiences," ASEE Annual Conf. & Expo, San Antonio, USA, 2012.
8 American Speech-Language-Hearing Association, "Scope of practice in speech-language pathology," *Communication Disorders Quarterly*, 2007. [Online]. Available: www.asha.org./policy.
9 Freeborn, T.J., Gosa, M., "Work in Progress: Pilot Shadowing Experiences to Introduce Engineering Students to Speech-Language Pathology," ASEE Annual Conf. & Expo, Salt Lake City, USA, 2019. Available: https://peer.asee.org/29918

## Todd Freeborn

Todd Freeborn is an Assistant Professor in Electrical and Computer Engineering (ECE). He regularly teaches courses in circuit analysis, circuit networks, and microcomputers. Through NSF funding, he has coordinated REU Sites for engineering students to explore renewable resources and speech pathology. He is also the coordinator for an NSF S-STEM program to prepare students for gateway courses across different disciplines of engineering to support and retain students in these disciplines.

## Memorie Gosa

Memorie M. Gosa is an Associate Professor in Communicative Disorders. She teaches courses in medical speech language pathology including voice and voice disorders, adult dysphagia, and pediatric dysphagia. Her research explores feeding and swallowing development and disorders in infants and children. She is the Co-PI for a current REU site for engineering students to explore technology solutions to support advancements in clinical service delivery for the fields of speech-language pathology and audiology.

## Debra McCallum

Debra McCallum is a Senior Research Social Scientist and Director of the Institute for Social Science Research. She is a social psychologist interested in evaluations of education and community intervention programs and research on social issues, such as career choices related to STEM fields, social-psychological aspects of health behavior and outcomes, and safety and well-being of children and youth. She has led program evaluation activities for a variety of NSF-funded projects.

**Erika Steele**

Erika Steele is a Research Associate at the Institute for Social Science Research. She received her M.S. in Cellular and Molecular Biology and PhD in Education from the University of Alabama. She is an education evaluator interested in measurement and assessment of learning, faculty professional development models, and social issues related to health and STEM fields. Erika has co-led program evaluation activities for a variety of NSF-funded projects.