

Pacific University

CommonKnowledge

---

Volume 13 (2013)

Interface: The Journal of Education, Community  
and Values

---

12-7-2013

## Building a web-based collaboration system for effective, engaging, and interactive teaching of undergraduate Speech Science curriculum: A review of a Berglund Center for Internet Studies Fellowship

Kerry Mandulak  
*Berglund Faculty Fellow*

### Recommended Citation

Mandulak, K. (2013). Building a web-based collaboration system for effective, engaging, and interactive teaching of undergraduate Speech Science curriculum: A review of a Berglund Center for Internet Studies Fellowship. In J. Barlow & M. Yasuoka (eds.). *Interface: The Journal of Education, Community, and Values* (Vol. 13, pp. 93-102). Forest Grove, OR: The Berglund Center for Internet Studies.

This Article is brought to you for free and open access by the Interface: The Journal of Education, Community and Values at CommonKnowledge. It has been accepted for inclusion in Volume 13 (2013) by an authorized administrator of CommonKnowledge. For more information, please contact [CommonKnowledge@pacificu.edu](mailto:CommonKnowledge@pacificu.edu).

---

**Building a web-based collaboration system for effective, engaging, and interactive teaching of undergraduate Speech Science curriculum: A review of a Berglund Center for Internet Studies Fellowship**

**Rights**

Terms of use for work posted in CommonKnowledge.

# Building a web-based collaboration system for effective, engaging, and interactive teaching of undergraduate Speech Science curriculum: A REVIEW OF A BERGLUND CENTER FOR INTERNET STUDIES FELLOWSHIP



by Kerry Mandulak, PhD, CCC-SLP

School of Communication Sciences and Disorders, Pacific University

## Introduction

The discipline of speech science is one of the foundational areas of communication sciences and disorders (CSD). Students often perceive the undergraduate requisite class of Speech Science as “difficult, irrelevant, and terrifying” [1]. In order to both increase interest in the specialized discipline of speech science and help bridge the gap between science and clinical practice, a solid, engaging, interactive class at the undergraduate level is needed.

With new advances in digital signal processing and freely downloadable acoustic analysis software, the speech science classroom could be changed dramatically. Instead of a class where students are mystified, intimidated, and anxious about the material, students could be instantly involved and interacting with easily accessible resources. Engaging students with laboratory activities and clinical applications of class content could bridge the gap between the science of speech production and its relationship to their future clinical practice. Introducing students to course content in ways that are viewed as accessible and relevant, rather than daunting or arduous, promotes a transformation of attitude toward speech science that could happen at the undergraduate level. As these same well-informed students progress into graduate programs to become clinical practitioners of speech-language pathology or au-

diology, a positive outlook and willingness to engage with and use technology will change how they approach future clinical practice.

Unfortunately, despite the importance of science to the foundation of clinical practice, interest in speech science has declined in our discipline. There is a current shortage of individuals receiving a Ph.D. in CSD, and, therefore, a shortage of doctoral level instructors at university programs. More importantly, of the 150,000 members of the American Speech-Language-Hearing Association (ASHA) [2] only a small percentage work in academia and an even smaller number identify themselves as speech scientists. [3] Speech scientists are essentially small fish in a big pond [4] and lack the benefit of experiencing a critical mass at any given community-building event, such as the ASHA annual convention, or within the context of an academic department or an area of clinical specialty.

The consequence of the doctoral shortage and small percentage of speech scientists within the field are twofold. New instructors are tasked with teaching the course with a lack of expertise in the subject area, in addition to the extensive time and effort for initial course preparation with few resources. Knowledgeable instructors have to actively seek collaboration and fresh teaching resources, expending time and effort that competes with their many other responsibilities, including research and service, in order to improve their current teaching. Speech Science is a required class for undergraduate curriculum in CSD programs throughout the country, yet there is no established central repository for course content materials that could support effective and efficient teaching by the inexperienced or seasoned instructor.

The purpose of this manuscript is to describe the challenges and successes of the process that was undertaken to build a web-based resource for teaching speech science curriculum, in addition to how selected resources were used and evaluated within the classroom environment. Preliminary data gained from weekly student questionnaires will be presented to illustrate how the end users of the course content responded to the introduction of various types of online media and interactive lecture techniques. Future directions and ideas will be presented regarding the continued work on this project.

## **Methods**

The four main goals of this project were to do the following: 1) build a website that would function as a primary resource for any instructor teaching the required undergraduate speech science course in a CSD curriculum; 2) collect peer-reviewed and openly shared course content; 3) establish video demonstrations of specific instrumentation or previously available media resources; and 4) create a discussion forum that would allow community building and

collaboration among speech scientists engaged in teaching and research.

### ***Building the Website***

As a starting point, current online and media resources that were available were collected. Finan & Tasko [5] [6] had begun this process with the creation of a website based in Google Sites that functioned as an introductory repository of video examples, pedagogical resources, physical models, and software resources. The current project was designed to expand and develop that current site. These resources were collected and categorized, along with other currently available resources that were found through a focused Internet search. A variety of options were found to be available including online courses, software downloads, video demonstrations, and textbook sites. These assorted findings covered a wide spectrum of topics as well, including: acoustics, phonation, phonetics, anatomy, and neuroanatomy. Relevant search terms representing specific aspects of curriculum, such as “source-filter theory,” “vocal tract – larynx,” and “spectrograms” were used, in addition to searching in fields other than communication sciences and disorders, such as linguistics or physics. The rationale for including any specific resource was that it made a classic concept typically taught in speech science curriculum both interesting and interactive. [7]

Wordpress (<http://www.wordpress.com>) was chosen as the platform on which to build and expand the website. Because of both the static and dynamic nature of a blogging platform, the ability to accommodate comments on blog posts, in addition to static pages that contain significant content, which were important features, in order to allow those who visit the site to interact with the material, ask questions, and pose discussions. The new website (<http://speechsciencetoolbox.wordpress.com>) [8] was designed to foster community, first and foremost, and by doing that, supporting both teaching and research interests focused on speech science of those that participate.

### ***Content***

There are sections for both the new and seasoned instructor of speech science curricula. Within the section for the new instructor, descriptions and informal reviews of textbooks, sample syllabi, and curriculum examples are posted. For the new instructor, the goal is to have a place to start building their course. Communication sciences and disorders programs will have various ways that speech science content will be delivered within their own curricular structure, whether it be a stand-alone class or within another course (such as anatomy and physiology of the speech mechanism), and so offering instruc-

tors examples from multiple university programs was deemed to be important. The contributors to the website will be offering material to be shared openly, whether it be a syllabus structure, lecture notes, or outlines of the content covered within a course. For the seasoned instructor, resources posted will include ideas for laboratory assignments, online resources, software ideas, and video demonstrations, in order for experienced teachers to enhance their course.

Because the addition of content to the website could become time consuming in terms of editing, vetting, and reviewing for any one (or a few) person(s), the creation of an editorial board will be established by the creators (Finan & Tasko) and other main contributor (Mandulak) to the website. At this point in the website creation process, the editorial board is not yet needed, but will be used in the future as the number of contributors and level of participation increases.

### ***Discussion Forum***

Because one of the goals of this website is to build and foster community among speech scientists, a central discussion forum is essential to build a critical mass of those involved in this specific area of practice and research within the larger speech – language pathology community. The discussion forum portion of the website will be updated weekly, and allow for subscription through email (via RSS feeds), so that end users of the website will be alerted to new posts and discussion threads on a regular basis. Topics could include teaching ideas, research interests, and special “ask the expert” type of postings in order to encourage online interaction and learning opportunities, from the undergraduate to post-doctoral level.

### ***Enhancing a Course Using Speech Science Toolbox: One Example***

As part of my Berglund Center for Internet Studies (BCIS) Fellowship, I used resources available on <http://speechsciencetoolbox.wordpress.com> in my undergraduate speech science course taught in the spring semester of 2014 at Pacific University within the School of Communication Sciences and Disorders. There were 15 students registered for class. I planned to integrate the use of online resources and media into all three modules of the course. In-class, hands-on activities were planned [7] in addition to interactive lecture techniques, in order to augment the traditional, standard lecture format that I had previously used to deliver content. Another change to the course included initiating weekly assignments that incorporated both content questions, for students to review their own understanding of learning objectives, and a laboratory type experience related to course content. To support student learning

through and participation in these, I created screencasts of assignment details or procedures and posted them to YouTube. Because many digital resources and acoustic analysis tools are highly accessible and no-cost, requiring students to complete these type of assignments independently, outside of class was a new endeavor for me as an instructor. I was particularly interested in how students would respond to these types of learning experiences, both in their achievement of learning objectives for class and their interaction with course content material.

As the first assignment for class, I required the students to complete a Learning Styles Inventory to self-identify and understand their own personal learning style. [9] The students gave me a copy voluntarily and kept a copy for themselves. I collected this data, in order to compare their responses on their learning styles questionnaire to their preferences for learning within the class environment.

Qnaire: **COMPLEX SOUNDS**

+1  
Please respond to the following questions about the content focused on COMPLEX SOUNDS (1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, 5 = strongly disagree).

	1	2	3	4	5
<input type="checkbox"/> I understand the difference between a pure tone and a complex sound wave.	<input type="radio"/>				
<input type="checkbox"/> I understand the relationship between fundamental frequency and harmonics (and vice versa).	<input type="radio"/>				
<input type="checkbox"/> I could explain the differences between a periodic and aperiodic complex sound wave.	<input type="radio"/>				
<input type="checkbox"/> I could independently and accurately draw a line spectrum of a complex periodic sound wave.	<input type="radio"/>				
<input type="checkbox"/> I could independently and accurately draw a continuous spectrum of a complex aperiodic sound wave.	<input type="radio"/>				
<input type="checkbox"/> The YouTube video explaining the web animation for Fourier Analysis / Complex Periodic Sounds was helpful to complete the assignment.	<input type="radio"/>				
<input type="checkbox"/> I am confident that I have solid answers to the questions posted for the WEEK 2 Reading Assignment.	<input type="radio"/>				
<input type="checkbox"/> I felt comfortable with the pace of delivery of new information within class.	<input type="radio"/>				

+2  
Which of the following was the MOST helpful for your learning with regard to this specific content?

- Reading before / after class (pages 25 - 29)
- Lecture (Complex Sounds)
- In - class activities (drawings, working with the waveforms within lecture together as a class)
- Online animations / media (Fourier Analysis)
- None were helpful

+3  
Which of the following was LEAST helpful for your learning with regard to this specific content?

- Reading before / after class (pages 25 - 29)
- Lecture (Complex Sounds)
- In - class activities (drawings, working with the waveforms within lecture together as a class)
- Online animations / media (Fourier Analysis)
- All were helpful in some way

+4  
The following concepts / ideas are still confusing to me and could use some additional explanation:

Figure 1: One of the weekly questionnaires administered as part of the study.

I used the Questionnaire activity on the Moodle Learning Management System to collect weekly feedback on the students' perception of their own learning of course objectives and their beliefs about what helped them learn

best (or least) over the past week.

The options for the choices of most or least helpful activities for learning stayed the same across questionnaires, but the specifics of each were changed for each week. Because the class is still being taught and data collection is in process, a preliminary data analysis will be provided with some general trends and themes from the student feedback. IRB approval was obtained through Pacific University, and the use of student feedback data was approved for exempt review with a waiver of consent.

## Results

Preliminary data analysis from the first module of class (Basic Acoustics) revealed consistent trends. Of the three modules of class (Basic Acoustics; The Source: Respiratory and Phonatory Physiology; and The Filter: Articulation and Resonance), the first unit (Basic Acoustics) is classically the most challenging in terms of learning concepts and applying them to the clinical aspect of speech – language pathology. For many students, the concepts, which focused on the physics of sound, introduce terminology and mathematical equations that are unfamiliar, abstract, and, possibly, difficult to understand.

There were four questionnaires administered during the first module in class: 1) Simple Harmonic Motion (SHM)/Waveforms; 2) Complex Sounds; 3) Frequency/Pitch/Intensity; and 4) Resonance/Source & Filter. The following table details the responses specific to their experiences with the in-class activities and online media/resources, rated as most or least helpful, for their learning in the first module, Basic Acoustics. Of the 15 students, the survey response rate varied from 10 to 13 responses per week. Students were not required to complete the surveys as part of class requirements.

In-class activities ranged from hands-on endeavors (tying a hex nut to a string to create a swing and represent simple harmonic motion that they could manipulate during class; using Play-Doh to illustrate the Source-Filter theory) to activities that I did alongside the students (working through logarithmic equations relating to intensity and pressure, after having them work in pairs or small groups, reviewing homework activities in class to ensure and reinforce understanding). Online media and animations referred to content on external websites that was shown in class, used in homework assignments for independent learning, and supported through the use of screencasts I designed to assist in completing homework assignments.

It should be noted that the consistent weekly response to “least helpful” by the overwhelming majority of students was the textbook reading for the course. Engaging students through the use of the textbook in class continues to be a challenge for me as an instructor, but the focus on in-class, interactive activities, in addition to the inclusion of online media and animations, was the main improvement in course

content that was planned for the current semester.

**Table 1: Preliminary student responses specific to their experiences with the in-class activities and online media / resources, rated as most or least helpful for their learning in the first module, Basic Acoustics.**

Title of Questionnaire (Content Area)	Student report of “most helpful” for learning	Student report of “least helpful” for learning
Simple Harmonic Motion / Waveforms	In – class activities (over half of class)	Online media / animations (less than 20% of class)
Complex Sounds	In – class activities (over half of class)	Online media / animations (approximately one-quarter of class)
Frequency / Pitch / Intensity	In – class activities (over half of class); online media / resources (about 10%)	“All were helpful” (approximately one-quarter of class)*
Resonance / Source and Filter	In – class activities (over half of class)	“All were helpful” (approximately half of class)*

*\* the option “all were helpful” was added for the third questionnaire (Frequency / Pitch / Intensity) and remained on all questionnaires that followed.*

## Discussion

The data from the student questionnaires provided a preliminary and exploratory look at the effect of including interactive lecture methods and online media resources into the speech science classroom environment. The pattern of students finding in-class activities the most engaging was intriguing. Although the majority of class time was still spent in traditional lecture format, for efficiency of delivery of course content, the incorporation of these activities reflected increased engagement and interaction from the student perspective. These activities were discovered through existing resources available on the original Speech Science Toolbox Google Site, in addition to the presentation at the American Speech – Language – Hearing Annual Convention that I participated in with Finan, Tasko, Dromey and Neel. [7]

The finding that the data for the first two questionnaires (Simple Harmonic Motion / Waveforms; Complex Sounds) indicated that students found the online media / resources “least helpful” was also thought provoking. Several differing perspectives could be considered. First, I may not have presented them in a way that facilitated their own learning or connection to the content. Second, the resource may not have been as relevant as I perceived in relation to the content or the student’s level of understanding. Third, the students may

have been getting used to the format of class, the type of materials being used, and the type of content being presented at this early stage of the semester. I believe it takes several weeks of “buy-in” for students to begin to see how the foundational concepts of Speech Science connect to the bigger picture of the subject matter and its relevance to clinical practice. Finally, the presentation of the resource in class could have been done differently. Regardless of the reason, having only used these resources for the first time in class this semester, the feedback from the students will be helpful in reconsidering their use or presenting them in an alternate way in class. Continued use of the resources and other teaching techniques will drive the process of continued improvement in the instructional methods used in the classroom.

A more complete analysis of the current data set will be carried out in the future. Relationships between what worked best for the students learning (as perceived by themselves) and the type of learning style with which the students identify (collected at the start of class), will be another way to explore the questionnaire data. I hope to disseminate these and other findings from this study and project at future national meetings of the American Speech – Language – Hearing Association and through relevant publications.

## Conclusions

The Speech Science Toolbox website will continue to evolve and change. Establishing this site as a resource for instructors and repository for teaching resources was the first step. As more instructors, speech scientists, and students of speech science become more involved, the hope is that this small community will grow and provide opportunities for all of us to learn from one another. In addition, it is anticipated that students from the undergraduate to post-doctorate level will continue to appreciate the contribution of speech science to our overall field of speech – language pathology. The class that no student looked forward to having to sit through will be a class that engenders curiosity, enthusiasm, and engagement, from both the student and the instructor.

## Notes

- [1] Berkowitz, S. S. (2012, April). Out of the lab...and onto the laptop. Paper presented at the Annual Meeting of the Council of Academic Programs in Communication Sciences and Disorders, Newport Beach, CA.
- [2] Brook, G. (2012, May 15). ASHA Members: 150,000 Strong and Growing. *The ASHA Leader*, 1, 10 – 13.
- [3] Finan, D. & Tasko, S. M. (2012a). Toward a Speech Sciences community. *Perspectives on*

- [4] Finan, D. & Tasko, S. M. (2012b, November). The argument for building a speech sciences community. Paper presented at the Annual Convention of the American Speech-Language-Hearing Association, Atlanta, GA.
- [5] Finan, D. & Tasko, S.M. (2012c). Speech science toolbox. Retrieved from <https://sites.google.com/site/speechsciencetools/>
- [6] Tasko, S. M., & Finan, D. (2011, November). What's a formant: Toward a speech science toolbox. Paper presented at the Annual Convention of the American Speech-Language-Hearing Association, San Diego, CA.
- [7] Finan, D., Tasko, S.M., Dromey, C., Mandulak, K.M., Neel, A. (2013, November). Speech Science: Does anybody know how to teach this stuff? Paper presented at the Annual Convention of the American Speech-Language-Hearing Association, Chicago, IL.
- [8] Finan, D., Tasko, S.M., Mandulak, K.M. (2014). Speech science toolbox. Retrieved from <http://speechsciencetoolbox.wordpress.com/>
- [9] Felder, R.M. & Soloman, B. A. (n.d.a.) Index of Learning Styles (ILS). Retrieved from <http://www4.ncsu.edu/unity/lockers/users/f/felder/public/ILSpage.html>

