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STEM for Teacher Educators

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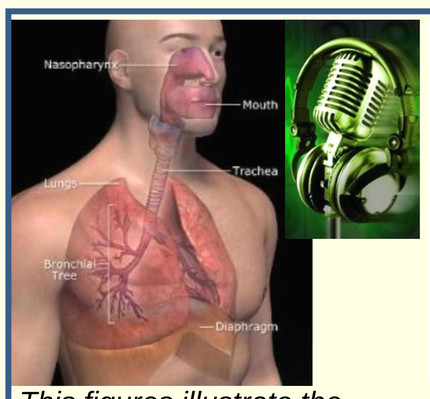
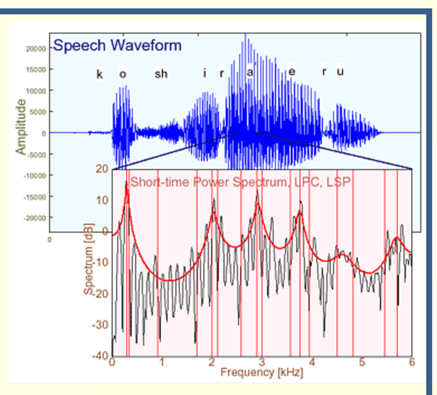
Signal Processing Research Group

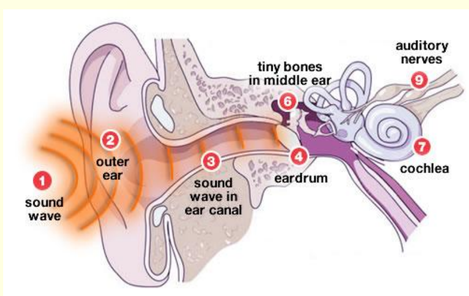
This project addresses the challenge of enhancing the ability of pre- and in-service teachers to provide STEM education. The goal is to bolster the science, technology and engineering components in K-12 STEM-education by using digital audio and image processing technologies.
The intellectual merit and broader impact of this project transcends the scope of the University of Bridgeport and Bridgeport schools, and it includes advanced discovery and understanding, creative and original concepts, extensive resources, participation of under-served populations, and dissemination of technological understanding.

The principles of digital audio and image processing have applications in an amazing diversity of areas, from science and engineering (biomedical engineering, astronomy, video and wireless communications) to entertainment (music and video games). Digital audio and image processing education needs to be able to cater to a wide spectrum of people from different educational backgrounds. These fields draw from a great variety of academic disciplines, including mathematics, biology, acoustics, computer graphics, computer vision, optics, and computer science. It is essential to present these inter-disciplinary topics to middle school and high school teachers. Proposed multi-media experiences will teach pre- and in-service teachers the content and pedagogical tools with which to guide students to an understanding of basic STEM topics.





This figures illustrate the speech production system and the ear. This unit starts with the physiology of speech production and ends with the acoustics and acoustic analysis of different sounds.



It is essential that teachers understand the content of the subjects they teach.
A particular challenge in a graduate program for secondary mathematics and science teachers is how to provide teacher candidates with subject matter content, on a graduate level, that does not replicate undergraduate courses.
Teachers need to understand their subject matter, not as undergraduates but rather with a broad-based understanding that enables them to teach their students in settings that allow for application and/or construction of something tangible, such as the construction of something. Teachers need exposure to material that furnishes both a review of key concepts in their field and an expansion of their knowledge into new fields.

This course provides comprehensive professional development for teachers in two major engineering technologies which use many concepts from mathematics and science: digital audio and image processing. These technologies are part of everyday life, and they provide our project with several unique features.

The School of Education and School of Engineering at University of Bridgeport designed the **EDMM 600D- STEM (Science, Technology, Engineering, and Math) for Teacher Educators** course for students of the School of Education.
Designed course uses audio and image processing techniques and technologies to teach fundamental STEM concepts to secondary pre- and in- service mathematics and science teachers.

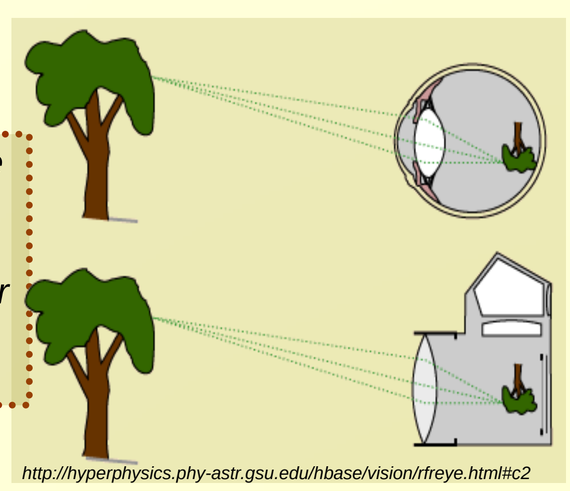
Designed to enrich the teaching and learning experience, the course activities include:
- ➢*Lectures and Discussions*
- ➢*Lab activities: Hands-on computer experience*
- ➢*Team Project*

Lecture will cover background material pertinent to lab, in these areas:
- ✓*Logic, Truth Tables, and Sets*
- ✓*Algorithms, Recursion Formulas, and Induction*
- ✓*Periodic and Aperiodic Signals*
- ✓*Linear Algebra*
- ✓*The Ear and How we hear*
- ✓*The physiology of speech production*
- ✓*The respiratory system*
- ✓*The acoustics and acoustic analysis of speech*
- ✓*The Eye and How we see*
- ✓ *Digital imaging*

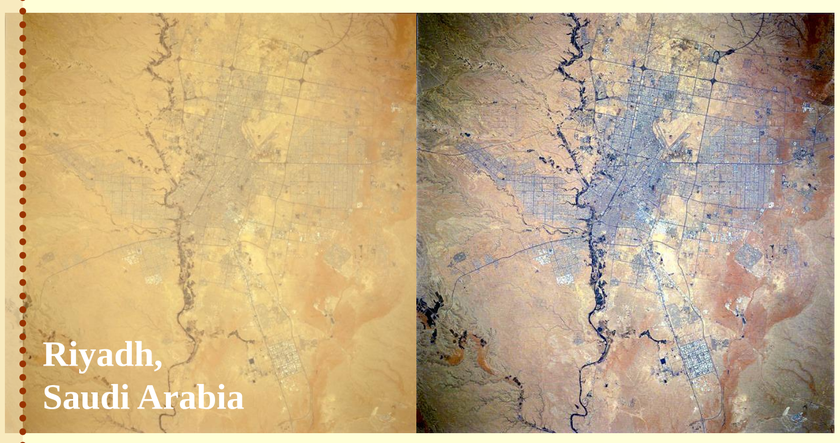
The objectives of the course are:

- To value and appreciate new technologies that enhance STEM learning
- To be able to conduct hands-on activities and to teach the topics in the classroom
- To be able to prepare instructional course materials for the classroom
- To develop a range of skills relating to the presentation of course materials in a formal setting

This figure illustrates the eye and the camera. Images are formed in a camera by refraction in a manner similar to image formation in the eye.



Next two images show how Digital imaging is applied in Earth Sciences.
STEPS:
1. *Sharpen, or Unsharp Mask*
2. *Despeckle (if sharpened…)*
3. *Alter Color Contrast and / or Brightness*
4. *Alter Color Level*



***With Team Projects**, the students will develop lesson plans to engage K-12 students with the cutting-edge digital image and audio technologies*. The students will choose a possible topic and develop STEM course materials in the area of their topic.

- ➢Develop a two-week unit designed to promote problem solving success at a particular grade level.
- ➢Develop a unit illustrating the use of problem solving in this area over several grade levels.