



SOCIETY OF PHYSICS STUDENTS

An organization of the American Institute of Physics

Marsh W. White Award Proposal

Project Proposal Title	Sounds and the Sources Around Us
Name of School	Cleveland State University
SPS Chapter Number	1247
Total Amount Requested	\$499.00

Abstract

For the 2016-2017 school year, the Cleveland State University SPS Outreach team will bring a broader awareness of sound to the students of Campus International School (CIS), a public K-8 school in downtown Cleveland. A constant focus will be the relationship between sound and energy to teach the children to identify how and why sounds are produced. The program will be delivered via four monthly interactive lessons delivered to the 3rd grade of CIS (a total of about 80 students) at CIS, culminating with the organized visit of the CSU's Physics Department/SPS chapter for the Day of Physics Sound demos. In addition, we plan to work out the details of the lesson plans during the monthly Physics Fridays (program supported through the previous Marsh White awards) at the aftercare program at the CIS.

Proposal Statement

Overview of Proposed Project/Activity/Event

Once a month the Cleveland State University SPS Outreach team will visit Campus International School's afterschool program (on Fridays) with various experiments and lessons associated with sound. These Physics Fridays' events will be followed by middle-of-the-day visits to 3rd grade classrooms at CIS in order to deliver the interactive lessons on sound. In the beginning the lessons will focus on how and why noises are generated, and then develop toward more complex sounds, resonance, and even modern capture and reproduction methods. A theme throughout these four lessons will be identifying and following the energy through the system so that by the end the students will know what makes floorboards creak, instruments so much louder than vibrating strings, reeds, or lips, and how microphones and speakers can capture and recreate all of it.

Campus International School (CIS) is a public school in downtown Cleveland which has close ties with CSU. The 3rd grade of CIS has about 80 students in 4 classes. The preliminary agreement for the interactive physics lessons has been obtained between our SPS chapter and Mrs. Bechtel, the master teacher for the 3rd grade at CIS. The afterschool program at CIS typically has forty to sixty students across grade levels K-8. One of the motivators behind this set of lessons is a former CSU student who helped create the outreach team and has remained actively involved since graduating. He has a particular interest and passion for sound through his love of music, and a physics-empowered curiosity for understanding how it and the many technologies associated with it function.

How Proposed Activity Promotes Interest in Physics

All of the lessons are devised to involve the children and direct them through the questions we ask, while also trying to keep the questions to something they may also ask. For example, why does the house go bump in the night, why do violins only produce certain sounds while speakers can produce them all, and how are sounds stored on physical media and as digital files? Each of these questions and more will be answered, and those answers will connect back to the physics and/or mathematics involved, demonstrating how omnipresent these fields of science are, and the value of understanding them.

Plan for Carrying Out Proposed Project/Activity/Event

- **Key Personnel**
 - Samantha Tietjen, Physics Major, New Outreach Coordinator
 - Tony Dobrila, Physics Major, SPS webmaster, guitar player
 - Christian Gunder, CSU CME Major/Physics Minor; SPS Treasurer, Previous Outreach coord.
 - Dan Terrano, Chemistry/Physics major; SPS President
 - Ilona Tsuper, Chemistry/Physics major; SPS VP
- **Marketing** – Identical to the previous year, afterschool staff will be notified of events two weeks prior to the event. Staff will continue to communicate this info to parents. In addition, the visits to 3rd grade classrooms will be coordinated with Mrs. Bechtel, CIS master teacher for the 3rd grade.
- **SPS member participation** – In addition to key personnel, 5-10 other students (physics, math, engineering majors) will join us in our efforts. Many are national SPS members, as our chapter rewards a yearlong outreach with a paid SPS membership.
- **Expertise** – Several members of the earlier outreach team will help us in our efforts:
 - Krista Freeman, 2011 Physics Alum, Carnegie Mellon PhD candidate, outreach co-founder
 - Jim Pitchford, 2011 Math Alum, science writer, past SPS outreach coordinator
 - J. Flaherty, 2015 Physics Alum, past pres., participant of SPS's Physics of Rock-n-roll show
 - Janna Mino, 2015 Physics Alum, past VP, participant of SPS's Physics of Rock-n-roll show

The past members of our outreach team provide valuable insight/experience to current outreach group.

Project/Activity/Event Timeline

Four lessons on sound will be delivered at CIS (first, at the aftercare and then, during school day, to 3rd graders), followed by Physics of Sound Day (for 3rd graders) hosted by our SPS chapter at CSU:

- I. **Noise/Sound Lesson (January 2017), CIS:** Generation of sound by various means (whoopee cushions, whistles, thundersheets, tuning forks). Examining how different sounds are made and what distinguishes noise from enjoyable sound
- II. **Music Theory and Acoustics (February 2017), CIS:** Learning to combine&propagate sounds (resonance, harmonics, musical instruments, sound level)
- III. **Reproductions of Sounds (March 2017), CIS:** Sound amplification, recording, reproduction (microphones, megaphones, records, speakers)
- IV. **Sound as a wave (April 2017), CIS:** Standing waves, propagation of sound through different media, adding sound (interference)
- V. **Physics of Sound Day (May 2017), CSU:** Bringing all concepts together with the help of the SPS chapter sound lab: Jamming with Rubens tube, Chladni Plate, and Sound modulated laser at the CSU's Physics Department.

For each of these planned outreach events, we will develop detailed lesson plans and rehearse them together before presenting to ensure the students get as much out of the experience as possible.

Activity Evaluation Plan

The outreach events will be carefully documented via: 1) lesson plan outlined and detailed for every outreach event; 2) photo-reports with multiple rehearsals from CSU and subsequent activities at CIS; 3) careful archiving of each of the activity's selection of equipment; 4) recorded number of kids and their respective grades for each activity; 5) surveys will be handed out to faculty, parents, and students to assess the overall effectiveness of our efforts. Moreover, outreach members will also be given a quick survey to assess the impact of the activities on themselves.

Budget Justification

The SPS outreach team has already developed some sound demos with the aid of previous Marsh W. White awards and with the help of SPS Sound Sock kit. We also enjoy a close collaboration with the Physics Department at CSU, which provides a wealth of sound related equipment. However, we have several new ideas for lessons to develop and will need funds to support these new efforts.

We request funds for our sound-based lesson plans:

- I. **Noise/Sound Lesson (January 2017), CIS:** Whoopee Cushions (a giveaway present to kids), \$28
- II. **Music Theory and Acoustics (February 2017), CIS:** Make Your Own Music Box Kit, Violins, Drum set, \$239
- III. **Reproductions of Sounds (March 2017), CIS:** Microphones and speakers to be taken apart, \$121
- IV. **Sound as a wave (April 2017), CIS:** Sound proof padding, Large Roll of paper for standing wave demo, \$28
- V. **Physics of Sound Day (May 2017), CSU:** Chladni Plate set, \$79 (Physics Dep will provide the vibrator)

We hope that, with these funds, we can utilize these materials to help these children grow intellectually, and come out with a newfound affinity for the wonderful world of physics.