



SOCIETY OF PHYSICS STUDENTS

An organization of the American Institute of Physics

Future Faces of Physics Award Proposal

Project Proposal Title	Can You Hear Me Now: Supplementing Memphis City Schools with Acoustics Labs
Name of School	Rhodes College
SPS Chapter Number	5940
Total Amount Requested	\$466.60

Abstract

Rhodes College's SPS chapter will create a set of portable laboratory experiments so students can measure the speed of sound in air. SPS members will use these kits to lead formal lab sessions in Memphis high school classrooms.

Proposal Statement

Overview of Proposed Project/Activity/Event

Since Rhodes SPS is very active in demonstration-based outreach, we would like to work on a branch of outreach that is new to our chapter. In response to a request from teachers, we plan to develop a portable lab experiment that we can bring to Memphis high school classes. Rather than merely entertaining students with demos, we want to contribute to the classroom by offering rigorous laboratory experiments that teach students physics in practice.

We will especially focus on two schools we have worked closely with in the past, Kingsbury High School and Soulsville Charter School. Both are strongly dedicated to encouraging students in higher education and focused on preparing them for college. However, lab equipment is typically limited and as a result students have little experience with actually conducting experiments. Since working with laboratory equipment and data is so crucial to physics, it is difficult for students to have a complete understanding of the subject without lab time. This is why we believe it would be highly beneficial to create these lab kits and to make them accessible to high school teachers across Memphis.

The specific experiment we have chosen involves measuring the speed of sound in air using a resonance tube. This experiment offers many advantages for the students (see next section), but a number of schools do not have the necessary equipment. We plan to assemble ten lab kits to accommodate up to thirty students, and then lead the lab in different high school classrooms. These labs will be reusable without incurring extra cost, and we will add them to the list of resources we can offer teachers.

It is our hope that these kits will reach many schools and organizations across Memphis and that they will give students a taste for actively engaging in physics. Since they are designed to be used many times, there is really no limit to the number of high schoolers that could be impacted. We intend to take this lab to at least two schools per semester, although we will work to meet demand as the project grows.

How Proposed Activity Promotes Physics Across Cultures

Most of the schools that Rhodes SPS does outreach at are primarily frequented by minority students. In addition, according to the US census less than a quarter of adults in the city of Memphis have a bachelor's degree, so many of the students would also be first-generation in college. In asking these students to actively participate in a laboratory experiment, we will give them an introduction to *doing* physics rather than merely studying it. The particular experiment we have chosen has the following advantages:

- *Students perform direct measurements.* The students will learn the importance of accurately measuring and recording data neatly, both essential aspects of any scientific experiment.
- *Students will have fun.* Rather than have students perform endless trials of a relatively mundane task, we want them to enjoy the experiment. Ours provides a good demonstration of standing waves and resonance, and the students will be able to “play around” with different frequency tuning forks. It also opens up possible discussion on other acoustic phenomena, such as music.
- *Results can be compared against an accepted value.* Beginning physics students are accustomed to thinking of the constants they use as absolute and unchanging, when in fact many of them are experimental values rather than exact numbers. Having the students “discover” the speed of sound has

two purposes: first, it helps dispel this notion and reminds students physics is not static but changes as more sophisticated experiments are developed; and second, it gives the students a value against which to check their answers and a goal to aim for, encouraging them to measure accurately and consider possible sources of error.

We hope that partaking in the labs will give students a taste for science, especially physics, and that it will encourage them to study these subjects. Some may be surprised to find that they enjoy the experimental aspects of physics, which they might not have experienced otherwise. Others will hopefully deepen their understanding of the material, which will then push them to learn more and ask more questions.

Plan for Carrying Out Proposed Project/Activity/Event

Personnel: Our Outreach Officer, Eleanor Hook, will work with our Demo Officer, Edo Draetta, to write the lab and assemble the lab kits. Eleanor will then be responsible for coordinating with schools to bring the lab to physics classes. Any SPS member who is interested can run the lab in the classroom.

Marketing: Many teachers we have done outreach with have approached us asking about the possibility of a lab. Eleanor will reach out to these teachers (see project timeline) and others with whom we have had contact in the past, as well as offer the labs to future contacts.

SPS member participation: Since this is not a single event but a project that will hopefully continue for several years, it is difficult to predict how many members will participate in total. However, the labs will be designed in such a way that they can be led by 1-2 SPS members to provide maximum flexibility; additional members will be encouraged to attend classroom visits and assist students.

Expertise: A number of current SPS members already serve as lab assistants in the Rhodes College Physics Department, so they have experience helping students in a laboratory setting. In addition, we will be able to work closely with both Rhodes physics professors and several high school teachers in developing the text of the lab and follow-up questions at an appropriate level for the targeted audience.

Specific goals: During the spring semester of 2016 we intend to develop the lab kits, including writing the instructions. We will then use the kits with at least two different classes before submitting our final report on this project.

Project/Activity/Event Timeline

Week	Action
January 11, 2016	Order lab materials
January 18, 2016	Contact teachers and establish approximate dates to bring labs to their classrooms
January 25, 2016	Write lab instructions and follow-up questions
February 1, 2016	Send lab instructions to Rhodes professors and select high school teachers for review
February 8, 2016	Make any necessary modifications to the lab materials or instructions; assemble kits
March-May	Take lab kits to classrooms; modify kits as needed
May 16, 2016	Document and prepare final report

Note: In order for the labs to make the greatest impact on the students, we will try to have their use correspond with the curriculum. This is why we do not have a date set for the classroom visits; we will coordinate with teachers as soon as possible to this end.

Activity Evaluation Plan

In order to evaluate the effectiveness of the lab, we will ask both teachers and students to fill out a brief questionnaire after using it. We will ask teachers questions about how the material in the lab fit in with their syllabus and whether students seem to be more or less engaged with the material having completed the lab, as well as suggestions for improvement and ideas for future labs. We will ask the students whether they understood the lab concepts and instructions, if they found it interesting, and whether they have a greater understanding and/or appreciation of physics.

We will then use these questionnaire results to reevaluate the lab kits and instructions after each session. Since the labs can be easily modified, we will consider this a fluid project. We can and will make necessary changes in response to feedback from both students and teachers in order to make it as effective as possible.

Budget Justification

All of the items on the budget will go directly towards the lab kits. We consulted with teachers at the schools we are specifically interested in, and determined that 20-30 students is typical for a high school physics class in this area. Since the main goal of the lab is to encourage each student to actively participate in a scientific experiment, we plan for groups no larger than three students each; hence we budget for ten lab kits total.

In order for this to be a sustainable project, we should not rely on borrowed equipment. However, the equipment listed should not need to be replaced and it will impact many students, not just once in the immediate future, but many times in the coming years.