SOCIETY OF PHYSICS STUDENTS
An organization of the American Institute of Physics

Future Faces of Physics Award Report

Project Proposal Title	Can You Hear Me Now: Supplementing Memphis City Schools with Acoustics Labs
Name of School	Rhodes College
SPS Chapter Number	5940
Project Lead (name and email address)	Eleanor Hook (hooeb-18@rhodes.edu)
Total Amount Received from SPS	$466.60
Total Amount Expended from SPS	$442.60

Summary of Award Activity

Having spoken to several Memphis high school teachers, members of Rhodes SPS became aware of how limited resources make it difficult for them to provide physics labs to their students. The students at these high schools primarily belong to minority groups, and we realized that without adequate experience at the high school level, they were unlikely to pursue physics in higher education or in their careers. Using the funds provided by the Future Faces of Physics Award, we developed a physics lab that asked the students to measure the speed of sound.

Statement of Activity

Overview of Award Activity

We created a portable lab kit, including the materials and instructions necessary for high school students to measure the speed of sound using resonance tubes and tuning forks. The lab is designed to be taught by SPS members, although teachers can also lead it if they prefer, and it can be reused for different classes. The instructions and questions are flexible so that the lab can accommodate a variety of class levels and time period

This project was aimed at minority high school students from Memphis. We worked with three classes, taught by the same teacher, for a total of 35 students. Our goal was to encourage students to explore physics concepts in a more hands-on way and to give them a sense of how the concepts learned in the classroom can be translated into real-life applications.

Since we were working with the same teacher and several different classes, this meant that he was able to help us look for flaws in the experiment and tweak them as necessary. For example, our original setup involved measuring the volume of water added to the resonance tubes as the independent variable. While the honors class had no problem with this, another section had trouble connecting the volume poured in with the effective change in the tube's length. For the next class, we changed the procedure to dipping the resonance tubes in to water reservoirs (recycling bins collected from the school), which improved the students' understanding of the experiment. Through tweaks like this, we were able to change the lab to suit the specific class at hand.

Historically, our chapter has done a lot of classroom outreach, but most has been centered around demos that are fun to watch and talk about but that don't require the students to interact much with the materials. With this project, we put less of an emphasis on "flashiness" (although it is very satisfying for the students to hear resonance when their setup meets the right conditions). This opens up a new type of outreach for our chapter, serving as a teaching aid that should fit directly in with course materials.

Impact Assement: How the Project/Activity/Event Promoted Physics across Cultures

The goals of this project were to help minority students gain a greater understanding of concepts they had learned as theory in class and to give them an idea of one way to set up an experimental procedure. We selected the speed of sound as a topic because that way the students could compare their results to a calculated (or accepted) value, and they could see the work that goes into finding a value that they use frequently in their calculations. The experiment was designed to be flexible so that it could fit into most class periods, and to have varying levels of difficulty for different classes.

As far as the experiment design goes, these goals were met successfully. The experiment worked very well, without being so easy the students didn't learn anything or being so difficult they couldn't complete it. Although

the experiment was designed in such a way that it would be difficult to "fudge" the results, most standard error was within 5%. Students answered questions verbally and in writing about how the procedure could have been designed differently, and where sources of error could be found; they were encouraged to think critically about the experiment and find ways to improve it.

While observation showed that the students were engaged and excited about the experiment, as part of our project proposal we suggested a brief questionnaire as another means to gauge its success. All of the students reported that the lab had helped them to understand the concepts covered in class, half of them "very much so". They also expressed an increased interest in physics as a field of study.

Impact Assement: How the Project/Activity/Event Influenced your Chapter

Although our chapter has a long history of designing and building demos, this was the first project we have worked on that was specifically designed for students to use in the classroom. It is different from our demos in that it isn't made to catch the students' attention and it relies less on the "wow factor", but its aim is to walk them through a physics experiment and show them what it means to "do" science. As such, it was challenging but rewarding for us to research experiments, looking at how other teachers had tackled the same problems and figuring out how we could create our own experiment that fit our needs.

Key Metrics and Reflection

The Future Faces of Physics Award is designed to promote projects that cross cultures. What cultures did your project attempt to bring together? (Please be as specific as possible.)	All of the students we worked with belonged to ethnic groups traditionally underrepresented in physics
How many attendees/participants were directly impacted by your project? Please describe them (for example "50 third grade students" or "10 high school volunteers").	35 high schools students
How many students from your SPS chapter were involved in the activity, and in what capacity?	Three SPS members were directly involved in developing the labs and teaching the students, while other members helped brainstorm
Was the amount of money you received from SPS sufficient to carry out the activities outlined in your proposal? Could you have used additional funding? If yes, how much would you have liked? How would the additional funding have augmented your activity?	We were able to complete the project successfully with the funds available. Given additional funds we may have been able to create a more sophisticated lab, but ours worked very well and achieved our goals.
Do you anticipate repeating this project/activity/event in the future, or having a follow-up project/activity/event? If yes, please describe.	Since all parts of the lab are reusable, we plan on offering it as a resource to other teachers in future outreach. Two of the schools we work with have already expressed an interest in using the labs next year.
What new relationships did you build through this project?	We worked extensively with physics teacher Jack Replinger at Soulsville Charter School to optimize the lab for his students.
If you were to do your project again, what would you do differently?	It would have been helpful to start testing the lab with students earlier, so that we could reach more students and continue to improve the lab for each class.

Press Coverage (if applicable)

N/A

Expenditures

All of the materials were purchased to be reusable, so that the lab will not cost anything extra (except for printing) to run. All of the lab materials were purchased through the award funding, and printing costs were covered by the physics department.

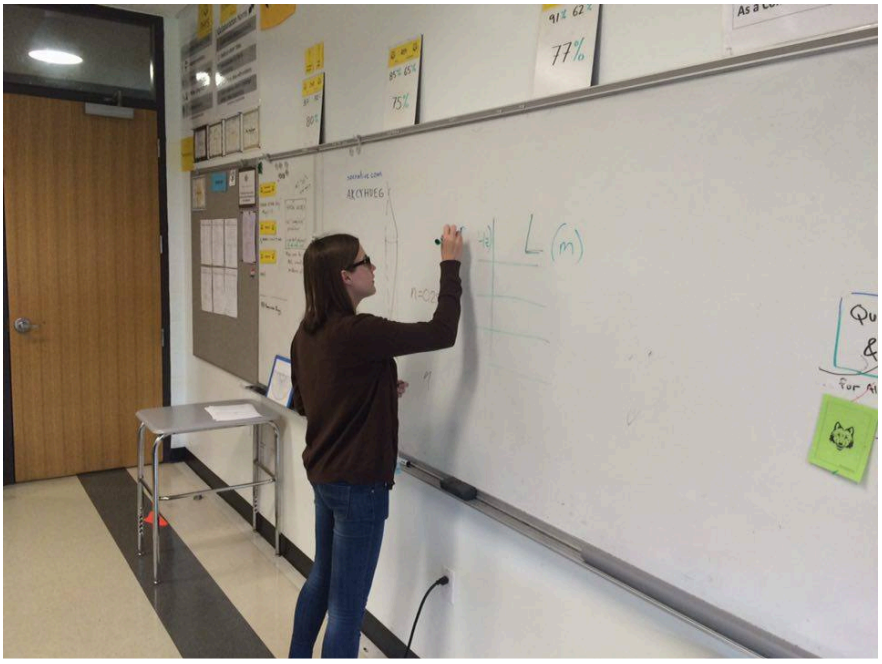
As discussed in our project proposal, we made ten lab kits so that in a normal class size of 20-25 students, no more than three students will be working together. This way they all can have the experience of performing an experiment in a small group.

As our project developed, we realized that there were different procedures that could be used and each had its benefit. While our original procedure, which measured the volume of water poured into the resonance tube, worked well for some students, others could understand a different procedure better. Since one of the goals was to create a lab that is flexible and can be used for a variety of classes, we developed two different methods of performing this experiment while remaining within the budget.

Expenditure Table

Item	Please explain how this expense relates to your project as outlined in your proposal.	Cost
Boomwhackers	Used as resonance tubes	$75.90
Tuning forks		$108.30
Boomwhacker caps	Used to close ends of resonance tubes	$22.70
Graduated cylinders	For measuring volume of water added in “advanced” version of lab	$143.80
Plastic bins	Serve as water reservoire for alternate lab	$59.80
Plastic rulers	For measuring water levels	$32.10
	Total of Expenses	$442.60

Activity Photos



Outreach Officer Eleanor Hook walks students through data collection tables

Eleanor gives students tips on experimental technique

Teacher Jack Replinger helps out as students answer conceptual questions

Students complete the lab using a water reservoir