



SOCIETY OF PHYSICS STUDENTS

An organization of the American Institute of Physics

Marsh W. White Award Proposal

Project Proposal Title	Electrifying Electronics
Name of School	Radford University
SPS Chapter Number	#5866
Total Amount Requested	\$330

Abstract

Electrifying Electronics is a program started by the Radford University SPS chapter to help spark scientific interest in local secondary school students by using basic electronic components and fundamental knowledge of electricity to construct AM radios with students.

Proposal Statement

Overview of Proposed Project/Activity/Event

This program seeks to engage with local students by walking them through the fundamentals of how a radio works on a conceptual level followed by the construction of one. SPS members will present a short conceptual talk describing the physics behind the function of a radio. After this talk, the classroom will be divided into smaller groups with each SPS member leading a group. Students will be given a radio kit that contains all the components required for building the radio. The SPS member will walk their group of students through building the radio while answering any questions the students may have. At the end of the event, the students will be allowed to have the radio they have built.

The program goal will be to excite students about physics and show how basic principles of physics are the backbone for everyday technology. Additionally, the goal is to emphasize the usefulness and applicability of physics to everyday life showing that physics consists of more than just equations on a sheet. The simplistic nature of building a functioning AM radio can also help inspire confidence in students that otherwise would feel as if physics, or science in general, is too complicated for them to grasp. For high school students, the goal is to get them to consider a potential STEM major in college. For middle school students, the goal is to cultivate interest in scientific concepts.

Electrifying Electronics is specifically aimed at middle and high school students with the intention of providing a spark that could potentially lead to them pursuing science later. Radford University is located by three public high schools: Blacksburg, Christiansburg, and Radford. Additionally, there are four middle schools in the area: John N. Dalton, Dublin, Christiansburg, and Blacksburg. Each school provides a unique

opportunity to engage with students of diverse backgrounds. The goal for the first semester of this program is to impact at least 50 students by visiting one local high school and one local middle school.

Physics is a crucial component of modern-day society with the fundamentals for all modern technology being drawn from basic principles of physics. However, there is a large misconception in public schools that physics is only “math” or symbols on a page that don’t mean anything to them. It is important to breakdown this misconception and to show that physics describes the universe. Constructing a simple AM radio can show students that physics is *real* and that it can be, and is, used all around them.

How Proposed Activity Promotes Interest in Physics

Many students, and people in the general public, don’t quite understand how radios work or that radio waves are a form of light. Electricity is perplexing and not readily associated with physics for those unfamiliar to it. Additionally, electric circuits can be confusing with many not knowing why an antenna works or what happens after it receives a signal. The goal is to remove this mystery and reveal to students that it is all physics and that they can do it. This program helps generate interest in physics by conceptually explaining the fundamental properties used in radios and allowing students to use those properties in building a radio. Allowing the students to keep the radio they built also serves as a positive scientific memory that could inspire them to do more research about the radio or the components that make the radio up. Students might also show other students the thing they have created which could lead to the spreading of scientific interest amongst the school.

Plan for Carrying Out Proposed Project/Activity/Event

Members of the chapter will develop a plan of action for engaging with the students and practice to ensure comfortability in performance. Our advisor, Dr. Herman, will reach out to the target schools to set up visit days. Visit days will be documented with who attended, how long the chapter visited, and how many students we were able to engage with. Surveys taken by the students after our visit will also help us measure our impact, see where we could improve, and help us find ways to make the program more exciting for more students.

Dr. Herman reaching out to schools well in-advance will help generate excitement for our visit. After successfully visiting one school we will be able to use that success to market to other local schools in the area allowing for the chapter to increase our radius of impact. Additionally, students keeping the radios they built can help generate word around the school and potentially create more excitement for a return visit.

Radford SPS members will be the primary conveyors of information to the students and will lead the in-class activity upon visiting. Each member will conceptually explain an electromagnetic property pertaining to the radios to the class. After explaining the theoretical ideas behind the radio, classes can be divided into multiple groups with each SPS member leading their own group in the construction of the radios.

Some of our chapter members have experience building simple AM radios as part of the Electronics Lab physics class at Radford University. Additionally, our advisor Dr. Herman teaches the Electronics Lab and can help the chapter develop their skills in teaching the students about the radios. Chapter members who have experience with radios will be able to assist in teaching chapter members who are not already knowledgeable about the radios and their construction. By honing the teaching skills of our members through practice, we can ensure a successful event when visiting the schools.

Project/Activity/Event Timeline

Visit Days: April 2020

November/December 2019: Develop outline of conceptual topics to explain and introduce radios to chapter members who have not built one previously.

January 2020: Our advisor, Dr. Herman, will begin contacting the targetted schools to schedule a date for our visit.

February 2020: As a chapter, we will begin developing the exact contents of our conceptual explanations and begin practicing. Additionally, we will also begin practicing how to clearly instruct others on building a radio.

March 2020: Continue practicing along with confirming the dates of visit with the schools and the availability of SPS members on those days. Perform a “dress rehearsal” of the event to ensure comfortability in explaining the conceptual topics and helping students construct radios.

April 2020: Visit schools on the scheduled days. After visitng, a survey will be sent to the students and teachers we engaged with to get an understanding of the impact we had and satisfaction of students with the event.

Activity Evaluation Plan

A record of the number of students we engaged with at each school will be kept to ensure we are on track to meet the programs goal of 50 students. After our visit, each student and teacher will be e-mailed a survey to rate their satisfaction with the visit along with the impact it had on their attitude towards science. The survey will be anonymous and feature some yes/no questions such as: “*Did you know before the event that radio waves were electromagnetic?*”, “*Did you enjoy building your own radio?*.” The survey will also have some open-ended questions to allow for feedback so we can continually improve the program. These free response questions would be something like “*If you could change one thing about the visit, what would it be?*”, and “*What is one thing you felt could have been explained more clearly?*.” This information will be discussed at the following SPS chapter meeting and used to help improve the program to make it more engaging.

Budget Justification

- **Tiny Breadboards**
 - Breadboards are used as a simple but effective way of containing the circuit and also allows for the radio to be constructed without having to solder. The tiny breadboards are economical and allow for simplicity in the circuits construction. We have requested 65 breadboards so that each student will be able to create their own radio along with their teachers.
- **Capacitor Kits**
 - The radio circuit requires a 470pF capacitor along with a 10pF capacitor. Purchasing two capacitor kits will allow for each student and teacher to have both. Additionally, it provides some additional capacitors of varying capacitances so that students could experiment with what happens to the radio when a different valued capacitor is input.
- **Germanium Diodes**
 - Diodes are essential in the radio circuit as they help in rectifying the signal. These diodes are priced at 19 cents per diode. We have requested 65 of them so that each student and teacher building a radio can have their own.
- **Earbuds with Audio Jack**
 - These earbuds have been chosen since they can be modified to easily plug directly into the breadboard. This will allow for the students to directly hear the signal after their constructed circuit has done its job. A 100-pack has been selected since it was the most economic option (50 cents per pair) compared to smaller sized packs. This will also allow for each student to have their own.

The chapter will also undertake fundraising efforts to supplement other expenses associated with the program to ensure its success. These efforts include things such as bake sales, paid volunteer help around the community, and donations from chapter members.