

Marsh W. White Award Proposal

Project Proposal Title	The “Phun”-damentals of Physics
Name of School	The George Washington University
SPS Chapter Number	2319
Total Amount Requested	\$300.00

Abstract

The George Washington University SPS chapter will work with Lifepieces to Masterpieces of Washington, DC to conduct six 45 minute physics workshops for elementary, middle, and high school boys. These sessions will allow us to promote interest in physics among young students by allowing them to create, experiment with, and learn from popular physics demonstrations.

Proposal Statement

The entire Proposal Statement should be no more than 2 pages, and organized as follows.

Overview of Proposed Project/Activity/Event

This outreach project will work to promote interest in physics for young men at the organization LifePieces to Masterpieces of Washington, DC. LifePieces to MasterPieces, which is a youth development non-profit that serves African American boys in Washington, DC, will be launching a new program called Innate Creativity Ability network (I CAN). Our outreach project will offer science lessons as one of the workshops of I CAN. Members of our SPS chapter would commit to conducting five consecutive weeks of two 45 minute sessions for two age groups (ages 7-10 and ages 10-14), with a culminating celebration, field trip and showcase on the 6th week. Each group will have 15 students, and we will be conducting sessions from January 16th, 2015 to March 6th, 2015. Our hope is to build these students' understanding of core physics topics through exciting, interactive demonstrations. In addition, we will structure the lessons so that the students can make their own discoveries while we guide them through creating and experimenting with the demonstrations. We will focus on four main lessons, one of which will extend over two sessions. The lesson topics will include rockets, velocity amplification/bouncing balls, lasers, and non-newtonian fluids. The students will have an opportunity to build demonstrations and understand the core physics principles behind what they create; we hope to span topics such as kinematics, astronomy, momentum and energy conservation, light and waves, and properties of fluids. Since we will be conducting sessions with two different age groups, we will adapt each of our lessons for the age group we will be teaching. Our project will help inspire interest and excitement in physics at a young age for these students. The project will be a great asset to the new I CAN program at LifePieces to MasterPieces, and will allow us to spark an interest in science and physics for young men in our city.

How Proposed Activity Promotes Interest in Physics

Our project will meet the goals above by carrying out four principal physics lessons: rockets, which will build the fundamentals of kinematics and extend to larger ideas in astronomy; velocity amplification and bouncing balls, which will teach the fundamentals of energy and momentum conservation; lasers, which will speak on light and waves; and non-Newtonian fluids, which will give students an understanding of different types of fluids and their properties. Our goal is to use key demonstrations in these four lesson topics to engage our student. Since our outreach project will span the course of six weeks, our SPS chapter members will be able to build stronger relationships with students they will be teaching and will be able to have a greater impact.

In the first session, we will spend one session using Non-newtonian fluids to discuss the states of matter as well as viscosity and properties of fluids. SPS members will go to the classroom with supplies to make oobleck, cornstarch and water. The idea of viscosity will first be introduced using water as an example as something that is not very viscous. Then SPS members will ask the students to brainstorm ideas of substances that are viscous. SPS members will then make oobleck in front of the students and demonstrate its viscosity. Students will then get a sample of the oobleck in a cup so that they can test the viscosity themselves.

Next, we will focus on lasers and light and introduce the students to different types of waves. We will be using the materials in "What's so special about the laser?" SPS SOCK laser demo manual developed by the 2010 SOCK interns. We will have them play with slinkies to help them understand standing waves and how to produce standing waves with different numbers of humps. We will also provide lasers and rainbow glasses for them to understand the different properties of light.

We will spend our next two sessions using rockets. The first one will be used to discuss the kinematics of rockets, and the second one will discuss the astrophysics/astronomy applications. During the kinematics lesson, members of SPS will go to the classroom with bungee rockets, meter sticks, stopwatches and a protractor. We will explain how through the principles of kinematics we can figure out certain details of how something moves. We will launch the bungee rockets at different angles to test

which angle will make the bungee rockets go the farthest. We will measure this distance with the meter sticks and time how long the rocket was in the air. We will let the students launch the rockets and record their own data as well. The students will get to keep the bungee rockets. During the astrophysics lesson, our focus will shift more to outer space. SPS members will explain the Big Bang Theory, the origin of the universe and the formation of stars and planets. SPS members will discuss how vast the universe is and start to brainstorm with the students how we have figured out so much about the universe. Various telescopes and experiments can be discussed as well as space exploration. Rockets will then be reintegrated into the lesson, as the design and building of the rockets will be discussed. The students will then build demo rockets based on what they learned.

Finally, we will introduce the students to the tennis ball/basketball problem in physics, in which a tennis ball is placed on a basketball and the two balls are simultaneously dropped. As a result, the tennis ball shoots up at a much higher velocity than the initial downward velocity of both the balls. In addition, the basketball does not rebound as much, resulting in a lower velocity. We will use this phenomenon to demonstrate conservation of momentum and conservation of energy. We will guide the students in carrying out experiments so that they will be able to arrive at the above conclusion after experimenting on their own. We will also bring other balls for them to be able to analyze the effects of different types of balls on this interaction.

Plan for Carrying Out Proposed Project/Activity/Event

Members from The George Washington University SPS will be carrying out these lessons. We will require a minimum of three members to attend each Friday session in order to carry out the lessons. The classroom will be split into groups. Each group will be overseen by a SPS member and assist the group in following along during the lesson, completing the worksheet that will be provided as well as ensure safety during any time the students handle equipment. Members will have the opportunity to sign up for the lessons so they can choose which lessons they would like to teach most based on their interest, expertise and availability. SPS members will be encouraged to sign up for lessons on topics that they are well versed in. As many of our members are upperclassmen, we do not foresee much difficulty in assuring that our members have enough knowledge. As our lessons will be a part of a larger program, called Lifepieces, SPS members will have to go to a meeting prior to when the lessons start to pitch the classes to the students. The students will watch all of the pitches, including ours, and sign up for which series of lessons they would like to attend. During the pitch SPS members will be highly enthusiastic and will do a demonstration from one of the lessons in order to get the students excited and encourage them to sign up for our lecture. We will also focus on the importance of physics and all of the exciting things one can do in the physics field. SPS members at the George Washington University are very excited for this opportunity and are likely to volunteer. However, if more volunteers are needed we will reach out to other physics majors as well as anyone with the interest and proper knowledge, which will be gaged on what level physics classes they have been in.

Project/Activity/Event Timeline

Our lessons would be coordinated through part of a program called Innate Creative Ability Network (I CAN) for young men, which is carried out through Lifepieces. Our lessons would take place on six Fridays in the spring, from January 16 to March 6. Each lesson will be 45 minutes long. Before we can carry out these lessons though we would have to figure out which members would be attending each session. The following members of our group have offered their time and dedication in carrying out this activity: Kara Zielinski, Srividya Murthy, Zoe Pierce, Brian Alden and Joseph Crandell. The members attending each lesson will be required to come up with a more detailed lesson plan as well as create a worksheet for the students to complete during the lesson. Next the pitch for the students needs to be created. The SPS members carrying out the most lessons will be encouraged to carry out the pitch. The pitch will focus on the importance and exciting nature of physics as well as have one demonstration component. All lessons and the pitch need to be prepared by January 9th, as January 16th is when the pitch needs to be carried out and then the program starts the next week. During the actual program, SPS members will go to Lifepieces and carry out their lessons.

Activity Evaluation Plan

SPS members are very excited in starting a partnership with Lifepieces, and we would like to hopefully continue teaching these lessons in the future. Therefore our group will be willing to receive feedback in order to best promote physics to the students of Lifepieces. We will ask members of the Lifepieces staff to provide suggestions for the improvement of our lessons and other critiques and evaluations they have for us. We will also make up a survey for the children to fill out on the last day of lessons. These surveys will include questions that would question their interest in the subjects we chose to for lessons as well as how the lessons could be made better in the future.

Budget Justification

The funds from the Marsh White Award will be used to purchase supplies for the demonstrations and items that students can take away with them after every workshop. By allowing students to take away physics demonstrations, they will have an incentive to participate in activities and have something to help them remember what they learned from these sessions. Additionally, if more funding is needed to complete these activities the George Washington University Physics Department will provide additional funding.