



SOCIETY OF PHYSICS STUDENTS

An organization of the American Institute of Physics

Future Faces of Physics Award Proposal

Project Proposal Title	California State University San Marcos's aim for Diversity in Physics
Name of School	California State University San Marcos
SPS Chapter Number	0853
Total Amount Requested	\$500

Abstract

Last year our SPS chapter took 120 students from a local middle school to a nearby planetarium at Palomar college. The students came from both underrepresented minority groups and socioeconomically disadvantaged communities. Our work sparked collaborative interest both outside and inside our University, so we hope this award allows us to expand our reach and make this a recurring event.

Proposal Statement

Overview of Proposed Project/Activity/Event

Last year we had great success in taking 120 8th grade students from San Marcos Middle School (SMMS) to the local planetarium. This year we want to not only take more students from SMMS, but we want to incorporate another middle school into the mix. Studies have shown that field trips that are educational spark interest in the students to learn more about the subject [1]. It is one thing to read about physics in a book and another to physically interact with it. During 8th grade is when students learn about the solar system and are first introduced to the basic concepts of physics. Our project co-aligns with what they are learning perfectly. Thus our proposed project will take the 8th graders to the planetarium where they will learn about physics, take part in interactive demos, and hear from the SPS members who are alumni from their middle school. Our project has two goals; 1) to ignite interest and motivation in these students to be college ready and aware of their potential to enter the physics field and 2) to increase the number of underrepresented students in physics or STEM degrees and the workforce.

In physics and other STEM fields, minorities have been underrepresented both in higher education and the workforce [1]. It is almost impossible to become something one didn't know existed. The planetarium we are visiting is 15 minutes walking distance from SMMS. Yet a majority of the students don't know about it. The students attending SMMS come from families who lack post-secondary education and are economically disadvantaged. As a result their parents or guardians are not able to take them to places like museums or the planetarium. It is evident that these students do not have any footprints to follow and making one's own can be intimidating, especially in physics. That is why it important that we take the science to these students. Since these students don't have family members whose path into physics to follow, we are serving as mentors and role models to them.

Studies done on mentor-mentee relationships have resulted in two main conclusions. The first one is that the same ethnicity mentor has a stronger influence on students to pursue STEM and the other is that mentors who hold similar values are more likely to have an influence on their mentee to pursue STEM [2]. The SPS-SMMS pairing holds potential for success in both cases of mentee-mentor relationships. Our SPS chapter is two-thirds women and of multiple cultures who come from similar backgrounds. Therefore this experience for them will be powerful because we mimic the demographics of the middle school and thus we serve as ideal mentors for the students.

How Proposed Activity Promotes Physics Across Cultures

While the proposed project definitely meets the goal of promoting physics across cultures, a more accurate description of what we are doing is re-introducing physics to these cultures. Many of the students at SMMS come from 3rd world countries that have rich histories in astrophysics and engineering. The students are unaware that their ancestors were not stargazers, but instead were engineers and astronomers who calculate planet alignment, built pyramids and infrastructure which were masterpieces of engineering. Taking the students to the planetarium will expose them to physics and the possibilities that come with it. Ultimately we hope that if they see us, who came from where they did, doing great things in physics, then they will also want to join in and pursue physics in college and in life.

SMMS needs us to do this because the unfortunate reality is that many schools like SMMS don't have the resources to conduct science programs or educational field trips. Which are generally what exposes students to the real-world applications and motivates them to want to keep on studying. SMMS's School Accountability Report Card (SARC) from the 2015/2016 shows that 88.1% of their students are nonwhite and that 77.4% are socioeconomically disadvantaged [3]. The students are not at fault for any of this, so it is on us to take the science to them. Studies have shown that students that come from socioeconomically disadvantaged communities are 29% less likely to enroll straight into a postsecondary institution the year after completing high school [5]. This is not because students from these communities are not interested in physics; rather they are just not set up to pursue or succeed in physics.

However, in the past 25 years there has been a shift in the demographics we see in undergraduate institutions. Since 1990, students of low-income communities have had nearly an 18 percent increase in the number of students they send to college [5]. The desire to pursue physics is there, it's just that the resources are not. It is not hard to get someone interested or excited about science. After all we are all born scientist who ask why the sun rises, and why the sky is blue, and how the remote control works. By us taking the students from SMMS, we are leading them towards the pathway of asking questions. We are feeding their curiosity in hopes that they will pursue a life and career in physics.

Plan for Carrying Out Proposed Project/Activity/Event

- Personnel - As the treasure of our SPS chapter, I will oversee this project. Last year I was fortunate to prepare, organize and participate in the event so I am confident that I can smoothly run it again and improve it. I am currently meeting with the middle school and the CSUSM's Office of Diversity to see how we can expand.
- Marketing - everyone involved in last year's field trip was very pleased with the execution and results. So it will not be hard at all to get SMMS, the planetarium, and our SPS chapter excited about expanding this project.
- Expertise – We have plenty of experience with community outreach events. We have taken part in many “STEM in your backyard” events, hosted multiple rocket launches for super “Super STEM Saturday”, and have gone out to many middle schools to display many physics demonstrations.
- Assessment – Last year we conducted pre and post surveys that looked at the student's interest and awareness in STEM and the project. We saw an 18.69% increase in the number of students who knew what a planetarium was and a 21.56% increase in students knowing what STEM stands for [4]. There were also increases in the number of students who were interested in STEM and the amount that wanted to pursue it in college, however those numbers were only a minor increase. This year we are working on

improving those critical responses. Our departments founding faculty members, who conduct physics education research, have agreed to assist us with this to ensure we do the best we can.

Project/Activity/Event Timeline

The field trip to the planetarium will be held in May after our semester ends, but the students at SMMS will still be in school. We will purchase the tickets upon receiving fund and confirming attendance. The timeline for the event is as follows:

Winter break- Plan the event and consult with faculty and outreach personnel on activities.

January – start collecting volunteers

February – confirm plans with SMMS and the planetarium (reserve tickets).

Spring break- Rehearse the activity.

April- get permission slips signed

May – purchase tickets

Late May - Palomar College Planetarium Event.

Activity Evaluation Plan

Last year we administered pre and post surveys to evaluate the student's knowledge on STEM, college, and career possibilities. The success in our event last year is evident in our data that we collected as well as the fact that the middle school wants us to help conduct this field trip again. However, there is always room for improvement. For example, we only saw an 8% increase in the number of students who said they want to pursue a degree in STEM. We are eager to work with our department's physics education researchers to improve the event and hopefully see that number go up.

Budget Justification

The main cost associated with conducting an event like this is purchasing the planetarium admission tickets for the students. This year we want to take at least 150 students, as well as for the staff and volunteers. Each ticket costs \$4.00 for a rough total of \$680. Thus we are requesting \$500 from this award and seeking matching funds from our Office of Diversity. We are determined to find a way to be able to reach more students with this event. We have had success in fundraising on our own here at our campus. We sold liquid nitrogen Ice cream and deserts and made a profit so we hope to continue this all the way through March in hopes of adding another middle school to this project.

References

- [1] Jones F, Harris S. "Benefits and Drawbacks of Using Multiple Instructors to Teach Single Courses." *College Teaching* 60: 132–139, 2012.
- [2] Hernandez, R Paul, Estrada, Mica, Woodcock Anna, Schultz Wesley. Protégé Perceptions of High Mentorship Quality Depend on Shared Values More Than on Demographic Match (2016)
- [3] San Marcos Middle School School Accountability Report Card [Online].
- [4] J.Gregorio, J.Perez, E.Robles,J.Perron, Future Faces of Physics: Palomar Planetarium Outreach Event (2017)
- [5] Barriers and Opportunities for 2-year and 4-year STEM Degrees: Systemic Change to Support Students' Diverse Pathways (2016) <https://www.nap.edu/catalog/21739/barriers-and-opportunities-for-2-year-and-4-year-stem-degrees>