‘Let Science come to your space’ - Delivering Astronomy and Optics outreach activities outside the cities

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ABSTRACT

Increasing science awareness can help increase interest in science, give the public a deeper understanding of science and its application, and lead to more informed choices in society. On this matter, the Faculty of Physics and Math Science of the Universidad Autonoma de Nuevo Leon works on a social program where teachers and students perform outreach activities related to Astronomy, Optics, and Physics in different schools and public spaces outside the metropolitan area. These activities include a mobile planetarium, solar observation, telescopes, hands-on optics, physics demonstrations, and more. This works presents a summary of the cities and towns visited since 2017 and the impact of this program between our community and our students. In conclusion, we have impacted the growth of the scientific interest in our community. Now, more families are interested in science as a recreational activity, and kids are interested in science as a possible career path. At the same time, we have been helping undergraduate students develop soft skills through science outreach activities.

Keywords: Optics, Astronomy, Hands-on, Outreach

1. INTRODUCTION

According to different research, over the last few years, students have decreased their interest in Science, Engineering, Technology, and Engineering (STEM) studies worldwide. This has led to a deficit in fulfilling the needs of science-related professionals in the academy and industry[1].

In addition, different countries worldwide are conducting projects to integrate STEM education in formal or informal environments as part of an integral and multidisciplinary education that promotes creativity, inquiry, dialogue, collaboration, critical thinking, experiential learning, and problem-solving skills[2].

Moreover, different Latin American countries are researching to measure the quality of primary education in rural communities and towns outside the metropolitan areas, concluding that inequality and inequity and the typical results in most cases. Also, in the Mexican context, the kids and youths that grow up in a town away from the cities tend to select as career paths the local opportunities, leading to a decrease of students in higher education from rural communities or small towns[3–7].

As we know, a change in the public policy of education is a long process, and as teachers and researchers in STEM fields, we are looking to make a significant change in our communities and our students every day. This work presents the summary of a multidisciplinary project where teachers, students, and technical staff of the Facultad de Ciencias Físico Matemáticas worked together to conduct science events in different facilities all over the state of Nuevo León and, in collaboration with other research groups, in different states of México.

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2. METHODOLOGY

The department of the Mobile Planetarium of the Facultad de Ciencia Físico Matemáticas (FCFM) is integrated by technical staff dedicated to astronomy*. The outreach group 'Physics for Everyone' is an academic group that was born as an evolution of the SPIE and OPTICA student chapters, where students, teachers, alumni, and early career volunteer to perform optics and physics demonstrations, using, in most cases, low-cost materials and conducting activities in public spaces of traveling to schools in the area[8,9].

This project's first approach was conducted in 2017 when the science community prepared events for the partial solar eclipse. The project 'Let the science come to your space' conducted the following activities:

- Contact public schools in the different towns of Nuevo León
- Train teachers and undergraduate students to perform safe solar observations using solar eclipse lenses, mobile phone solar filters, and DIY devices for solar projections
- Contact other science outreach groups in Mexico to distribute solar films and solar eclipse lenses
- Organizing the public observation of the Solar Eclipse in October 2017 simultaneously in different places in Nuevo León and almost every other state in México

After the success of the Solar Eclipse observation of 2017, the project was consolidated and structured as follows:

- Undergraduate students training. Teachers, researchers, and technical staff train volunteer students in telescopes, solar observation, general optics, optics outreach, public communication, storytelling to explain science, and astronomical photography.
- Big public events. Most of them were performed in Monterrey, but it promotes the projects and facilitates the training of teachers interested in science.
- Visiting towns and rural communities. With all the volunteers, several visits per year were performed, having astronomy and optics as the main topics, including STEM demonstrations in general, thanks to the collaboration of the Secretary of Public Education of Nuevo León (SEP NL).

2.1 Public events

The public events performed in different cities and towns of Nuevo León include:

- Mobile planetarium
- Solar observation for day events
- Sky observation and use of the telescopes for night events
- Electromagnetism demonstrations to understand the nature of Light
- Optics demonstrations and workshops based on 'Dumpster Optics' project[10]
- Other STEM demonstrations

All the events include the participation of students and early careers professionals to create accurate role models of women and men performing science activities, where the diversity in gender and age of the volunteers makes more manageable for the public to feel identified and to consider pursuing a career in STEM fields[11]

*The project 'Let Science come to your space' was used before 2017 by the Mobile Planetarium department, but it was since 2017 that 'Physics for everyone' was integrated into the project and Optics was covered as part of the project activities

3. RESULTS

The Facultad de Ciencias Físico Matemáticas de la Universidad Autónoma de Nuevo León (FCFM-UANL) has collaborated with the Secretaría de Educación Pública de Nuevo León and municipal governments to promote science in public spaces and local schools in Monterrey and its metropolitan area. FCFM-UANL has sought to bring knowledge and interest in physical, mathematical, and computational sciences to the population and elementary and upper secondary education students through scientific events. The program has grown since its inception in 2017, reaching both urban and rural areas of Nuevo León with the support of participating municipalities and schools. Table 1 show the number of events held annually and the impact this program has had on outreach. It should be noted that no face-to-face events were held in 2021 due to the health emergency, but they were gradually resumed in 2022.

Figure 1 presents the map of the localities that benefited from this program, which covers a wide area of the state of Nuevo León. Likewise, the Universidad Autónoma de Nuevo León has expanded the number of high schools in rural areas.

Figure 2 shows the program's impact on different municipalities where optics and solar observation activities have been carried out. The program aims to contribute to bringing STEM activities closer to communities.

Table 1. Total number of attendees benefited from this program.

Year	Attendees	Number of events
2017	17,184	27
2018	15,910	13
2019	15,453	18
2020	9,027	6
2022	10,304	20
Total	**67,878**	**81**

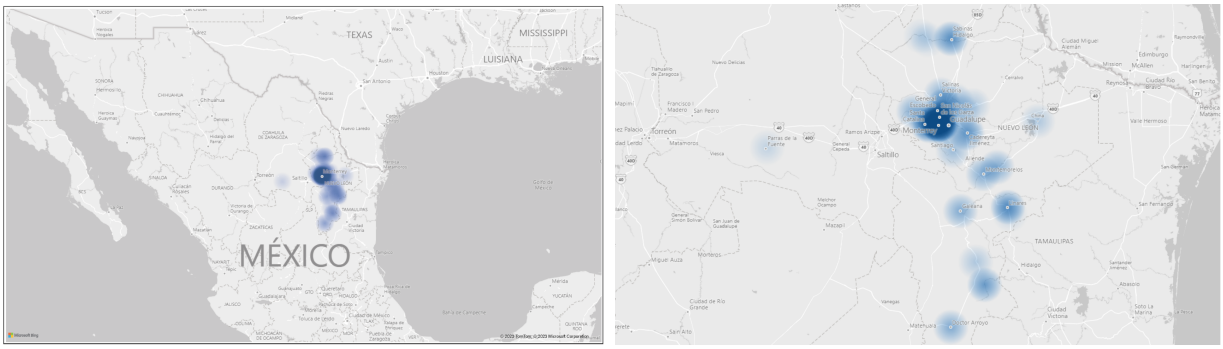

Figure 1. With over 80 events in over 60 cities and municipalities, we have reached around 68,000 attendees in Nuevo León. As seen in the figure, the highest density is in Monterrey and its metropolitan area, as it is the closest area to our University

Figure 2. Some pictures of different events over the years.

4. CONCLUSIONS

The project 'Let Science come to your space' has had a great and positive impact on our community:

- A rise of 10% of the Physics students in our Faculty and an increase of 15% of all our careers. An increase of 20% of the students coming from towns and rural communities in Nuevo León.
- A creation of 2 new student outreach groups supporting the project.
- Due to the increasing number of students interested in our Faculty, a new campus opened on the Northwest of Nuevo León, having an average of 15 new students every year.
- Undergraduate students involved in the project are now supporting new projects such as the new Museum of Sciences of our Faculty and the 'Scientific Turism' project organized by the Astronomy academy in our Faculty.
- Former program volunteers are now conducting educational programs in different institutions in Nuevo León. They mentioned that the soft skills acquired as project volunteers allow them to easily adapt to formal education environments as educators.

This project will continue looking to increase the impact and develop a solid strategy to support new scientific projects that reduce the gap between the Nuevo León and Science community, looking to erase the geographical limits.

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