



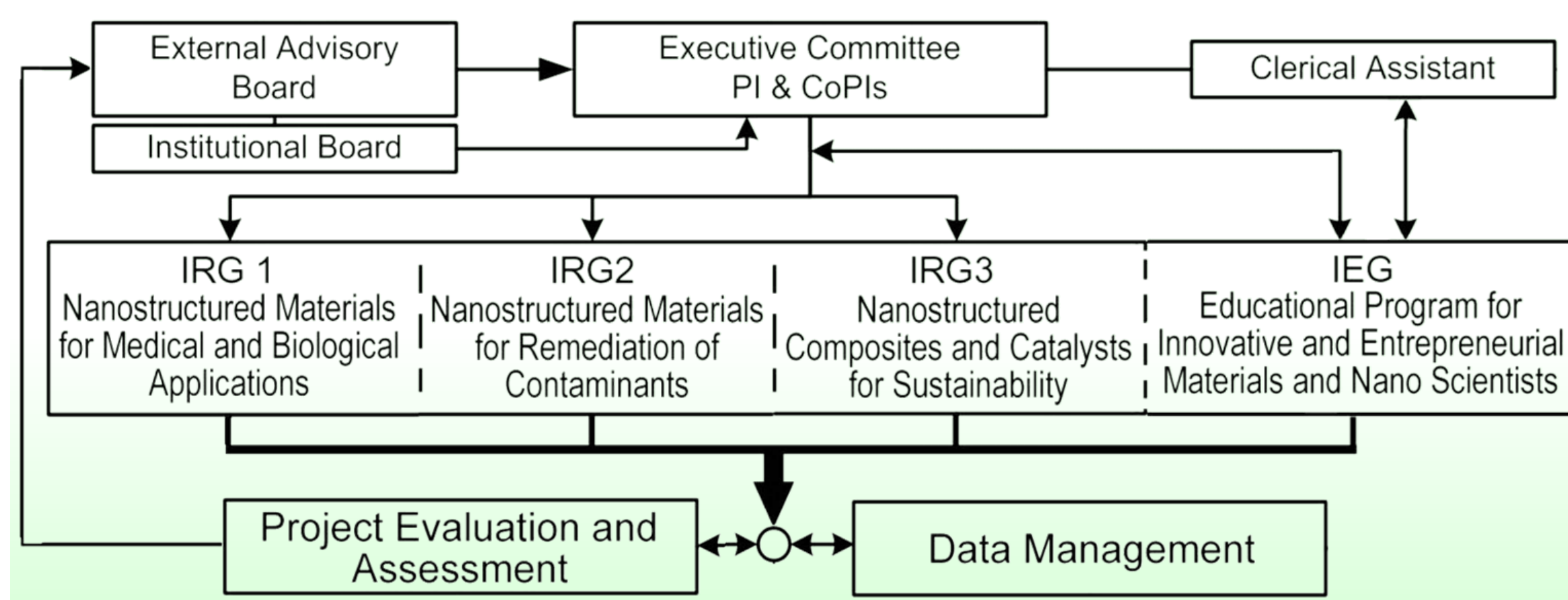
UPR-Mayagüez Nanotechnology Center: 10 Years of Transformative Impact on STEM Education and Research Across the Academic Echelon

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Abstract

Established in 2008 at the University of Puerto Rico – Mayagüez (UPRM), the Nanotechnology Center Phase I focused on in-depth training of students from public schools and undergraduate and graduate students (UGS). Originally engaging two high schools, after 10 years, the Center's Phase II Interdisciplinary Education Group (IEG) maintains 15 Materials Science and Engineering (MSE) Clubs in middle and high schools in Western Puerto Rico. This strategy is at the core of the Center's social impact, as many of their 500 student members represent economically-disadvantaged households. Mentored by a teacher, affiliated to and trained by the Center, each MSE Club provides an enriching venue through planned hands-on interventions by the IEG and carried out by the Center's UGS. The MSE Clubs' Annual Meeting, held at UPRM's Coliseum, serves as an entertaining activity, where the participants learn by building large-scale scientific models using air balloons to demonstrate complex functionalities of nanostructured materials studied in the Center's three research groups. Meanwhile, these groups have been solidly productive and trained more than a hundred UGS, including former MSE Club members, who nowadays pertain to the STEM and Nanotechnology workforce.

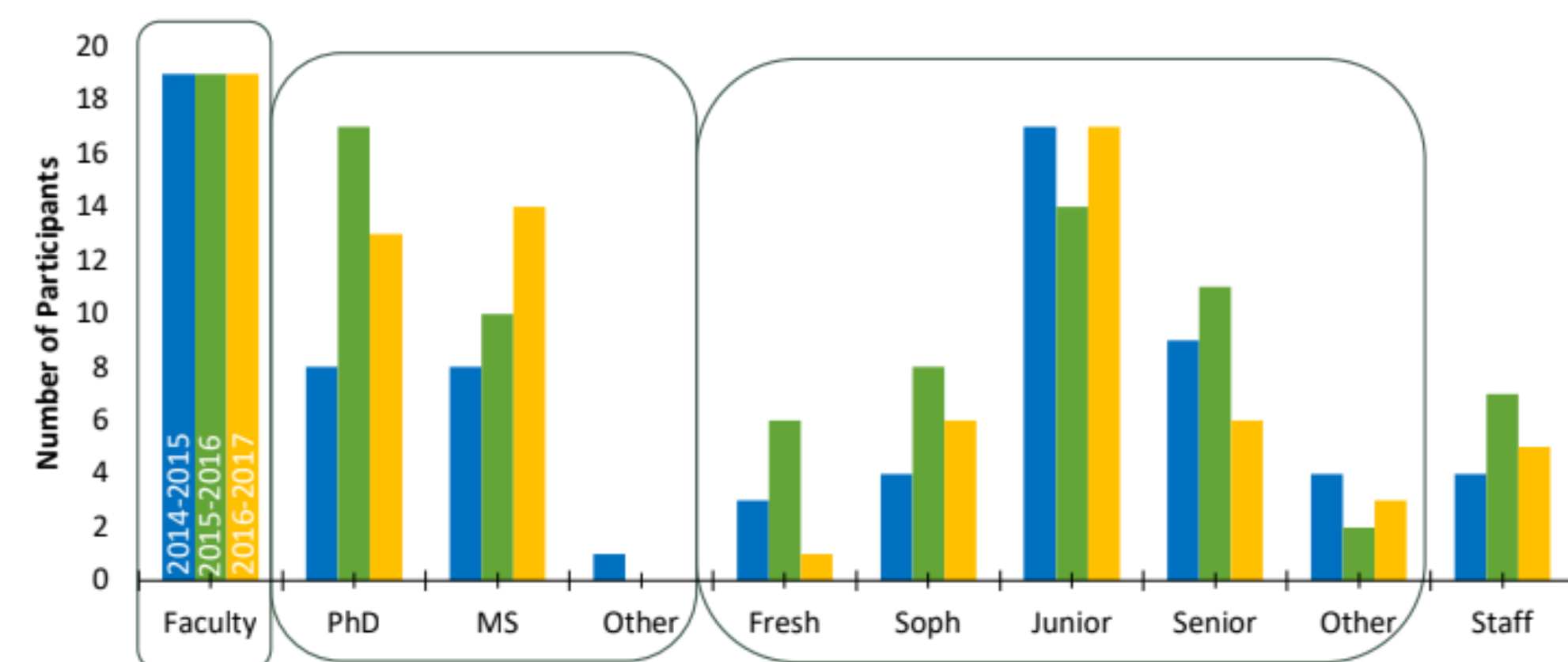
The Nanotechnology Center Phase II Structure



The Overarching Goals

1. Advance the state of knowledge in **engineered** nanomaterials, while achieving national competitiveness.
2. Prepare UPRM students for successful insertion into the future Nanotechnology workforce.
3. Increase the number of minority scholars entering and receiving engineering degrees related to Materials Science and Nanotechnology.

UPRM Participants



Ongoing Broader Impact

The Center has established and maintains an average of fifteen Materials Science and Engineering (MSE) Clubs in Puerto Rico's public middle and high schools, serving mostly low income households. This initiative engages nowadays 530 students. Each MSE Club is led by a teacher, who has partaken in the Center's summer programs. Students' participation is monitored over time to evaluate their interest in pursuing STEM careers.

Education and Outreach Activities

- In addition to research activities, undergraduate, graduate students, staff, and faculty participate in:
- Workshops and seminars to develop their communication, formation literacy, and entrepreneurship & innovation skills.
 - Visits to MSE Clubs at middle and high schools in Western Puerto Rico.
 - The Annual MSE Club Meeting at the Rafael A. Mangual Coliseum (or "Balloon Activity").
 - NanoDays demonstrations at a variety of venues, including the Mayagüez Mall.



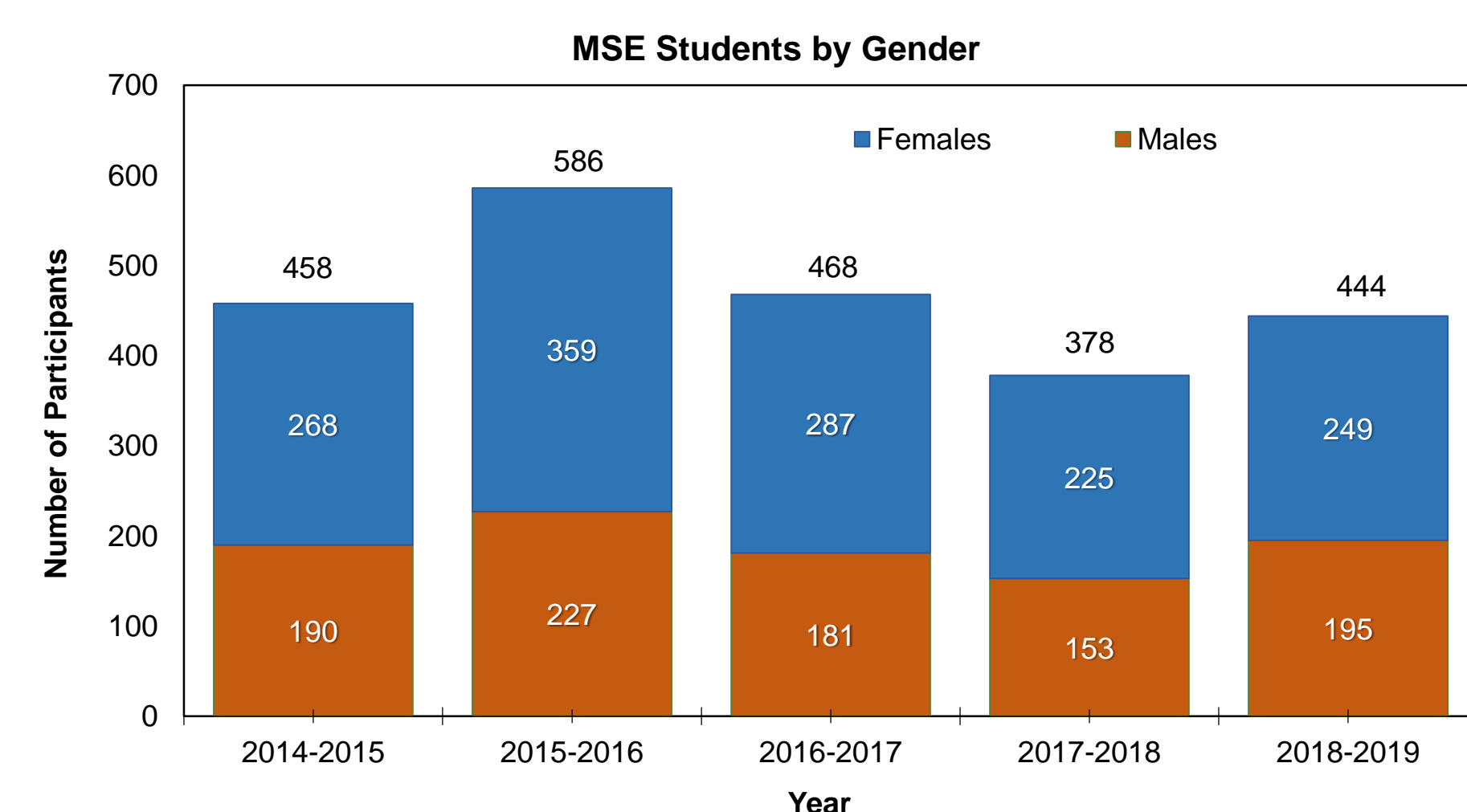
NanoDays at the Mayagüez Mall



MSE Club visits in the public schools



2018 Annual MSE Club Meeting



Dissemination in Local Media



ESTUDIANTE DE LA ESCUELA SUPERIOR EUGENIO MARÍA DE HOSTOS DE MAYAGÜEZ GANA COMPETENCIA DE AFICHES EN EL RUM

Enviado por Adelaida Rivera el 13 Julio 2018 - 5:17pm

Decidida y con mucho entusiasmo, una estudiante de la escuela superior Eugenio María de Hostos de Mayagüez fue la última en ser seleccionada para, aceptar el reto de participar en el Campeonato de Verano CREST 2018.

Con tan solo tres (3) semanas de preparación, Anelys Méndez obtuvo el primer lugar en la competencia de afiches ofrecida por los campeonatos de verano del Centro de Excelencia en Investigación de Ciencias y Tecnología CREST por sus siglas en inglés y Centro de Investigación de Ingeniería para Tecnologías de Fabricación Celular (CIAT) por sus siglas en inglés) ambos de la UPR Rectro de Mayagüez.

Prof. Javier Romero, Lucio Benítez, Daniel López, Arquis Mery, y Prof. Rafael Pomales

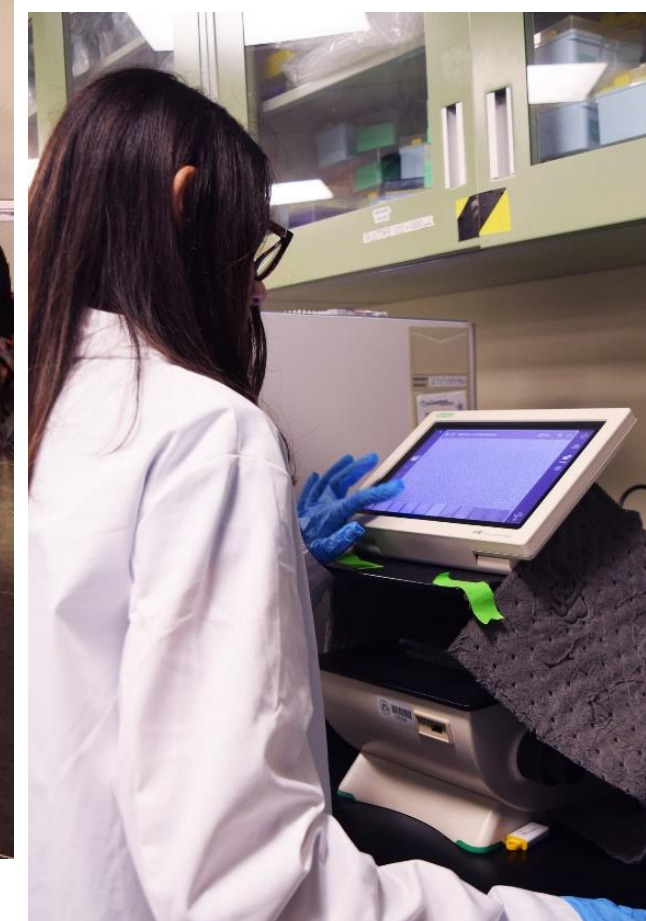
Summer Programs for Teachers and Students



Workshop for public school teachers during Summer Program



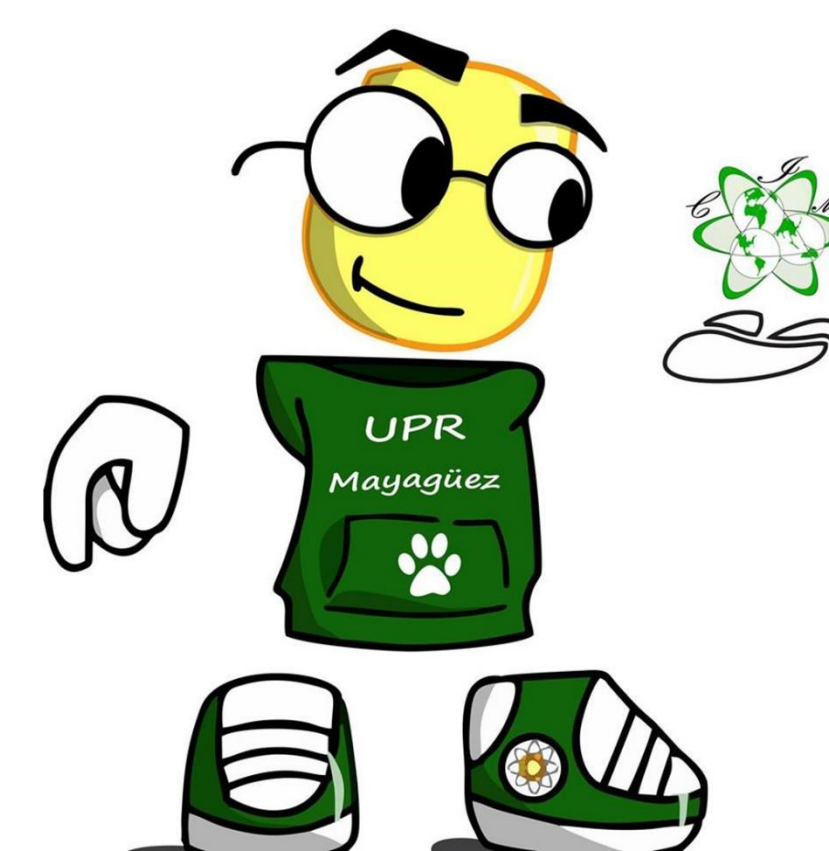
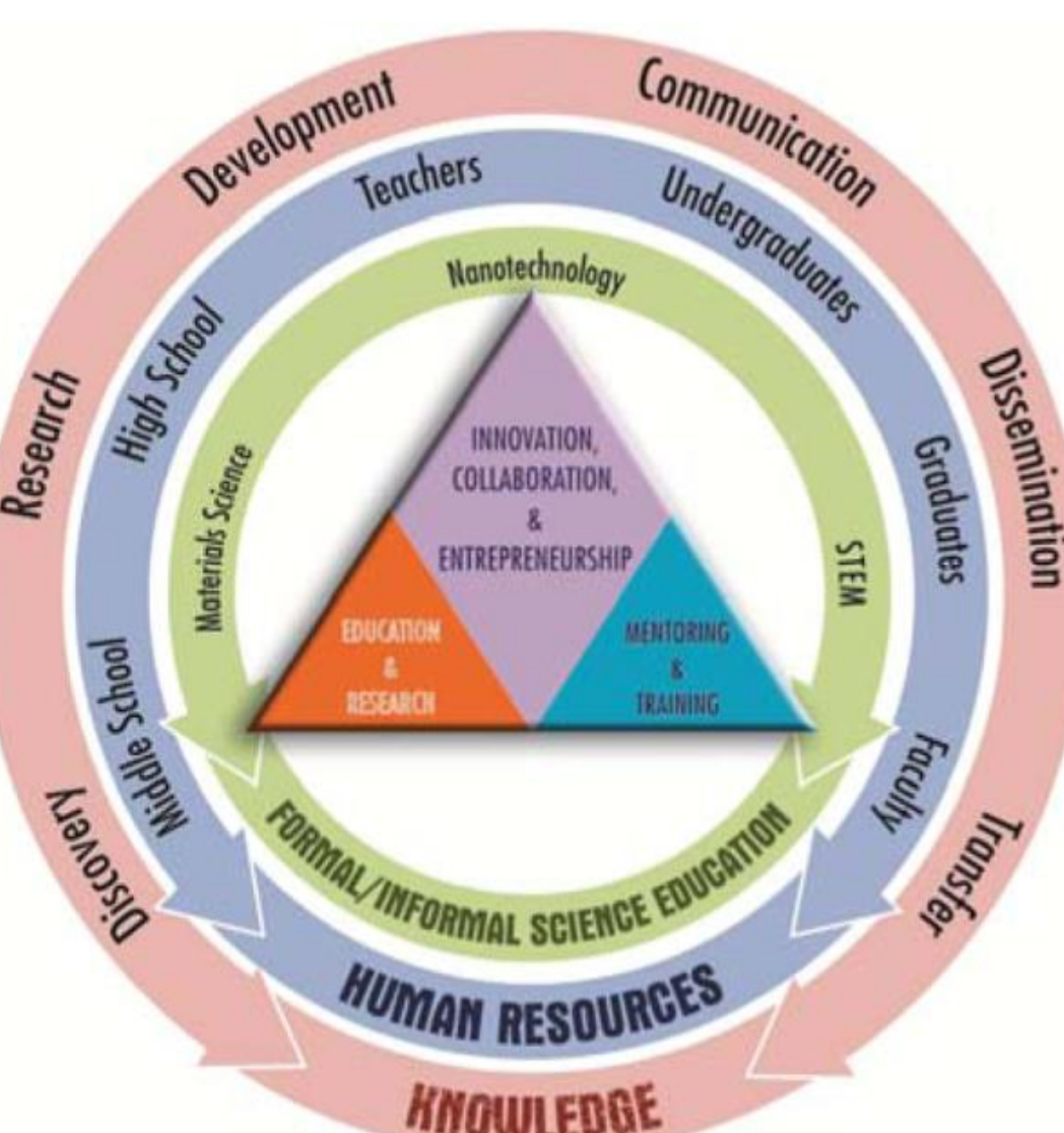
High school students' presentations during Summer Program



High school student's research experience during Summer Program

IEG: Interdisciplinary Education Group

The heart of the Center, this group works towards impacting and developing a more globally-oriented Nanotechnology workforce. Through a multilevel strategy, this team is developing a cadre of Hispanic professionals by expanding their education and training required for a competitive Nanotechnology workforce, beyond traditional Science and Engineering concepts.

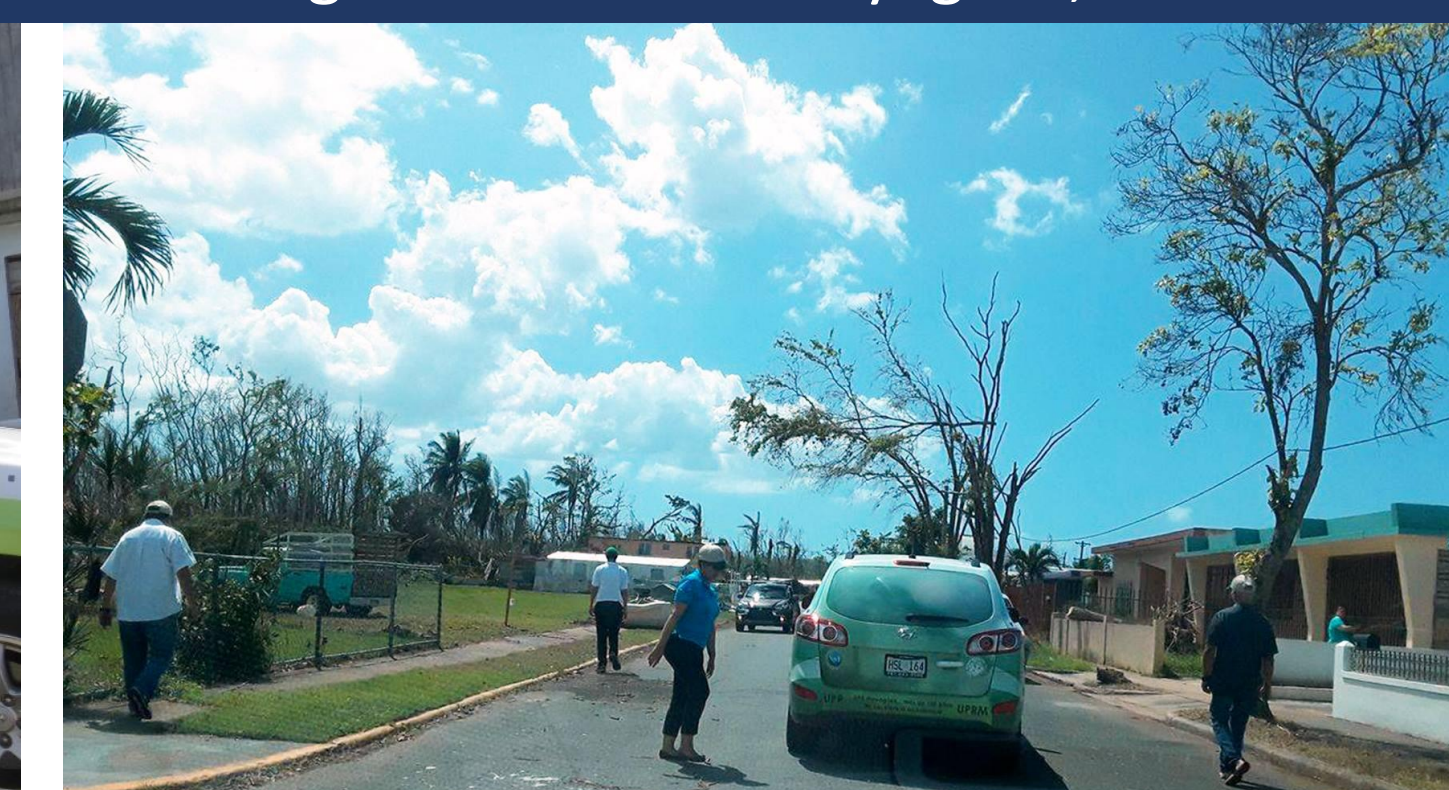
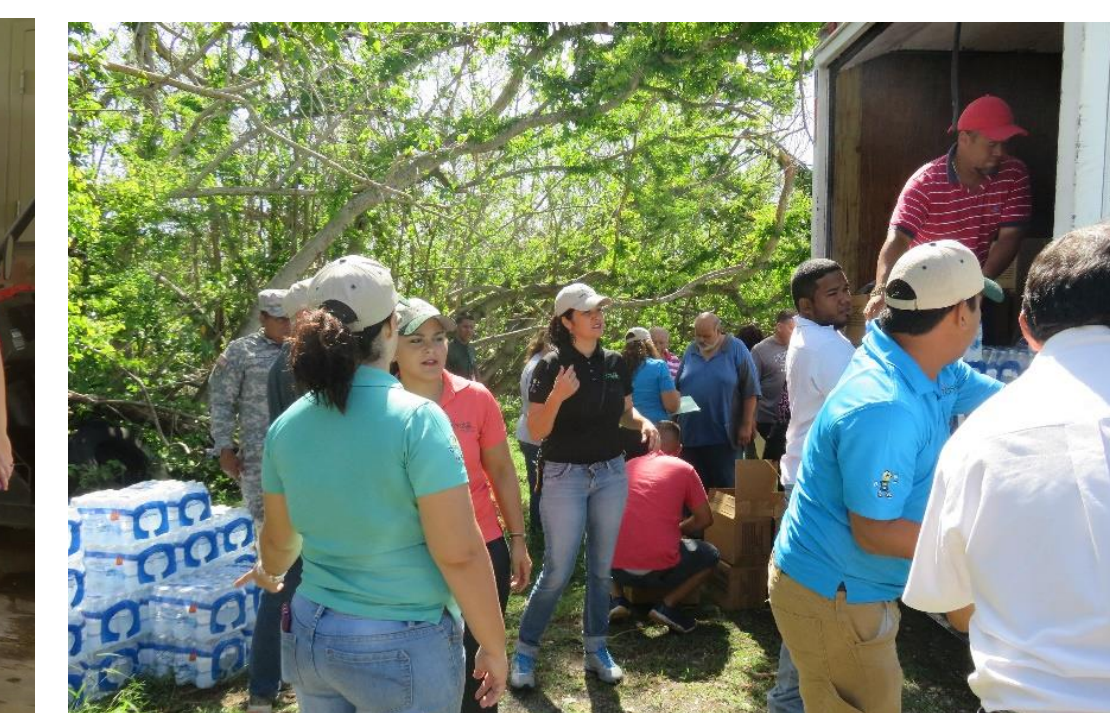


Nanito, the ambassador of Nanoland, is the mascot and symbol of the effective outreach strategy. He was adopted by all MSE Clubs providing an identity to their efforts.

Community Service after Hurricane María

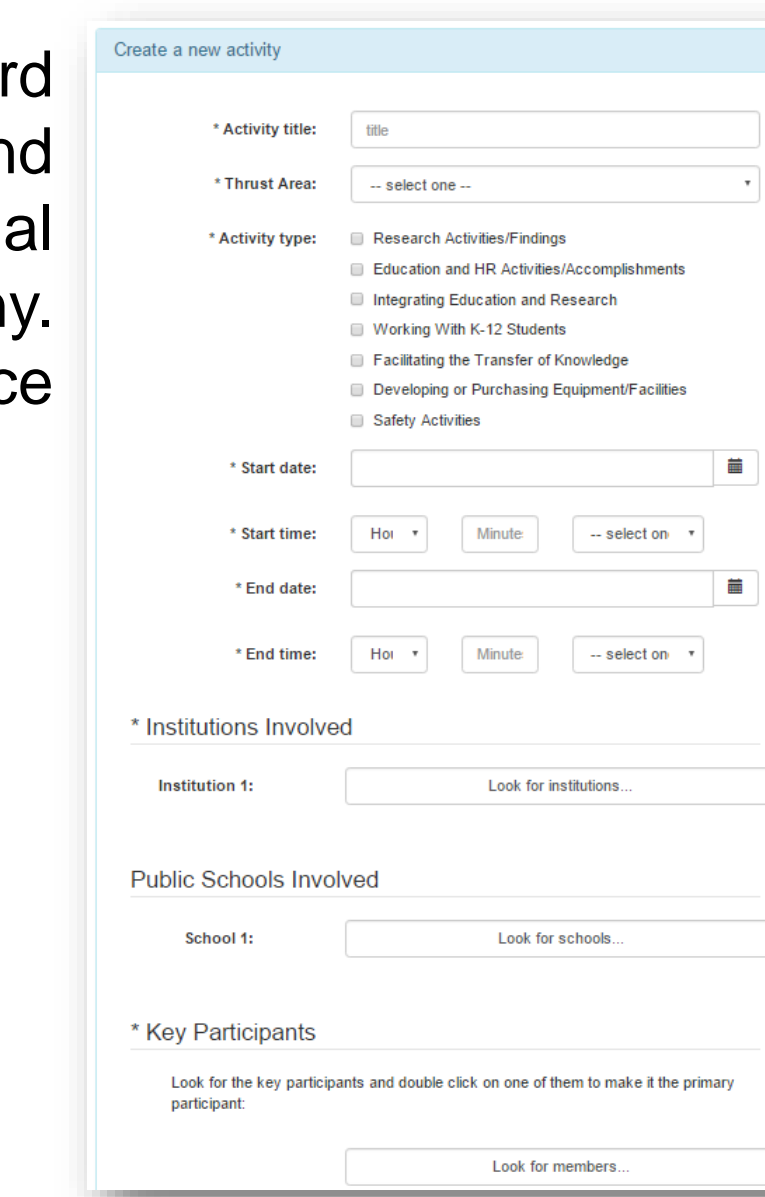
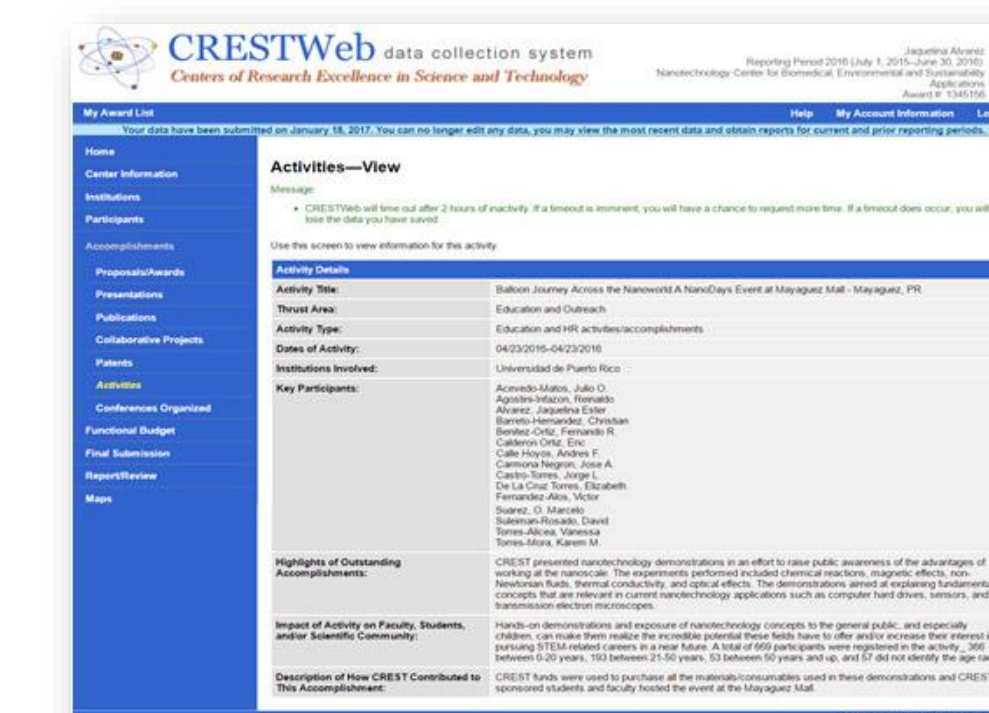
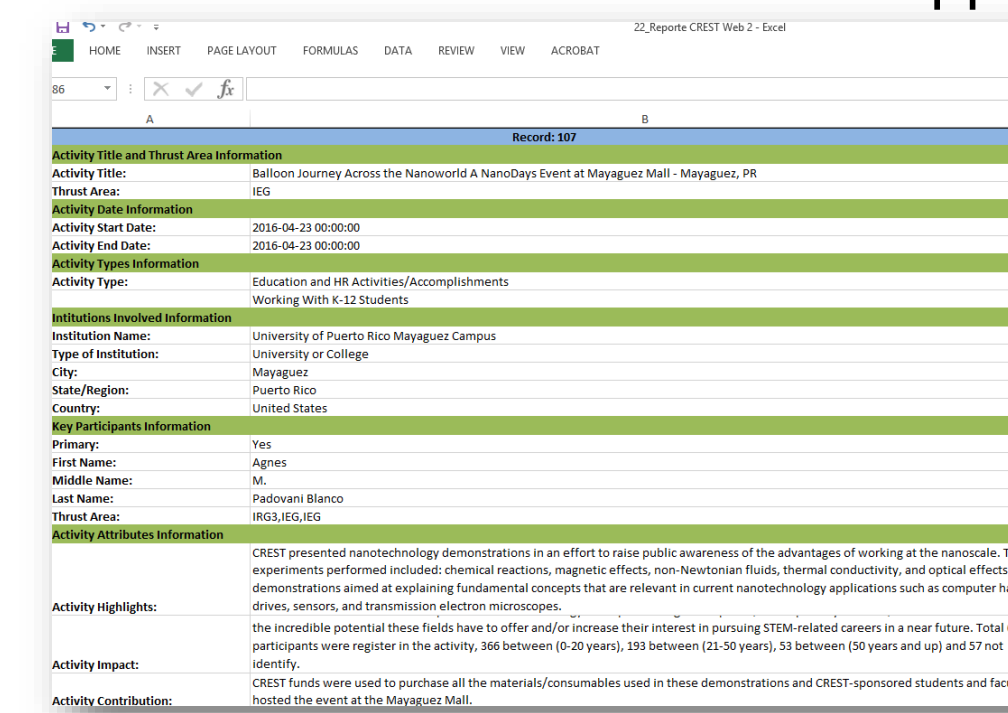


Using the *Nanomobile*, professors, staff, and students joined the relief efforts in support of the most devastated neighborhoods in Mayagüez, PR



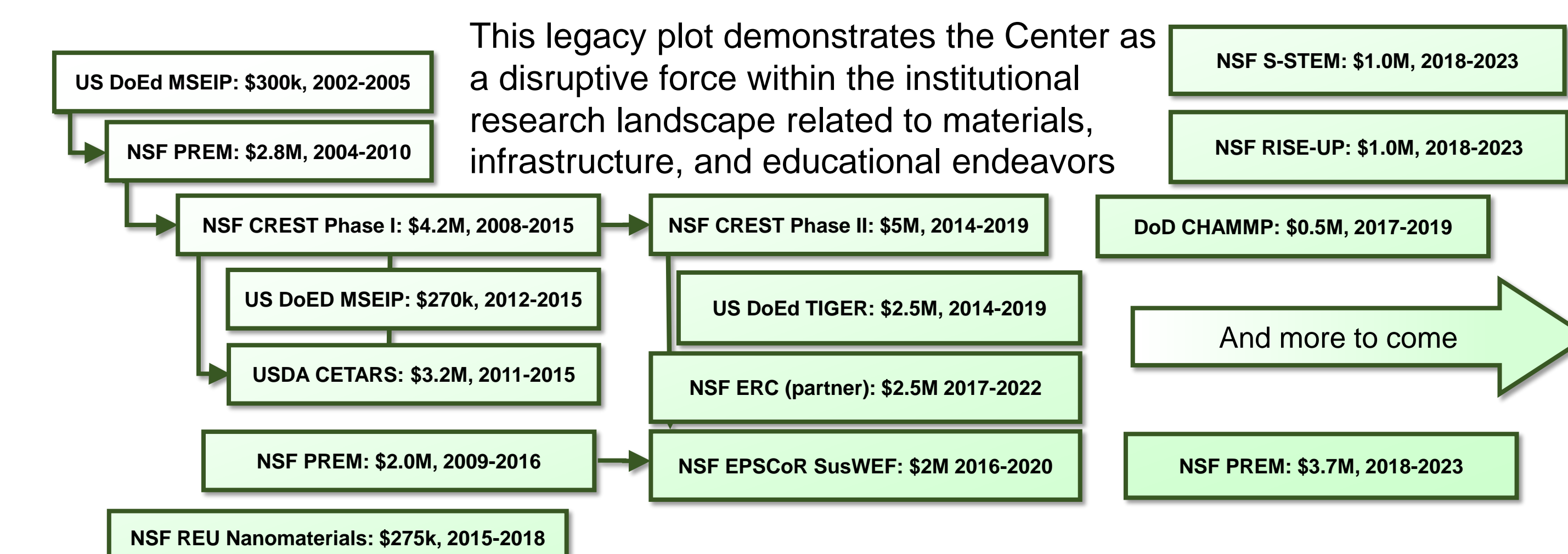
Annual NSF & CRESTWeb Reports

The Center uses a versatile data management system called Sysdat to record participant's involvement, including visits to schools, summer programs, and financial support, such as to facilitate reporting to NSF: both the conventional annual report and CRESTWeb, managed by a third-party evaluation company. The system includes a tablet app for portability, as most activities take place off-site. This is a Web-based application with a PHP database.



What message should you take home?

- The Nanotechnology Center is the largest investment of the National Science Foundation at UPRM with nearly \$10 million in 10 years.
- From extensive leveraging funds to a broader network of collaborators, the Center's legacy will be lasting at all levels of the educational echelon.
- The success is not only reflected by productivity and broader impact, but also on the number of awards granted, not only to students, but also to the Center's faculty.



Prof. Madeline Torres-Lugo
Member of the College of Fellows of the American Institute for Medical and Biological Engineering (2015)

Prof. Arturo J. Hernández
Professional Achievement conferred by Great Minds in STEM (2016)

