A successful Pre-College Nanotechnology experience for low-income students (Evaluation)

Cristina Pomales-García, PhD, Internal Evaluator, Industrial Engineering
O. Marcelo Suarez, PhD, Agnes Padovani, PhD, Materials Science Engineering
Jaquelina Alvarez, Library
University of Puerto Rico-Mayagüez
Nanotechnology Center Goals

(1) advance the state of knowledge in engineered nanomaterials, while achieving national competitiveness

(2) prepare students for successful insertion into the future Nanotechnology workforce

(3) increase the number of minority students entering and receiving engineering degrees related to materials science and nanotechnology
Nanotechnology Center Facts

Since 2014, has impacted with Science, Nanotechnology, and Engineering activities:

- 73% families below poverty levels
- 1,512 Hispanic students
- 64% female students
Program Activities

- Pre-College Program
  - MSE Clubs
    - School Visits
    - Annual Club Meeting
    - Nano Days
  - College Student Volunteers
  - Summer Program
    - Educational Workshops
    - Mentored Research
  - Evaluation and Assessment

- Science Teachers
- HS Students
- MS Students
MSE Clubs at Puerto Rico

Cities with MSE Clubs
Annual MSE Club Meeting
Qualitative Student Feedback

“Learn about nanotechnology, polymers, engineering, and how engineering relates to the environment... Working in groups and sharing with other schools.”

Student 2014
“[Learned to] preserve water (recycle water) and avoid its contamination, as well as reduce waste by choosing products that do not contaminate.”

Student, 2015
College Student Feedback

“... the Center has **transformed** the way I see things. I have become a better **mentor and researcher**. Also, I have learned to **communicate** difficult topics to the general public and other students.”

“One of the greatest opportunities that I’ve ever had to **give back** to our society the knowledge, experiences and help that I’ve acquired for the next generation of professionals. It is, without any doubt, a great **satisfaction**!”

“Outreach activities have helped me **discover many opportunities** available within the engineering branches and further aided me be a **sensible guide and mentor** to others. As a professional, I feel the obligation to help students discover their own goals in the same way my mentors have helped me.”
Web-Based Data Management System

- Institutions
- Key Personnel
- Participants
- Events Calendar
- Impacts
- Accomplishments

SysDat

- Annual Federal Reports
- Program Evaluation
Evaluation Strategies

Documentation and student tracking using the Center’s data management system

- Demographic information
- Parental consent forms
- School record (i.e. school name, GPA, study year)
- Academic interests
- Member code

Activity and Program Evaluation

Student Self-Evaluations/Reflections

College Admissions Data
Evaluation Strategies

Before Activity: Register Event

• Trust area
• Target
  • Research
  • Education
  • Knowledge transfer
  • Working with K-12 students
• Participating institutions or schools
• Key participants
• Date, location and description

After Activity: Document Impact

• Attendance
  • MSE Club Participants
  • Gender
  • Geographical information
• Highlights, participants and contributions
## Activity Evaluation

<table>
<thead>
<tr>
<th>Closed Questions</th>
<th>Objectives</th>
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<tbody>
<tr>
<td></td>
<td>Speaker knowledge, effectiveness and question response</td>
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<tr>
<td></td>
<td>Usefulness of information</td>
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<td>Knowledge gain and application</td>
</tr>
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<td>Organization</td>
</tr>
<tr>
<td></td>
<td>Overall rating</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Open Questions</th>
<th>What would you do differently given what you learned in the activity?</th>
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<tbody>
<tr>
<td></td>
<td>When would you apply the skills learned and the information provided?</td>
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<td>Suggestions to improve the activity in the future.</td>
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Evaluation Results
Summer Research Program Evaluation Results

<table>
<thead>
<tr>
<th>Statement</th>
<th>Rating</th>
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<tbody>
<tr>
<td>The summer program successfully provided opportunities to <strong>learn about nanotechnology and its applications.</strong></td>
<td>100%</td>
</tr>
<tr>
<td>The summer program helped me develop <strong>effective communication skills.</strong></td>
<td>100%</td>
</tr>
<tr>
<td>The summer program helped me develop new <strong>technical skills.</strong></td>
<td>100%</td>
</tr>
<tr>
<td>The program provided a space to share my ideas and <strong>collaborate</strong> with others.</td>
<td>100%</td>
</tr>
<tr>
<td>The workshops and activities <strong>increased my knowledge</strong> in the topics presented.</td>
<td>100%</td>
</tr>
<tr>
<td>I will be able to <strong>apply the skills</strong> learned in the program to my academic or personal life.</td>
<td>100%</td>
</tr>
<tr>
<td>Overall how will you <strong>rate</strong> this summer program?</td>
<td>Excellent</td>
</tr>
</tbody>
</table>
### Summer Research Program Evaluation Results

<table>
<thead>
<tr>
<th>Teachers (n=8)</th>
<th>83% Motivated to integrate nanotechnology and science concepts in their courses</th>
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<tbody>
<tr>
<td></td>
<td>83% Comfortable implementing the modules they developed during the summer</td>
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<tr>
<td></td>
<td>83% Comfortable creating new modules based on the training provided by the program</td>
</tr>
<tr>
<td>Students (n=16)</td>
<td>66% Motivated to participate in future science fairs</td>
</tr>
<tr>
<td></td>
<td>44% Interested in developing a science fair project aligned with the summer program project</td>
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<tr>
<td></td>
<td>77% Confirmed the summer program motivated them to pursue a college degree in STEM fields</td>
</tr>
</tbody>
</table>
Summer Research Program Outcomes

- 75% enrolled @ UPRM (N=16)
- 92% admitted in STEM programs

In a 2yr period:
- 100% active at UPRM
- 91% retention in STEM fields
Summer Research Program Feedback

“I learn how to develop effectively an oral presentation, as well as improve my English” [S]

“I was helped to give presentations more fluidly and I know that in school I’ll be more professional in my presentations” [S]

“I was interested in Engineering... now I am decided; I saw it was fun, interesting and very important” [S]

“Learned to prepare an effective presentation, for research purposes, and an adapted educational module to translate what I learned to my classroom” [T]

“I will modify my classes towards research” [T]

“... first-hand experience and [will guide] my students towards studying engineering” [T]
MSE Club Program: Interest in STEM degrees

- Maintain, 73%
- Increase, 7%
- Reduce, 20%

7% increased their interests in STEM degrees
College Admissions Data (2015-2016)

Admissions
- 42% of all students from schools with MSE clubs

Enrollment
- 107 students
- >60% females

Retention
- 94% MSE
- 90% Regular
Fields chosen by students from MSE clubs

STEM Programs
- Chemistry
- Microbiology
- Biology
- Geology
- Nursing
- Surveying
- Agricultural Sci.
- Computer Sci.
- Engineering
- Mathematics

<table>
<thead>
<tr>
<th>Field</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
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</thead>
<tbody>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td>33%</td>
</tr>
<tr>
<td>Health</td>
<td>2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering</td>
<td></td>
<td></td>
<td>30%</td>
</tr>
<tr>
<td>Business</td>
<td></td>
<td></td>
<td>8%</td>
</tr>
<tr>
<td>Science</td>
<td></td>
<td></td>
<td>10%</td>
</tr>
<tr>
<td>Technology</td>
<td></td>
<td></td>
<td>10%</td>
</tr>
<tr>
<td>Agriculture</td>
<td></td>
<td></td>
<td>8%</td>
</tr>
<tr>
<td>Math</td>
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Conclusions

• Pre-college program as an effective strategy to engage community members with limited access to educational resources

• Our pre-college intervention in public schools, serving underprivileged Hispanic communities, uses limited campus resources
  • faculty members, undergraduate and graduate student volunteers

• Successful intervention recruiting and retaining high school students from MSE Clubs and summer program
Future Work

• Number of students who completed their college degrees by 2021.
• Survey students to understand if club participation is related to student’s career choice
Contact Information

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UPRM Nanotechnology Center
http://crest2.uprm.edu
Contact: cristina.pomales@upr.edu