Development of a photonics outreach, recruiting, and retention program through partnerships at Universidad Metropolitana

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School of Environmental Affairs
Universidad Metropolitana

San Juan, PR
Barceloneta, PR
Outline

- Who we are
- Where are we?
- Key data / evidence points
- Best practices in recruiting / retention
- Best practices in evaluation
- Acknowledgements
Who we are
13,780 students, 5 campuses in Puerto Rico (PR)

- Part of Ana G. Méndez University System: 45,200+ students, biggest private non-profit University System in PR with 5 campuses in US

- 95% Hispanic
  - 90% - Puerto Rico.
  - 10% - Dominican Republic, Colombia, and other Latin American countries.

- 90% - 95% of undergraduate students: student aid and/or student loans
The only photonics education, R&D, and outreach program in Puerto Rico and the Caribbean

Founded in 2011, development of academic program started in 2014.

Foundational support from the PR Development Industrial Development Company (PRIDCO) and the PR Science, Technology, and Research Trust

Education and training program supported by a TAACCCT grant from the US Department of Labor, called New Horizons – Puerto Rico Lasers and Photonics Career Pathways
1-year certificate in Photonics & Lasers Technical Specialist
   - 10 courses, 40-credits over 4 trimesters
   - Started in March 2016
   - 10 Students (first cohort will graduate in May)
   - Integrated Industry Internships

Associate Degree in Engineering Technology in Photonics and Lasers
   - Starting Fall 2017

Continuing Education courses

Future: Masters in Aerospace Photonics
My role

- **Academic**
  - Academic Coordinator
  - Proposal preparation and approval for Certificate and AAS degree
  - Instructor
- **Administrative**
- **Marketing & Recruiting Coordinator**
  - University resources
  - External resources / partnerships: OP-TEC
  - OP-TEC Student Recruitment working group
    - Spanish versions
    - Outreach and recruiting at IHCC (IA) and CSTCC (OH)
- **Outreach**
- **Research**

**Partnerships are Key!!!**
Where are we?

ESTABLISHING A BASELINE
Recent studies by the National Center for Optics and Photonics Education (OP-TEC) show the need for trained photonics technicians.

Photonics is vital to emerging technologies.

Puerto Rico’s economy has a large component of high technology, whether in medical devices, aerospace technologies, or pharmaceuticals.

To grow its economy, Puerto Rico needs to create new opportunities through innovation and entrepreneurship.
The economic situation in Puerto Rico has driven many to leave for the US mainland, where work and education opportunities are better.

The remaining population is poorer both economically and in education.

Attractive educational opportunities in cutting edge technologies are of interest for careers and workforce development.

Entrepreneurs and innovators are badly needed to anchor the economy.
Puerto Rico’s Strengths and Opportunities

- US Territory: federal laws and regulations are applicable
- Puerto Ricans are US citizens by birth
- PR as a bridge between the US and Latin America
  - Expansion of our university system to the continental US and future plans for Dominican Republic, Panama, and agreement with Colombia
  - US Accreditation of PR institutions by Middle States Association with studies at a fraction of the cost
  - Bilingual education
- 80% to 85% of PR high-school graduates continue on to post-secondary education
PRPI Students currently are comprised of 1/3 displaced workers and then a combination of veterans, people looking to new careers and skills, and recent high-school grads.

- 20% Female
- 100% Latino
Operational & Strategic Goals

- Increase the number of students in our program
  - Associate Degree in Engineering Technology in Photonics & Lasers
  - Actively work on Retention
  - Focus on educational excellence
  - Outreach program: create awareness about the importance of O&P and opportunities in the field
  - Have our students become ambassadors of our programs

- Grow as an institute
  - Increase our academic offering and full-time faculty
  - Research programs: basic and applied
  - Lessen our dependence on “soft money”
Key data / evidence points
Hispanics are the largest minority racial/ethnic group in the US (55 million, 17%, in 2014, with an estimate 119 million, 28%, by 2060).

Median age of 28 compared to 43 for non-Hispanic Whites (2013)

Majority of Mexican descent (2012):
- 64% Mexican descent
- 9% Puerto Rican
- 8% Central American
- 6% South American
- 3% Cuban
- 9% Other

Lower educational attainment than other groups

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- Latinos were more likely to enroll in community colleges than all other groups (2012).
- Latino college enrollment is projected to increase more than other groups.
- Latinos significantly increased associate degrees in the last 10 years compared to other groups.

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Some Statistics

Science and engineering bachelor's degrees earned by Hispanic women, by field: 1995–2014

Figure 3. Percent of Photonics Technicians by Gender and Ethnicity


NOTES: Data not available for 1999. Hispanic may be any race.
Women, Minorities, and Persons with Disabilities in Science and Engineering: 2017
Scientists and engineers working in science and engineering occupations: 2015

Compare to US population ages 18-64:
- 8.7% Hispanic men
- 8.3% Hispanic women
- 6.1% Black men
- 6.6% Black women

NOTES: Hispanic may be any race. Other includes American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, and multiple race.

Women, Minorities, and Persons with Disabilities in Science and Engineering: 2017

Prospective students may face one or more of the following situations:

- Economic disadvantage / working while studying
- Political and social uncertainty
- Language barrier
- Immigration status
- Prejudice / Stereotype / Bias / Systematic discrimination (implicit and explicit) / Distribution of roles
  - Not having raw/innate talent
  - “Let’s not look at race and gender, let’s just only look at merit”
    - Damaging perspective: there is a trade-off between diversity and excellence
- Lack of appropriate role models

Situations affecting prospective Latino/Hispanic students
How do the previous situations affect the student?
- Students not as prepared as other populations on campus
- Cultural disconnect
- Low self-esteem
- Increased high-school or college drop-out rate

**Note:** It is important to not stigmatize or show condescending attitudes
Information is key in approaching Latino/Hispanic students
prepare/provide an information package (or a flyer with links) on:

- ESL programs
- Economic student aid
- Tutoring and mentoring resources on/off campus
- Immigration information:
  - What are my rights / opportunities / limitations with my immigration status
  - Sanctuary cities
  - Deferred Action for Childhood Arrivals (DACA) eligibility
- Invite parents/family of prospective students to be involved in the process
How to address these situations?

Tips:

- Prepare to provide this information verbally and/or as written material
- Ideally: have bilingual information sessions / promotional material
- Don’t do everything yourself - find partners:
  - Within your own institution: marketing and recruiting office, other programs, your Dean, your own students, international student office
  - Other colleges & universities
  - Hispanic partners and allies: Hispanic Chambers of Commerce, radio and TV stations, consulates


Best practices in recruiting & retention

• Educational Outreach Program
• Recruiting Program
• Retention Program
• Partnership Opportunities
Educational Outreach Program

- Activities for K-12 students
- Workshops for K-12 in-service teachers
- Outreach activities for the general public
- Video development
- Research projects with an outreach & educational component
- Publicity in social and written media, radio, and TV
- Special populations: Veterans and TAA participants
Activities for High-School students and Workshops for High-School teachers

Grants for Outreach and Recruiting
- OP-TEC
- DOL TAACCCT grant
- Puerto Rico Science, Technology and Research Trust
- PR Development Industrial Development Company (PRIDCO)
- Industry and other Associations: SPIE, Edmund Optics

Marketing in social (Facebook, Twitter, webpage) and written media, radio, and TV
Significance of our outreach program

- Economic upheaval affecting the local workforce
- We can provide training/education/work experience
- Recruiting campaign reaching out to:
  - High-School students
  - Displaced workers/ TAA-eligible
  - Veterans
  - Workers of industries where O&P is an enabling technology
Educational Outreach Program

Based on:
- 22 demos
  - Developed in-house
  - LightBlox
  - OSA Optics Kit
- 20 min to 3 hr presentations
- Galileoscope workshop
Educational Outreach Program

- Activities for K-12 students
  - Lab tours and Open House
  - Summer Camps
  - School visits
  - Other
    - Manufacturing Week (390)
    - Career day at PRMoA (370)

Impact:
- 2,600 K-12 students
- 36 schools
- 30 min presentations to 3-hour workshops

2015-9-3 Homeschooling
2015-6 UPRRP Summer Camp
2014 and 2015 Earth Day (600 students)
2015-3-2 Colegio San Vicente de Paul
Educational Outreach Program

- Workshops for K-12 in-service teachers:
  - MSP program
  - two 2-day workshops
  - impacting 700+ teachers

2014-3 MSP UMET

PRPI Teachers Workshop at the Puerto Rico Math-Science Partnerships Congress, 22 November 2014, in Fajardo, PR.

2015-3 Sheraton San Juan
Educational Outreach Program

- Outreach activities for the general public
  - Caribbean Space Summit
  - Yuri’s Night (During the Day) @ Arecibo Observatory
  - Exhibition at Plaza de las Américas Shopping Mall
  - Space Week @ Arecibo Observatory
  - International Educational Congress
  - Job Fairs

2015-4 Yuri's Night During the Day

2015-7 Plaza de las Américas

2015-10 Space Week at AO
Educational Outreach Program

- Video development

Videos produced:
- Student-produced
- Recruitment 30 second promo
Educational Outreach Program

- Research projects with an outreach & educational component
- Wave propagation software
- Laser pattern generator: Lissajous figures

prpi.suagm.edu
Educational Outreach Program

- Publicity in social and written media, radio, and TV
- Interview for “El Nuevo Día”
- Radio interviews
- TV interview
Educational Outreach Program

- Special populations: Veterans and TAA participants
  - Veterans
  - TAA population

2015-3-13 Buchanan - US Army Transition Service and Veterans
Educational Outreach Program

- Partnerships
  - Exhibition “Light: Beyond the Bulb”
  - Conference “Stars for All” at the University of Puerto Rico
  - Podcast “Light Pollution in Puerto Rico”
  - Photo Exhibition “Light in Nature”
  - Conference on the “Impact of Light Pollution in our Ecosystems”
  - Forum on “Prevention and Control of Light Pollution in Puerto Rico”
International Year of Light week in PR

- Workshop and symposium
- PRPI lab inauguration, open house, and launch of 1-yr certificate
- Concert of Light by the PR Symphony Orchestra
Do you know how to create the figure of a ghost floating in space?

This is how they do it at Disney’s Haunted Mansion!!

- Search YouTube for any “4 Faces Hologram Videos”. Make sure your smartphone screen is set at its brightest.
- Place the pyramid upside-down in the middle of the screen. You can use one of the mounting squares to stick it down so that it doesn’t move.
- Crouch down so that the pyramid is at eye-level and play the video!
Retention Program

Dedicated Career Coach (activities coordinator)

- Recruitment and prospective-student follow-up
- Coordinates interviews, registration, appointments with Financial Aid office, Vocational Rehabilitation, etc.
- Once a student is registered: the career coach is the go-to person for any student need (certifications, parking, tutoring, absences, etc.)
- Organizes group-building events, résumé workshops, mock interview practice, visits to industries, etc.
- Assembles all the student résumés to send to industry for internships and job applications.
- If a student thinks about dropping out, works with the student to change his/her mind; documents the reason if the student does drop out.
- Works in coordination/collaboration with other university offices: registrar’s, student counseling, learning zone (tutoring services), financial aid, marketing and admissions, etc.

Tips

- This position should not be contingent on an enrollment “quota”
- Its existence should be justified by retention statistics alone.

CALENDARIO DE ACTIVIDADES 2017

- **Febrero**
  - 7: Study Group
  - 14: San Valentine’s Day
  - 24: Career Day: “Career Opportunities in AU”

- **Marzo**
  - 3: Taller Desarrollo Profesional: Caringo Mutuo
  - 14: Study Group
  - 20: Inside Priscojo Térmico
Collaborations and Partnerships

- Foundational support and grants
- Local and national professional societies
- State-level organizations and non-profits
- Educational institutions
- Industry Affiliates Program
- Partnerships for the academic component
- Recruitment
Partnerships Developed

- Foundational support and grants
- Local and national professional societies
- State-level organizations and non-profits
- Educational institutions
- Private Companies
- Partnerships for the academic component
- Recruitment

Puerto Rico Industry Development Company

PUERTO RICO Science, Technology & Research Trust

SPIE. 2014 Education Outreach Grant

OP-TEC National Center for Optics and Photonics Education

2014 and 2015 Student Recruitment Grants
Partnerships Developed

- Foundational support and grants
- Local and national professional societies
- State-level organizations and non-profits
- Educational institutions
- Private Companies
- Partnerships for the academic component
- Recruitment

Optics demo kit donation

IYL posters

3 hr workshop for college students and 1.5 hr workshops for vocational high-schools
Partnerships Developed

- Foundational support and grants
- Local and national professional societies
- **State-level organizations and non-profits**
  - Educational institutions
  - Private Companies
  - Partnerships for the academic component
  - Recruitment

- Puerto Rico Department of Education: MSP Program
- Puerto Rico Office of Youth Affairs – Juveempleo
- Musical Arts Corporation (parent co. of the PR Symphony Orchestra)
- KV265 non-profit: communication of science through art (Dr. Jose Francisco Delgado)
- Northern Technological Initiative (Intenor)
- Museums: Caribbean Center for Science and Technology (C3Tec), PR Museum of Art, PR Wildlife Museum
- SRI and the Arecibo Observatory
- You can also try: Greater Dallas Hispanic Chamber of Commerce, Tri-County Regional HCC (Frisco)
Partnerships Developed

- Foundational support and grants
- Local and national professional societies
- State-level organizations and non-profits
- **Educational institutions**
- Private Companies
- Partnerships for the academic component
- Recruitment
Partnerships Developed

- Foundational support and grants
- Local and national professional societies
- State-level organizations and non-profits
- Educational institutions
- **Private Companies**
- Partnerships for the academic component
- Recruitment
Partnerships Developed

- Foundational support and grants
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- Recruitment
Partnerships Developed

- Foundational support and grants
- Local and national professional societies
- State-level organizations and non-profits
- Educational institutions
- Private Companies
- Partnerships for the academic component
- Recruitment
Part of OP-TEC / Optic & Photonics College Network (30+ members)
- Meetings before the Hi-Tec Conference
- Visits to IHCC (IA), CSTCC (OH) for Hispanic workshops/recruitment

Responsibilities:
- Prepare materials / provide narratives
- Track material usage
- Share experiences and best practices
- All information and forms shared among members (Dropbox)
- Any member can take any of the material, adapt it, and just use it!
- Teleconferences (every 2-3 months) are recorded and saved

Examples
Student Recruitment Working Group

- Career Videos Handouts
- Infographics
- Math for O&P: Teacher handout
- Military Veteran Brochures
- Booklets and College Flyers
- Recruiting Material and Content Idea Form
- Success Story Handout

What is Photonics?
Photronics, or photonic technology, is the technology of generating and detecting light and other forms of radiation using quantum principles to control the generation, detection, and manipulation of light. Photronics requires a broad range of skills to design, build, and test photonic devices and systems. The knowledge and skills developed in a photonics-oriented education can lead to a variety of career paths and opportunities in a wide range of industries. These career paths can include becoming an engineer, scientist, technician, or manager in the field of photonics.

Photonics Career Links
- www.op-tec.org/careervideos
- www.op-tec.org/video

Photonics Career Ideas
- Laser Beer Glasses
- Laser Hair Removal
- Laser Tattoo Removal
- Laser Hair Removal
- Laser Tattoo Removal
- Laser Eyelash Extensions
- Laser Hair Removal

What is O&M?
O&M stands for Orientation and Mobility, a field that focuses on teaching individuals with visual impairments how to navigate their environments safely and independently.

O&M Career Ideas
- Orientation & Mobility Specialist
- Orientation & Mobility Instructor
- Orientation & Mobility Assistant
- Orientation & Mobility Intern
- Orientation & Mobility Trainee
- Orientation & Mobility Coordinator
- Orientation & Mobility Consultant

Certificado en Fotónica y Láseres
El Instituto de Fotónica y Láseres (IFL) ofrece un certificado en Fotónica y Láseres con el objetivo de brindar a los estudiantes una formación avanzada en el campo de la Fotónica y Láseres. El programa tiene una duración de 1 año y está diseñado para aquellos interesados en el desarrollo de tecnologías avanzadas en el ámbito de la Fotónica y Láseres.

Industrias con Carreras en Fotónica
- Aerospacial: Drones, Imágenes y Navegación
- Agricultura: Teledetección de Cultivos por Satélite
- Médicos: Láseres de Rayos X y Equipos de Transmisión
- Construcción: Equipos de Láseres de Agricultura
- Neurociencia: Láseres en el Cerebro
- Energía Renovable: Coches Fotovoltaicos
- Medicina: Imágenes en Láseres
- Investigación: Láseres de Investigación
- Industria: Láseres de Industria

Salario Inicial
- $35,000 a $40,000**

* Salario inicial en PR, Fuente: Departamento del Trabajo de PR.
** Salario inicial en EE.UU, Fuente: OP-TEC
Student Recruitment Working Group

- Career Videos Handouts
- Infographics
- Math for O&P: Teacher handout
- Military Veteran Brochures
- Booklets and College Flyers
- Recruiting Material and Content Idea Form
- Success Story Handout
**Student Recruitment Working Group**

- Career Videos Handouts
- Infographics
- **Math for O&P: Teacher Handout**
- Military Veteran Brochures
- Booklets and College Flyers
- Recruiting Material and Content Idea Form
- Success Story Handout
Student Recruitment Working Group

- Career Videos Handouts
- Infographics
- Math for O&P: Teacher handout
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- Booklets and College Flyers
- Recruiting Material and Content Idea Form
- Success Story Handout
Marketing Materials and Content Idea
Please attach mock-up of item, if possible.

1. Name of item:

2. Type (video, document or other):

3. How will it be used by recruiters?

4. What is the purpose of the video or document?

5. What content should be included?

6. What source would be used (examples: OP-TEC 2012 Survey, “Mathematics for Photonics Education” textbook)?
Meet a Laser Technician

Karen Diaz considers herself lucky; she gets to experience firsthand the incredible way that electronics, mathematics, and physics work in harmony. As a student at Central Carolina Community College (CCCC), Karen initially completed an associate of applied science program in electronics and computer engineering technology. Upon earning her degree, Karen decided that an additional degree in laser photonics would offer an even broader spectrum of opportunities, so she continued at CCCC, ultimately earning an associate degree in lasers and photonics technology. Once she enrolled in the program, she found herself fascinated by what she was learning. “I took the chance to try something new,” she says, “and found that I loved it.” Karen was also eager to take advantage of the many opportunities available to women in technology.

“As a female,” she explains, “there are so many opportunities for me in the engineering field. At the time I graduated, photonics seemed to be an up-and-coming field with lots of options.”

Karen was enrolled at CCCC, she also focused on gaining valuable work experience. At first, she worked as an information and communication intern for Progress Energy, where she did everything from building a relay-testing panel to designing electrical schematics. Later, she worked as a contractor for both Power Equipment Maintenance and The Atlantic Group. As a contractor, she calibrated plant equipment and performed maintenance activities. The variety of experience she gained confirmed her suspicions that photonics was the right subject matter for her. “This field is so broad,” she explains, “that I have found myself in situations where I have to apply the knowledge that I learned in electronics and computer engineering.”

By the time she graduated in May 2013, she was ready to advance her career and continue her education.

Currently, Karen is pursuing a bachelor’s degree at Duke University, where she works as an intern in the photonics and spectroscopy lab. Karen’s internship has given her additional experience in Python and MATLAB programming, optics handling, and components testing. At Duke, Karen is able to apply everything she has learned in her education so far, including electronics engineering, computer engineering, and laser and photonics technology. One of the things she most appreciates about her photonics career is the opportunity to face something new and interesting every day. For example, she is currently working on the revolutionary MOSAIC giga-pixel camera. “I am proud to be involved in such a revolutionary project,” Karen explains. This camera “can potentially change the way we take photographs, as well as the media industry.”

Karen believes that students considering a career in photonics will be amazed by the many opportunities that the field offers. She acknowledges that many students are intimidated by the amount of physics and mathematics involved in the photonics. Initially, she, too, was worried about her physics courses, but she stuck with them and now says that physics is “really not that hard.” She urges those interested in a technical field to stick with their studies so that they can see all that photonics has to offer.

Karen has been offered the opportunity to work in Research Triangle Park, but she has decided to focus instead on earning her bachelor’s degree. She believes that a bachelor’s degree will give her career an extra boost and allow her to advance more easily.

Karen lives in Durham, North Carolina. She happily dedicates most of her time to her education and her work, but in her spare time, she enjoys reading and watching movies with her family.
Best practices in evaluation
Document everything that has any bearing on your outcomes: every visit, event, and collaboration for each area:

- Outreach
- Recruiting
- Retention
- Evaluation

Show the information through maps, statistics, graphs, etc. Take pictures, lots of them!!
Documenting every activity: a simple shared excel file may suffice.

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**School Visits to PRPI Labs at Barceloneta**
Document, document, and then document some more.

Documenting every activity: Summary at a glance

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<th>SUMMARY TABLE</th>
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<th>K-12 Students</th>
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<td>4 Workshops and Cont Ed (includes teachers, engineers, others)</td>
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<tr>
<td>6 Outreach Events</td>
<td>6,365</td>
<td>3,247</td>
<td>116</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>10,937</strong></td>
<td></td>
<td><strong>116</strong></td>
</tr>
</tbody>
</table>
Results, Rewards, and Challenges

Impact: 9,500 direct 3,000+ K-12 students 700+ teachers
Join Mentor-Connect and the EvaluATE team to learn how to effectively evaluate your small project!

You're invited

Small-Scale Evaluation

Wednesday, February 15, 2017
1:00 - 2:00 p.m. EST

No-cost Webinar

Benchmark success with small-scale evaluation

http://www.mentor-connect.org/events.aspx
Acknowledgements
Information on PRPI

Andres Diaz: adiazg@suagm.edu

- http://umet.suagm.edu/prpi
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- Instagram: PRPhotonics
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Questions?