



SMART LIGHTING ENGINEERING RESEARCH CENTER

Lighting Innovation for a Smarter Tomorrow



Educating the Next Generation in Smart Lighting

Kenneth A. Connor
Education Director



Rensselaer

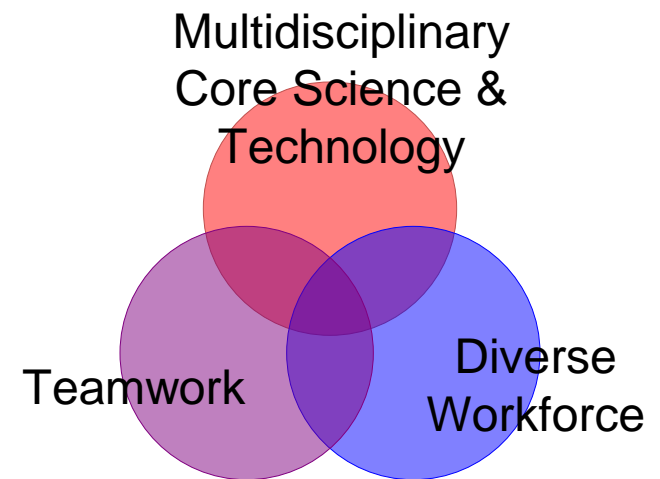


ROSE-HULMAN
INSTITUTE OF TECHNOLOGY



- Introduction and Overview
- University Programs
- Pre-College Programs
- Mobile Studio Platform

- Core science and technology, integrated through engineering systems principles, linked through applications
- Teamwork emphasizing multidisciplinary and multi-institutional programs and projects, engagement with industry, research labs, universities, K-12 schools and museums
- An ever more diverse student body and workforce



Our Graduates Will:

- be grounded in the fundamentals of Smart Lighting, have strong analytical skills, and engage in lifelong learning
- contribute to the core research of the Center
- collaborate effectively in technically and culturally diverse circumstances involving communication skills, project management, leadership and mentoring, ethics, professionalism and community service
- be able to follow the path of successful entrepreneurs using technical ideas from their research demonstrating practical ingenuity, creativity, dynamism, agility, resilience, and flexibility



Faculty and students to engage in both research and teaching

Many Available Resources:

- Education/Outreach Platform
 - Mobile Studio
 - Learning Modules
 - Inexpensive, Portable Materials
- Rich Collection of Optics/Photonics Materials from a Variety of Sources

- **Science You Can See**

- **Learn by Teaching**

- **Beyond Research**

Systems Engineering

Fundamental to ERC

Essential to our health happiness and safety

- **Science You Can See (SYCS)**

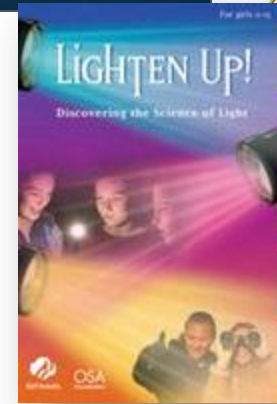
- Light provides a fully engaging visual experience with strong social impact

- **Learn by Teaching**

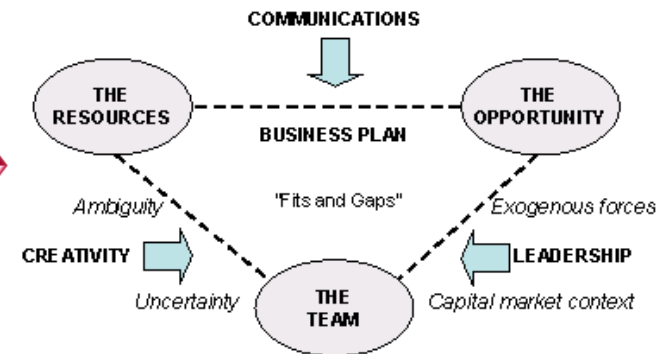
- Teaching educates Educators

- **Beyond Research**

- Innovation/entrepreneurship
- Effective communications, IP working and living cultures, mentoring, life balance, effective teaching and educational assessment



Timmons Model of the Entrepreneurial Process



- **Inadequate Pipeline**
 - Perception of technical career opportunities
 - Homogeneous workforce
- **STEM Students Lack Characteristics of 2020 Engineer**
 - Dearth of entrepreneurial background
 - Proclivity to work in narrowly focused environment
 - Inability to balance many activities
- **Not Simple to Impact K-12 and Other Communities**
 - Mismatch between university and K-12 personnel
 - Lack of K-12 engineering resources (teachers, facilities ...)
 - Little effectiveness assessment data

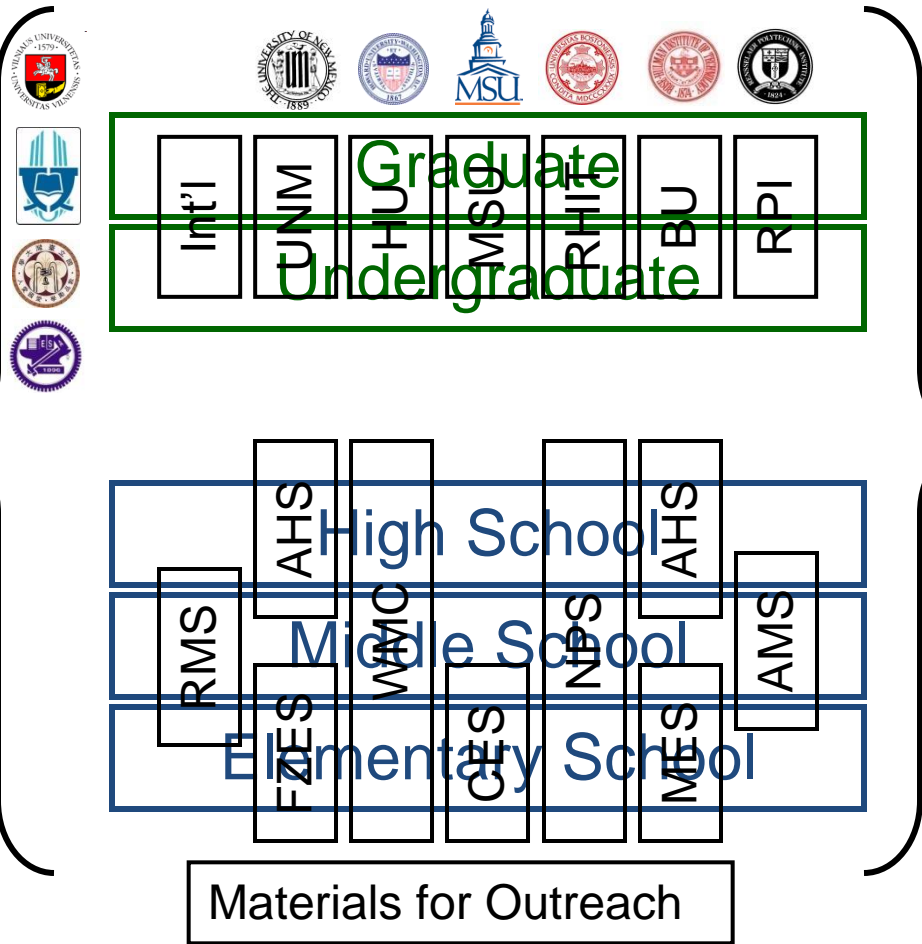
Engineering Profession & Continuing Ed.

All K-12 Partners Will Help Develop and Implement Courses & Modules That Meet Their Needs

All Academic Partners Will Help Develop and Implement Courses & Modules That Meet Their Needs

Industry
Prof. Soc.
NGO's

Museums



Key Ideas from Thrusts & Testbeds



Example: LED Driver Electronics



Undergrad Lab & Design



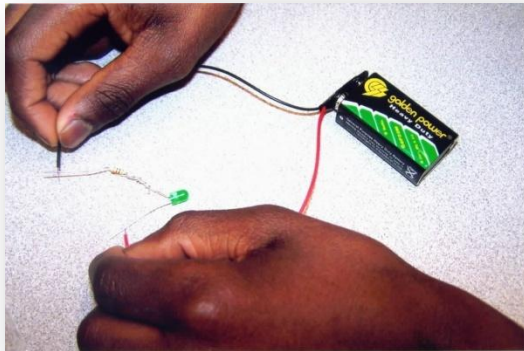
High School Engineering



Grade 4 & 5 Science & Math

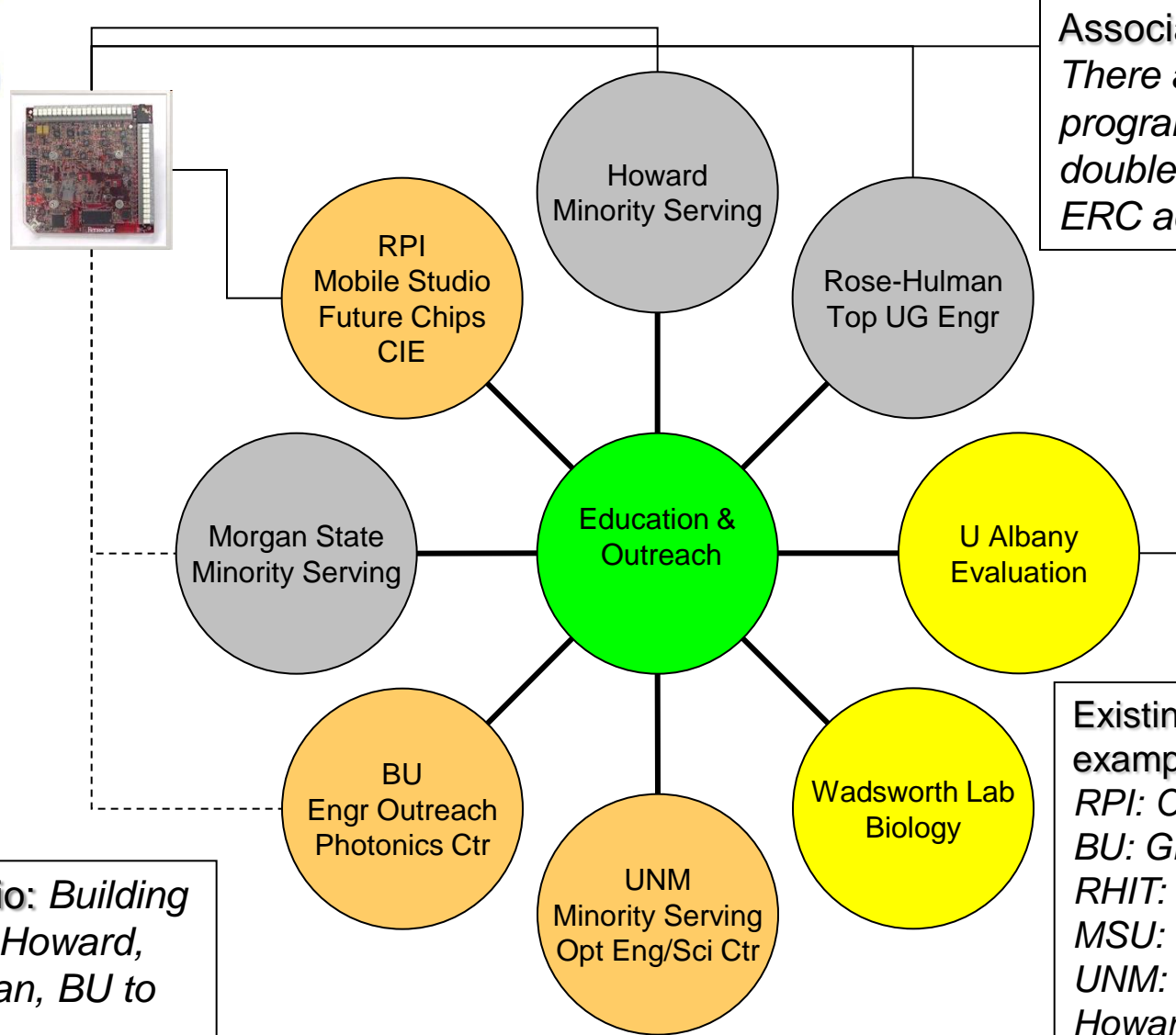
This very simple circuit can be used to address: basic electrical connectivity, systems, scientific method, etc.

Use LEDs to introduce the area of design trade offs (e.g. voltage, power, packaging, etc. requirements).





Partner Strengths



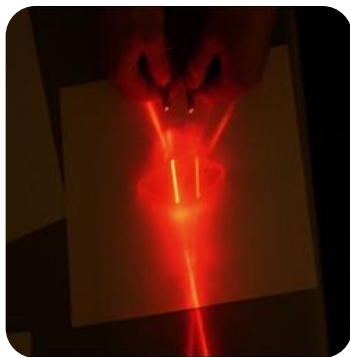
Associated Programs:
There are many funded programs that at least double the impact of ERC activities

Existing outreach examples:
*RPI: Ohio STEM
BU: Green Energy
RHIT: Charging Up K12
MSU: PACE
UNM: IGERT
Howard: HUSEM
Wadsworth: Holy Names*

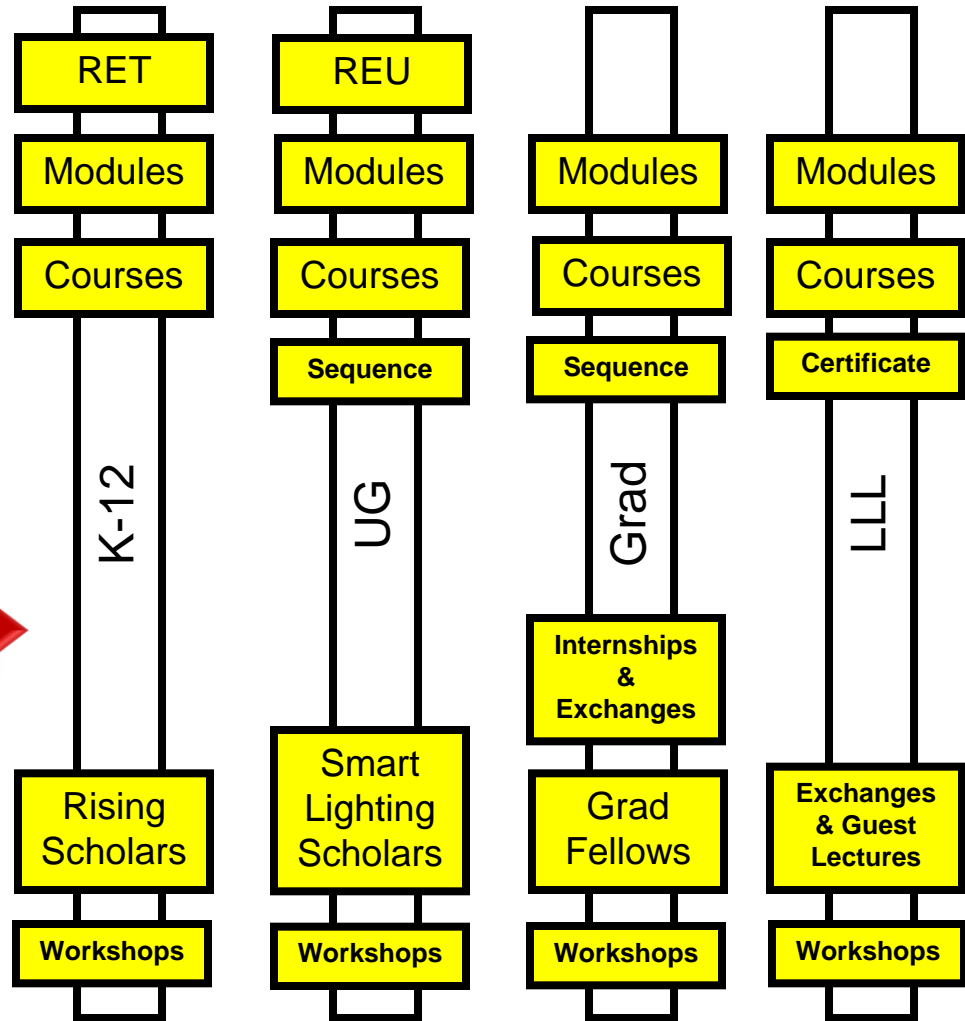
Mobile Studio: Building from RPI to Howard, Rose, Morgan, BU to All

Science You Can See Lab

- Main facility in CII 7124
- Satellite facilities planned for all partner institutions (BU, UNM, Howard, Morgan, Rose-Hulman)
- Goals:
 - *Introduce visitors to Smart Lighting*
 - *Educational lab for courses*
 - *Development of modules/materials*
 - *Testbed research*



- Existing Courses
- Beyond Research*
- Science You Can See*
- Research Content and Facilities
- Optics/Photonics Materials
- Unique Resources from Partners
- Learn by Teaching*
- Website
- Assessment



Outreach: Museums, Industry, Prof. Soc, NGOs ...

NSF Review Criteria

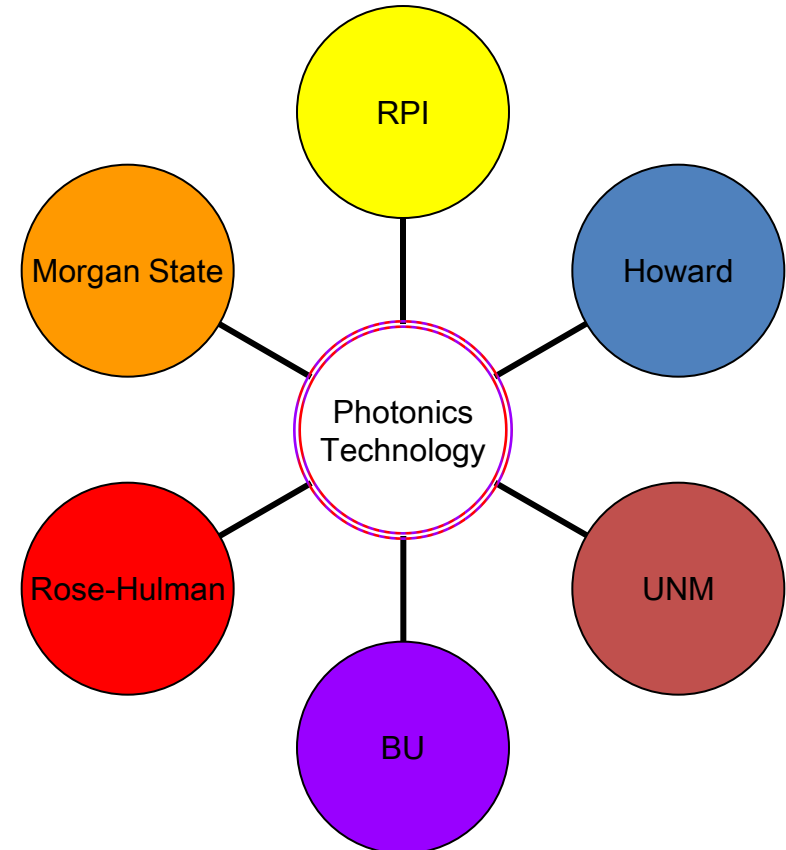
- The intellectual merit of the proposed activity; and
- The broader impacts resulting from the proposed activity”

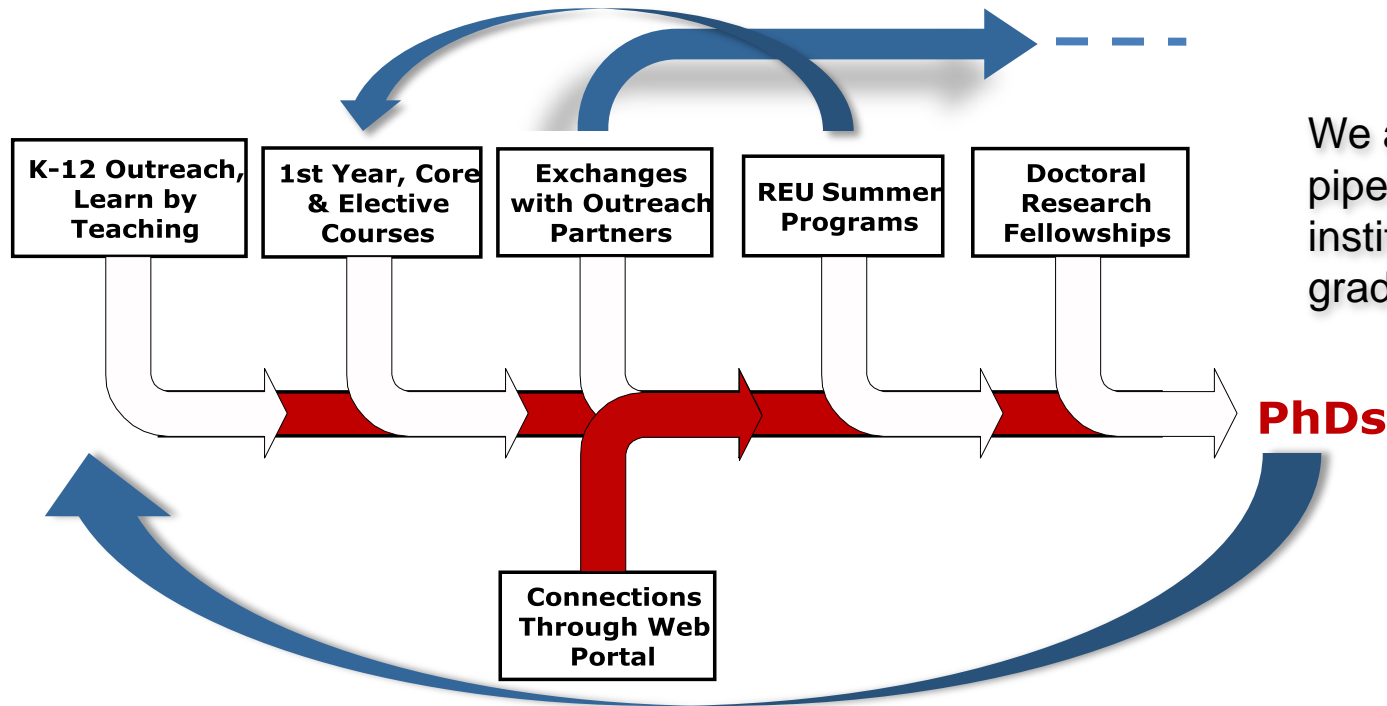


- 90 Second Presentation
- Training and Feedback Provided
- Students Learn to Quickly and Effectively Communicate the Key Aspects of their Work

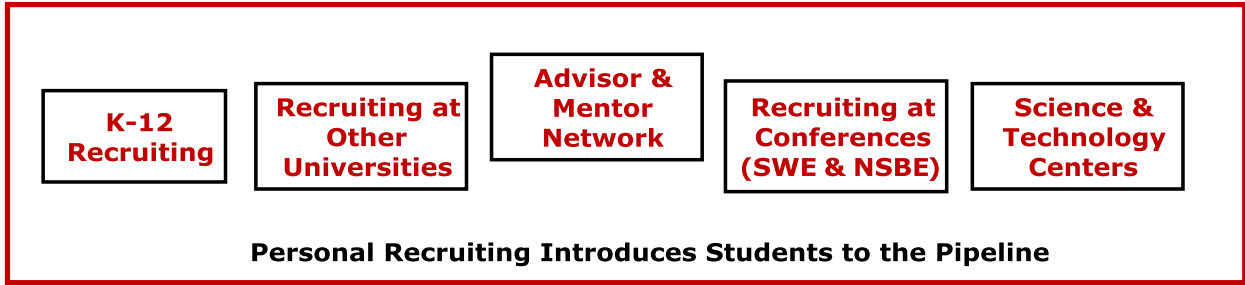
Reversing the Lecture/Homework Paradigm

- New Course in Optoelectronics Technology
- Jointly Taught at All 6 Partner Schools, With Equal Responsibility for Content
- Lectures Recorded for Outside of Class Viewing
- In Class Activities – HW, Projects, Discussions, etc.
- **Permits Partners to Add Elective Course with Minimal Resources**
- Outstanding Teachers at Other Universities (Utah, Wisconsin) Find Approach Very Effective





We also contribute to pipelines at partner institutions that produce grads *at all levels*



All Education/Outreach Activities Connect to the Pipeline

Path to Core Research for Outreach Partners

- UNM as Model – Minority Serving Institution (Top 10 Engineering School for Hispanics)
- Build Optics, Photonics, Smart Lighting Educational Offerings
 - Distributed education
 - Photonics Technology course (co-taught by 6 instructors)
 - Modules in existing courses
 - **SYCS** Labs at all partners
- Student & Faculty Exchanges
 - **REU** summer program
 - Jointly supervised grad students
 - Integration of outreach partners in thrusts & testbeds



This is a great opportunity to build connections between partners & to collaborate on common goals



**Relationships! Relationships!
Relationships! Cindy Furse (Utah)**

Teacher Workshops

- ★ Workshop for Ohio HS Teachers (RPI)
- ★ Green Energy Teachers Workshop (BU)
- ★ *“Charging Up”* K-12 Teachers Workshop (RHIT)
 - Workshop for Albany HS Academy of Engineering Teachers (RPI)

High School

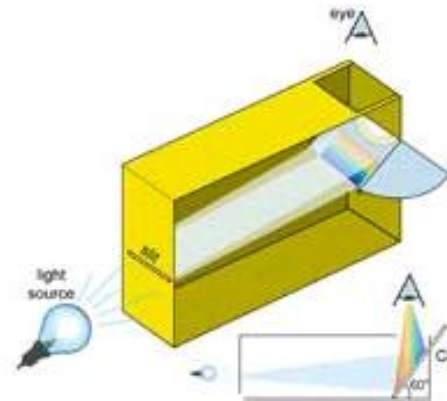
Middle School



Separately funded programs in which we add significant Smart Lighting content

Student Workshops

- ★ BU STEM Day (May 26)
55 - 5th graders from
Trotter, Curley, &
Dickerman Schools
- ★ BU Smart Lighting Short
Course (June, July) 10th
& 11th graders (See
Poster)
 - Many 1 or 2 Hour
Activities at Elementary
Schools and Partner
Universities



Ken Connor



Elementary School

★ Separately funded



The vision is to: *develop & deploy affordable technology and "hands-on" learning materials to enhance STEM education*; while expanding the studio pedagogy to environments that are no longer limited by equipment access issues. Our goal is to: enable the "hands-on" exploration of STEM principles, devices, and systems - *anyplace at anytime*.

Hands-On Learning Environment

Experiment/Demo

SL Daughter Board

Mobile Studio IOBoard

Based on the ADI Blackfin Processor

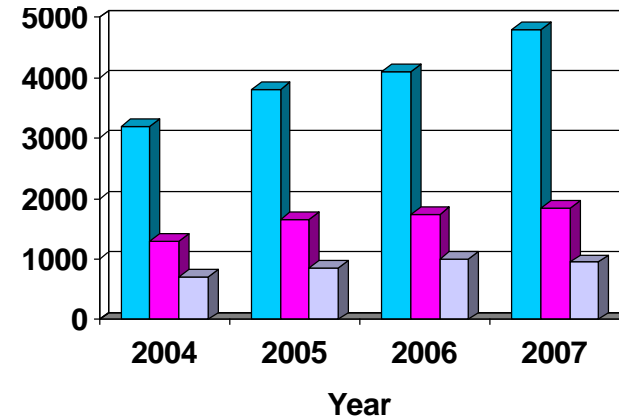




Collaborative Outreach with Industry



Wilmington Tech Fair



■ Total ■ Female ■ Underrepresented Minority



Regional



Global

Broad Range of Opportunities – *Universities Not Involved*

- Core science and technology, integrated through engineering systems principles, linked through applications
- Teamwork emphasizing multidisciplinary and multi-institutional programs and projects, engagement with industry, research labs, universities, K-12 schools and museums
- An ever more diverse student body and workforce
- Leadership in **Smart Lighting Education**

