

EMPOWERING MINDS WITH SCIENCE

ENGAGING THE PUBLIC THROUGH OUTREACH



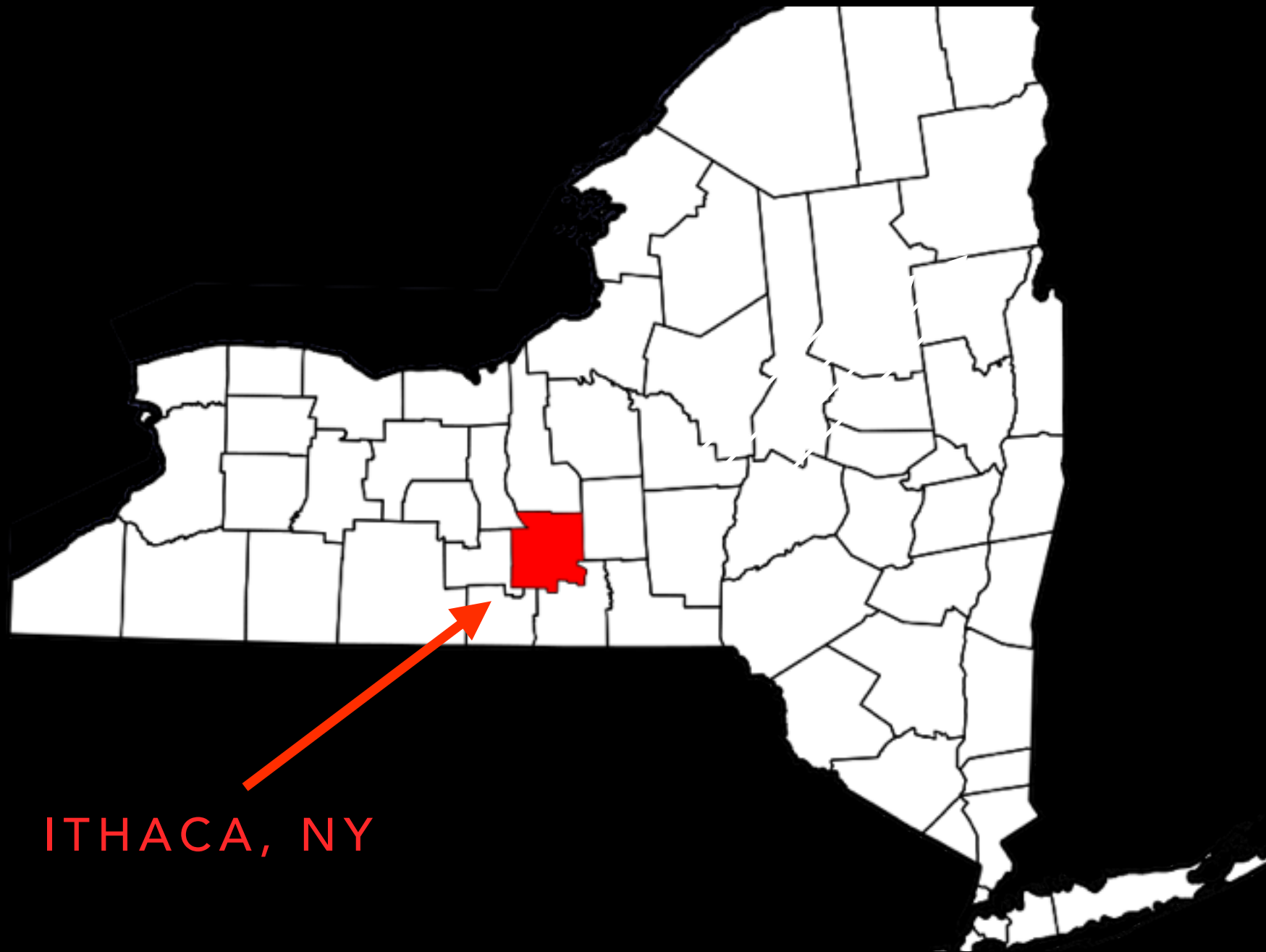
XRAISE IS OUTREACH FOR CLASSE

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- Erik Herman, Science Engagement Specialist
- Eva Luna, Teaching Support Specialist



TOMPKINS COUNTY

CONTEXT FOR LOCAL OUTREACH PROGRAMMING



ITHACA, NY

PERSONS BELOW
POVERTY LEVEL
20.5%

FREE OR
REDUCED LUNCH
30.39% - 38.01%

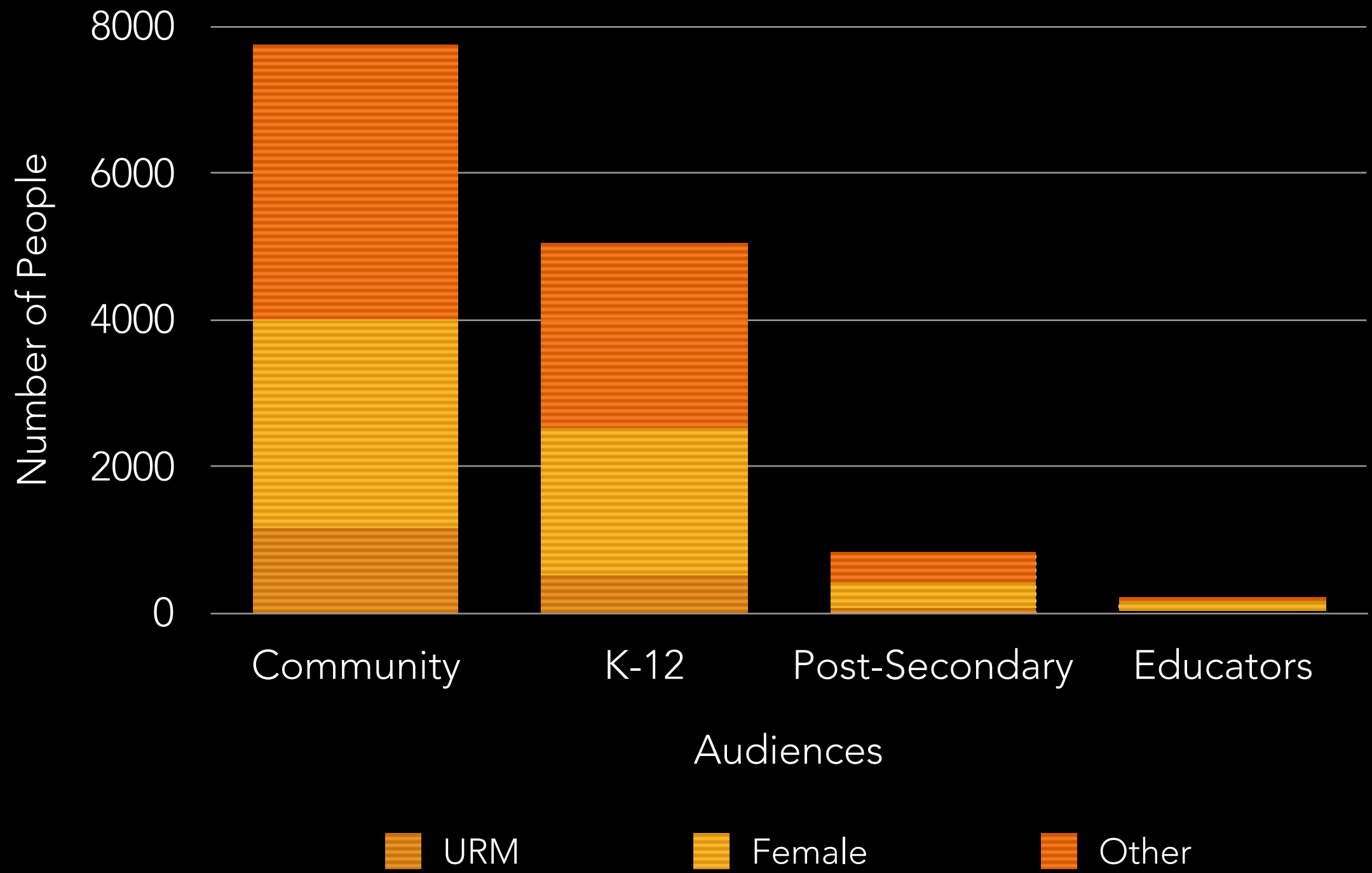
BLACK OR
AFRICAN
AMERICAN 4.4%

HISPANIC OR
LATINO 4.7%

US CENSUS BUREAU, 2014

PEOPLE IMPACTED, BY AUDIENCE AND DEMOGRAPHIC

7/1/2014-6/30/2015



NSF MERIT REVIEW CRITERIA

GUIDING PRINCIPLES (PRESENTED TO NSB 2011)

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects.

MISSION OF THE OUTREACH PROGRAM

EMPOWER MINDS WITH SCIENCE



OUTLINE OF PRESENTATION

- Four outcomes of current programming
 - For each outcome:
 - Strategies used to achieve outcome
 - Research supporting chosen strategies
 - Example of activities implemented
 - Indicators of success
- Focus for the future

OUTCOME: HIGHER ENGAGEMENT IN STEM

XRAISE PROVOKES INTEREST, ENTHUSIASM AND ENGAGEMENT IN STEM TO ESTABLISH A LIFE-LONG PASSION FOR SCIENCE LEARNING AND UNDERSTANDING



Maddison and Paul prepare acrylic for use in internal reflection cards

OUTCOME: HIGHER ENGAGEMENT IN STEM

- Strategy: Hands-on explorations of new science phenomena, approachable and non-threatening
 - Research: Kanter and Honey, 2013
 - Programs that address this outcome
 - Junk Genies of Science
 - Garbage to Gadgets
- Indicators of reaching desired outcome:
 - New requests for our programming from parents and educators
 - Demand for, and attendance at, public events
 - Substantial time spent interacting with exhibits
 - Infusion of new exhibits by new students



Graduate student, Howie Joress, helps design and present exhibits that invite visitors to explore phenomena

OUTCOME: INCREASED SENSE OF AGENCY

XRAISE CULTIVATES A SENSE OF AGENCY AND IDENTITY IN STEM, FOCUSING ON THE NEEDS OF TRADITIONALLY MARGINALIZED POPULATIONS



Graduate student Robin Bjorkquist, coaches Thalia on the use of a multimeter

OUTCOME: INCREASED SENSE OF AGENCY

- Strategy: Students actively involved in engineering design, making, creating devices and educative play
 - Research: Lachapelle et al., 2011 and Cantrell et al., 2006
 - Programs implemented:
 - BioBuild – Physics of Cayuga Lake
 - Science Snapshot for Youth
- Indicators of success:
 - Perseverance and follow-through
 - Personal stories and testimonials
 - Showcasing devices to peers and parents
 - Demand for program exceeds capacity



Lydia and Tom fine-tune their turbine project to light LED

OUTCOME: ENHANCED CAREER & COLLEGE READINESS

XRAISE ENHANCES CAREER AND COLLEGE READINESS FOR STUDENTS, SUPPORTING RESEARCH OPPORTUNITIES AND ALTERNATIVE STEM CAREER PATHS



Summer researcher Carlos Santiago explains project results to engineer Alan Pauling

OUTCOME: ENHANCED CAREER AND COLLEGE READINESS

- Strategy: Mentored research opportunities, teacher training and exposure to technology
 - Research: Lopatto, 2007
 - Programs that address this outcome:
 - High School Teacher Workshops/ Lending Library
 - Research internships for secondary and post-secondary students
 - Tours for thousands of visitors
- Indicators of success
 - Requests for equipment kits from educators
 - Survey results indicate research experiences support career decisions
 - Tour requests - demand exceed capability; result in undergrad research appointments



High school teachers explore wave interference patterns with assistance from graduate student Jen Chu

OUTCOME:
DIVERSIFY STEM
PIPELINE

XRAISE BROADENS
THE PARTICIPATION
OF UNDERSERVED
POPULATIONS TO
DIVERSIFY THE
STEM PIPELINE

*Photo: Jen and Chaya explore potential energy with
encouragement from undergraduate Pratiti Deb*



OUTCOME: DIVERSIFY STEM PIPELINE

- Strategy: Establish a collaboration of science experts, educators and institutions to partner with, and offer opportunities for, underserved and underrepresented groups.
 - Research: Domina & Ruzek, 2012 and Denner et al., 1991
- Collaborations established:
 - Saturday Science and Math Academy/ Saturday Programs with Xraise
 - Greater Ithaca Activities Center/Laptop Refurbishing, Scrappy Science
 - Physics Factory/Ithaca Physics Bus
 - Ithaca Generator/G.E.R.L.S Camp
 - Tully Regional Enrichment Program/Summer Science Snapshot
 - Cayuga Lake Floating Classroom/Biobuild!



OUTCOME: DIVERSIFY STEM PIPELINE

- Indicators of success:
 - Established partnerships that support trust and ongoing commitment
 - Expansion of network of collaborators who share similar vision and philosophy
 - Continued requests for science programming from rooted community groups
 - Demand for community college summer research opportunities

Photo: Simone seeks advice from CIT staff Rich Sholtys and graduate student Sam Whitehead



FOCUS FOR THE FUTURE

- Streamline our outreach initiatives, focus on those that emphasize:
 - Direct experiences
 - Engineering practices
 - Relationship building
- Four main thrusts for the future
 - Mobile Science Outreach
 - ReDesigning Science Education
 - Enhanced Mentoring
 - Research on Science Education

Photo: Scientist Margaret Koker explores materials with students



MOBILE SCIENCE

- Past year pilot of Mobile Science program and targets met:
 - Leveraged collaboration with Physics Factory/Little Shop of Physics
 - Embraced NSF Maker Movement by infusing Design/Engineering practices into outreach
 - Engaged undergraduates, graduates, and staff in public outreach
 - Developed a high profile way to showcase student built exhibits and relevant science
- Future - expand innovative Ithaca Physics Bus pilot program and increase our national impact:
 - Accessing remote and distant populations
 - Promoting the replicability of Physics Bus model



Girls feel electric charge at Girls Club's of NY

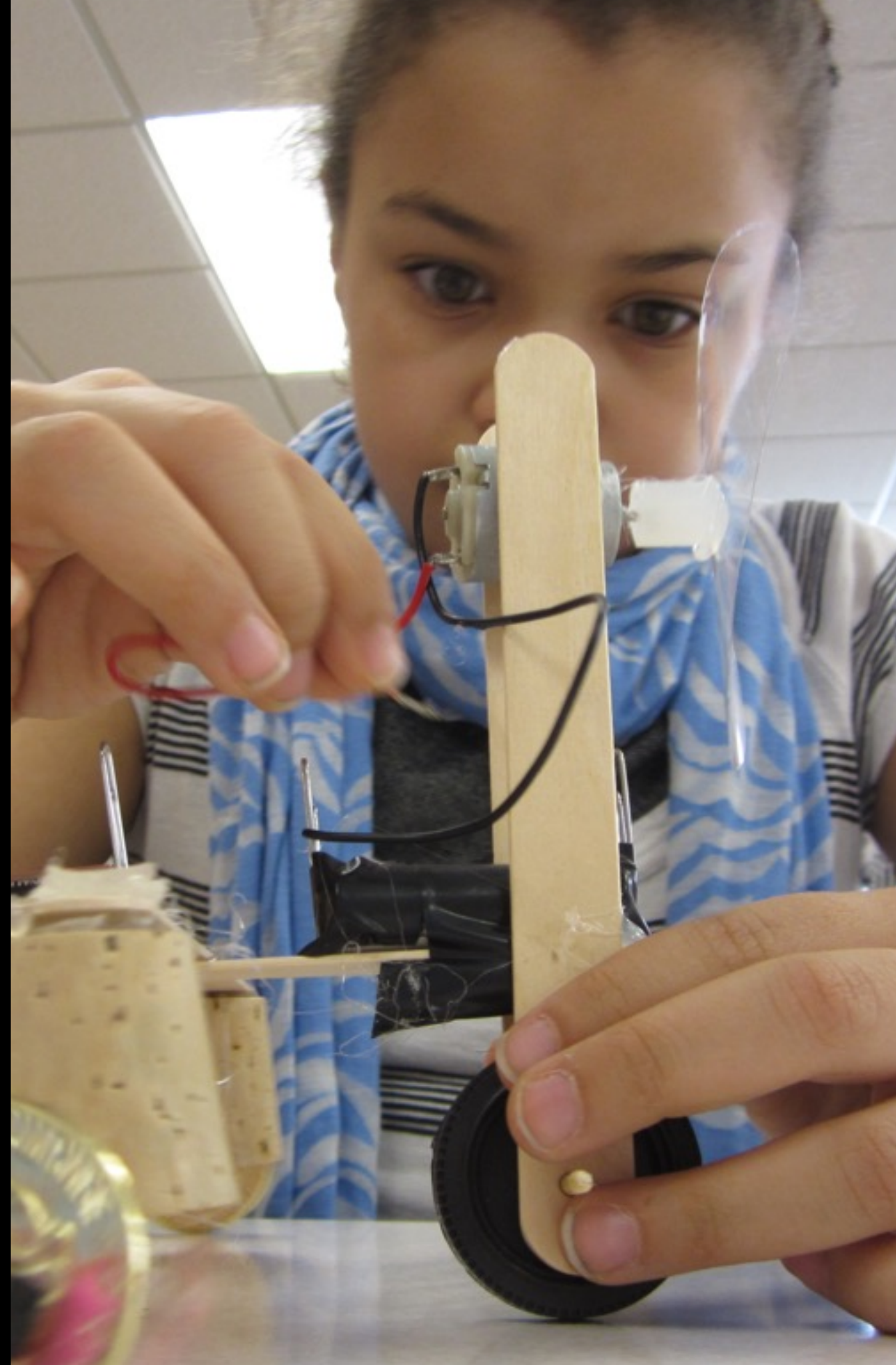


Families experience minimal surfaces and interference of light at STEAMworks in Brooklyn, NY

ReDesigning Science Education

- Promote the integration of engineering practices (as emphasized in *Next Generation Science Standards*) into existing science curriculum
- Using in school and out-of-school time to experiment with an engineering-design-based learning environment
- Recent publication in *Excelsior: Journal of Teaching and Learning*
- Support and embrace the Design, Make, Play initiatives, for implementation in the formal classroom

Photo: Jenelle prototypes a propeller-powered car using accessible materials



ReDesigning Science Education (continued)

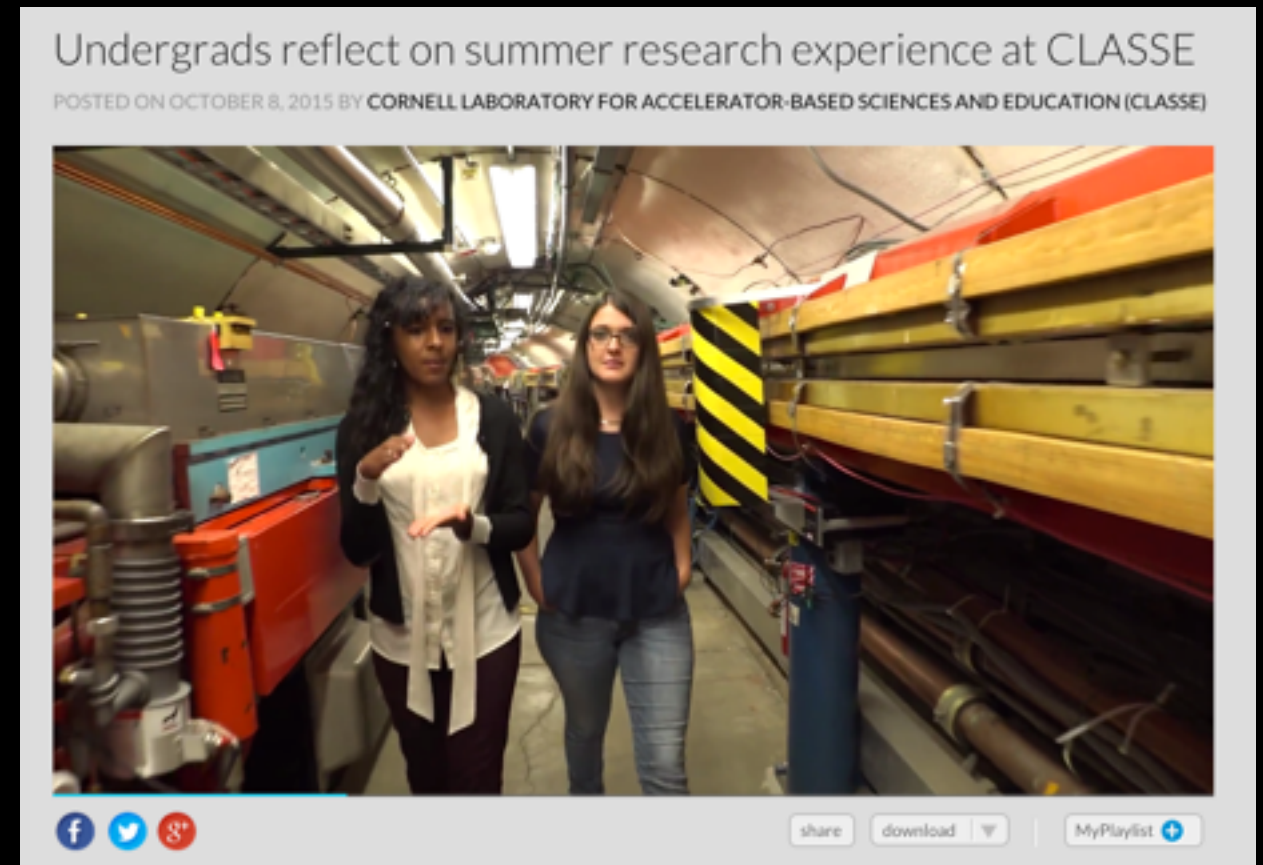
- Decrease “cook book” investigations, increase opportunities for student led inquiry and product-based outcomes
- Emphasize the integration of the disciplinary core ideas in the sciences to reflect research initiatives
- Expand network of trained educators
 - Lending Library expansion
 - Center for Bright Beams outreach thrust; develop investigations and materials for middle school
 - Create YouTube instructional videos for increased accessibility

Photo: Teachers design their own device for measuring turbidity



ENHANCING MENTORING

- In 2015, over 25 undergraduate students participated in summer research programs
- Recruitment efforts have resulted in an increase in the numbers of URM's and women participating in research at our facility
- Student feedback indicates that more support is needed to meet the social, cultural and academic needs of these students
- Provide resources, platform and opportunity for sharing, connections to other programs, etc.



Undergraduate researchers Anjuli Jones (Florida A&M University) and Naomi Gander (Reed College) share their summer experiences in a video posted online at cornell.edu/video

EDUCATION RESEARCH & EVALUATION

- Xraise will conduct research to examine the effectiveness of design-engineering projects and artifacts in their ability to cultivate, in participants:
 - Acquisition of scientific knowledge, 21st Century skills, and science & engineering practices as outlined in Next Generation Science Standards
- Evaluation by an external evaluator to determine areas of improvement, and how Xraise is affecting the lives of the communities
- Goal: Produce meaningful evidence from one Xraise program initially —> share results with funders & shape future programming
- Xraise will disseminate findings through publications in professional journals and presentations at professional conferences



Photo: Jacob shows off his innovative spinner design

THANK YOU

DISCUSSION



LITERATURE REFERENCED

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