

Engineering Outreach: Kids in Engineering

23 May 2014

The Cooper Union
ASME Diversity Action Grant 2014

New York, NY

The Cooper Union: ASME Diversity Action Grant Report

Grant Recipient Information

Date: June 2013 - June 2014

Student Section: 020200 0202B (Metropolitan)

Grant Awarded to: The Cooper Union

Address:

The Cooper Union
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New York, NY 10003
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Summary of DAG Project

Project Title: Engineering Outreach: Kids in Engineering

ASME DAG Funding: \$2500

Total Project Budget: \$3700

Partnering Organizations: Cooper Union ASME & SWE

Attendance:

- PS130K events: **Total 38 Women 20 Minorities 28**
- Total of 24 PS347 afterschool events: **Total 17 Women 8 Minorities 6**
- (Note the entire PS347 lower school benefits from the Interactive Light Studio: # of students: 214, Minorities ~70%, Free Lunch ~70%, Female ~50%, Special Education*, ~40% of Pre-K, *includes deaf, hard of hearing, and children of deaf adults)
- Cooper Union volunteers & professors: **Total 14 Women 9 Minorities 5**

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Engineering Outreach: Kids in Engineering

Project Description:

ASME and SWE members from The Cooper Union worked together to coordinate and lead engineering activities for elementary school students in New York City. These activities introduced young children to the fields of mechanical, electrical, chemical and civil engineering by learning about, brainstorming, designing, and building bridges, LEGO machines, batteries, propeller racers, and windmills.

There are three components of this outreach project. First, Cooper Union students visit classrooms at a public school in Brooklyn (PS130K) to lead discussions and demos that explain what engineering is and what engineers do. Next, a fourth grade class PS130K visited The Cooper Union. The fourth graders participated in a hands-on lesson about bridge design, were given tours of The Cooper Union's engineering labs, and were lead through a discussion about how they have already encountered engineering in their own experiences. Lastly, several Cooper Union students visited an elementary school in Manhattan, PS347, to perform engineering outreach activities with kindergarten through second grade students over a 5-month period for a new afterschool STEM program. Note, that this project will continue until the end of June.

Project Goal/Objective and How Achieved:

The most important objective of this project was to spark interest in elementary school students about the study of engineering.

The DAG funding allowed The Cooper Union to purchase LEGO Education Robotics kits, Green Science kits, and Engineering is Elementary kits, books, and teacher's guides, which were developed by the Boston Museum of Science (<http://eiestore.com/index.html>) and were instrumental in the success of this project. The kits were a very helpful time-saver and were full of great age-appropriate activities as well as all materials necessary to perform these activities.

We also purchased new manipulatives, such as musical instruments, flashlights, and STEM books, for the Interactive Light Studio at PS347. The Interactive Light Studio is an inspirational play and learning space created with previous ASME DAG funding. The Interactive Light Studio incorporates technology designed by Cooper Union students to help both the deaf and hearing population at the school interact with sound.

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Visits to PS130K

Cooper Union students visited several classrooms at PS130K to lead discussions and present demonstrations to students in 1st through 4th grade. Discussions focused on what engineering is and what engineers do. Cooper Union students also talked about what types of subject matter they study in school, and what projects they are currently involved in. Additionally, Cooper Union students pointed out real-life problems that engineers work on solving. Demonstrations focused on teaching science concepts. For instance, one demonstration included passing an oiled wooden skewer through an inflated balloon. First, Cooper Union students told PS130K students what they were about to do. Next, Cooper Union students asked the younger students what they thought would happen to the balloon. After showing the younger students that the balloon did not pop when the oiled wooden skewer was passed through the parts of the balloon that experience the least amount of stress, Cooper Union students explained why the balloon did not pop. After the discussion and demonstrations, the PS130K students were invited to ask other questions about engineering. Another session is planned at PS130K is planned for June, which will include a new engineering kit and activity.

PS130K at Cooper Union

Bridge building lesson plans and activity kits were used for the Cooper Union – PS130K event. In order to guide the elementary school students through this introduction to engineering, a slideshow presentation was prepared with pictures and an explanation of the design process. The students were shown pictures of famous bridges that exist around the world, as well as several models made of index cards and drinking straws that were prepared by Cooper Union students prior to the lesson. As the elementary students were lead through the design process with the help of the slideshow presentation, the kids worked in teams of two. The teams made sketches to brainstorm their ideas and prepared a materials list choosing from items such as index cards, tape, paperclips, drinking straws, and string. The teams also figured out the projected cost of their bridge using a list of costs that was given to them. Then, each team built their bridge, tested it with a toy car, and was asked to think about what improvements they would make if they could do this project again.

Visits to PS347 Afterschool Sessions

Cooper Union students and ASME faculty advisor visited PS347 for weekly afterschool STEM sessions throughout the Spring semester. First, the bridge building and windmill design lesson plans and activity kits where used. Next, using the LEGO Education WeCanDo kits, Cooper Union students and faculty, and a teacher from PS347 helped the students to build various LEGO machines with moving parts over a number of sessions. Cooper Union students and faculty asked the PS347 students to predict what would happen if pulleys were changed and parts were moved, to encourage

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thinking while building. Then the students performed activities using Environmental Battery, Propeller Racers and Eco Recycling Green Science kits. PS347 students built batteries using potatoes, raced car with wind propellers and designed toys using recycled materials. Future sessions are planned with the EiE Oil Spill and Earthquake kits.

Evaluation of Program's Success:

This engineering outreach project was an amazing experience for all those involved, including Cooper Union students, students from PS130K and PS347, as well as teachers and professors. For Cooper Union students, the opportunity to work with young children was a rare and exciting one. College students often have to think about how to present their work and projects to peers or professors, but the students organizing these outreach events were encouraged to think about their fields of study in a new light and had to reflect on the essential basics of engineering and design.

PS130K students were visibly excited about having an unordinary lesson taught by college students. Due to their questions and active participation, discussion and demonstration sessions easily took up an entire class period. The outreach project was received positively by the PS130K teacher and by parent chaperones. The PS130K teacher commented that he felt lucky his class was invited to Cooper Union and he looked forward to bringing his class back next year.

In addition, the funding made engaging activities possible for a new engineering afterschool program at PS347, a school with a significant high-needs population. The benefits of the DAG funding will extend far beyond the outreach events described here; having Cooper Union students and teachers at PS347 work together helps get young students excited about STEM during their formative years.

The success of the project is also evident in the publicity that has been generated. Cooper Union worked with Deborah Wetzal from ASME Media Relations and the PS347 Interactive Light Studio was featured locally on NY1 and nationally on Time Warner cable network news in a segment entitled "**Some Students At NYC School Study Music Despite Being Unable To Hear.**" The segment was also featured on the Connect A Million Minds "It Ain't Rocket Science" show. A link to the NY1 segment can be found at: <http://www.ny1.com/content/news/199421/some-students-at-nyc-school-study-music-despite-being-unable-to-hear>. The Light Studio project was also featured in ASME ME Today Article "**Interactive Light Studio Stimulates Learning: Designed for Special Hearing Impaired Children**" by Alaina Levine, which can be found at: <https://www.asme.org/career-education/early-career-engineers/me-today/interactive-light-studio-stimulates-learning>.

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Future Work:

Cooper Union plans to continue collaborating with PS130K and PS347 and also develop new programs beyond the DAG funding period. Planning for future STEM sessions at PS130K and PS347 are underway. Cooper Union is also exploring collaborating with a new partner, New Explorations in Science and Technology, to help design engineering related enrichment clusters. Due to funding coming later than expected this year, one LEGO Mindstorm EV3 kit was purchased with funding from the Cooper Union Joint Activities Committee to begin learning how to work with this kit, developing lesson plans, and deciding how to best utilize such kits into our outreach activities. The remaining funding will be used to purchase additional kits for future sessions. Future work is also planned by Cooper Union students to expand the Interactive Light Studio.

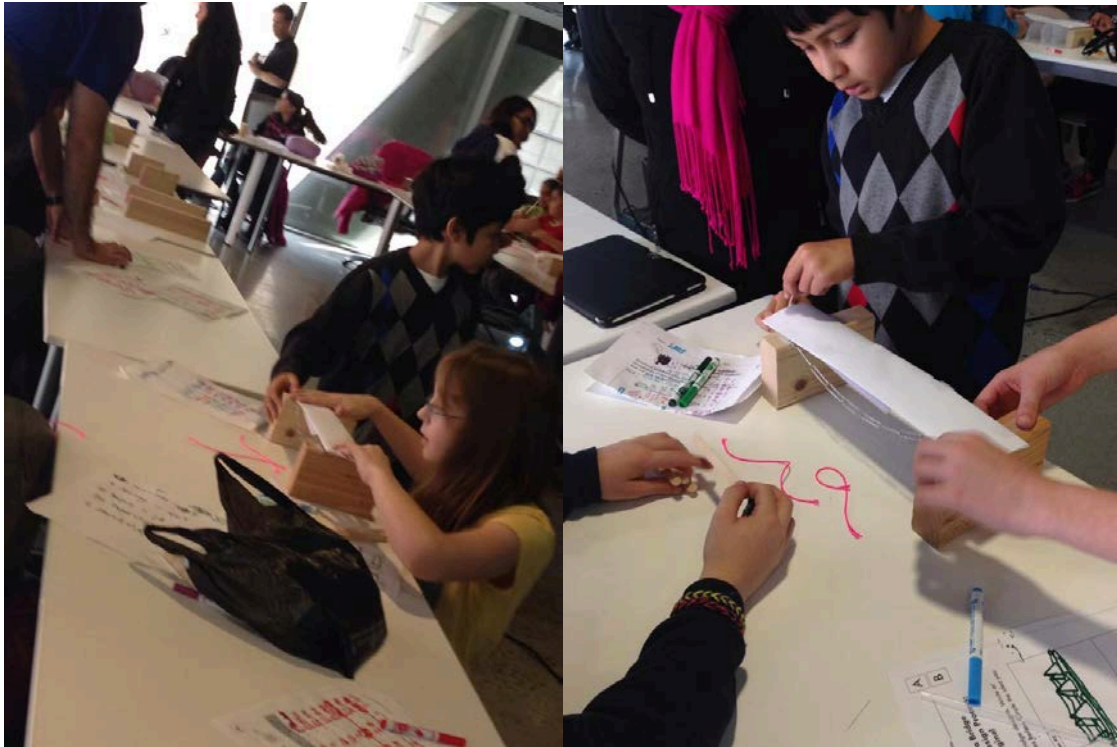
Other Comments:

A picture gallery from the events can be found below.

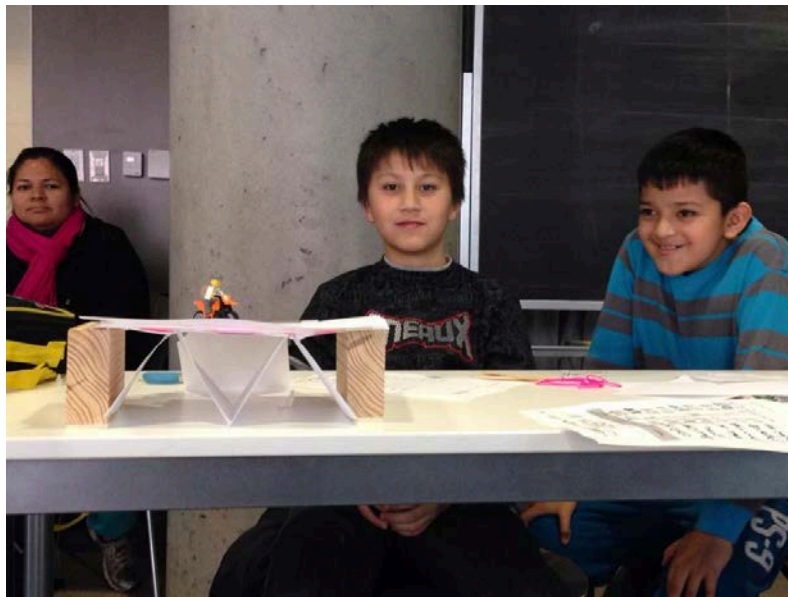
Thank you to ASME DAG for supporting this project and allowing The Cooper Union to continue to reach out to schools in the New York City area!

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Picture Gallery

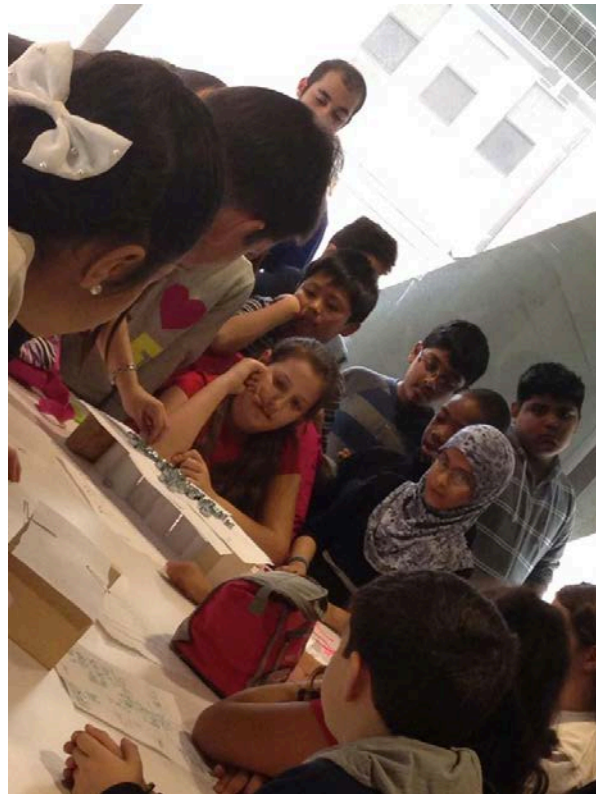


PS130K students work on assembling their model bridges.



A finished bridge.

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PS130K students use bolts as weights to test their bridges.

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A Cooper Union lab technician, Brandon (at far left), shows PS130K students Cooper Union's Formula SAE car, built in-house at Cooper Union.



A Q&A session with Brandon.

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Students at PS347 and Cooper student testing windmill sails.



Cooper Union student helping with more windmill testing.

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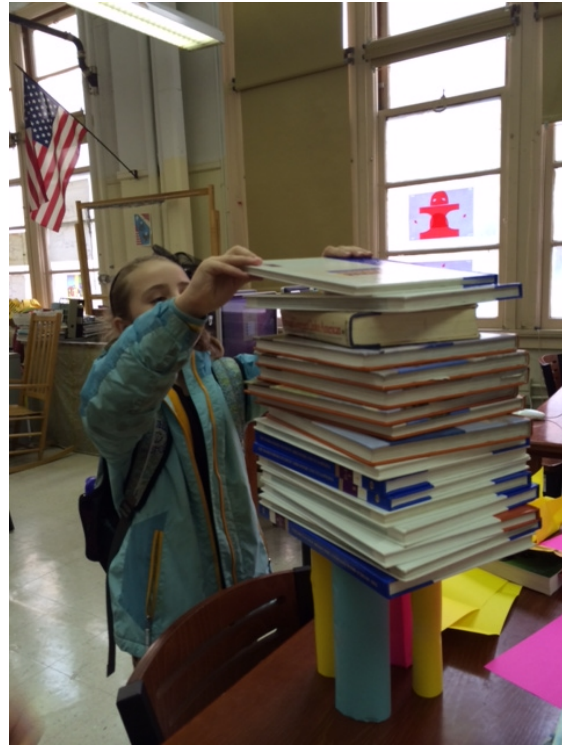


Building LEGO machines with motors and gears at PS347.



More LEGO machine building at PS347.

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PS347 students learning about structures and participating in Eco Green Science activities.

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Financial Summary:

Engineering Outreach 2013-2014 Project Financial Summary			
#	Item(s)	Vendor	Amount
1	Manipulatives for light table, musical instruments, batteries, science books, flashlights	Amazon.com	\$ 384.96
2	LEGO Education WeCanDo Kits and Software	www.legoeducation.us	\$ 636.95
3	Batteries & Flashlight replacements	Amazon Marketplace	\$ 40.13
4	Pizza from volunteer info session	Mercado	\$ 63.02
5	Enviro Battery and Compass Green Science Set	Amazon.com	\$ 15.88
6	Enviro Battery, Eco Science, and Propeller Race Car Green Science Kits	Amazon.com	\$ 127.77
7	Science and Technology Books	Amazon.com	\$ 61.99
8	Potatoes and misc. supplies for battery activity	Metro Market	\$ 5.00
9	LEGO Mindstorm EV3 Core Set	www.legoeducation.us	\$ 396.03
10	Ecosystems: Oil Spill kit & materials	EiE Kits (eiestore.com)	\$ 424.60
11	Earthquake kit & materials	EiE Kits (eiestore.com)	\$ 440.00
12	LEGO Education EV3 Kits	www.legoeducation.us	\$ 1,188.09