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Reports

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Partnering With Utilities for Hands-On STEM

Utility companies, hoping to inspire the next generation of employees, meet community outreach and other obligations, or both, are teaming up with educators to create innovative, hands-on learning opportunities.

Keri Randolph, director of innovation for Hamilton County Schools in Tennessee, has worked with two utility companies—the Tennessee Valley Authority (TVA) and the local electric power board (EPB)—to expand science, technology, engineering, and mathematics (STEM) offerings for Hamilton County students. TVA's Partners in Education program supports initiatives including robotics and energy-focused supports, such as donating solar arrays and other equipment.

Her work with the EPB grew out of a casual conversation with an EPB employee about the challenge of marketing a community solar energy program. That led to a meeting with EPB and K-12 teachers from six Hamilton County schools who brainstormed project-based learning ideas based on the program. Randolph reports that each grade level took a different approach, and in the end, "the kids had a whole package of solutions they presented to EPB." They included public service announcements created by kindergarten students and a solar power education kiosk designed by high school students.

"EPB has said they will take some ideas and implement them," she notes. "This has opened up more opportuni-

ties for us to partner [with EPB]... At our STEM high school, students do quarterly [projects. When EPB was designing] a new power grid in a new neighborhood, our kids came up with their own plan... that would reduce the number of transformers [needed] and save [EPB] money."

She says teachers have reported higher student engagement and are requesting more opportunities to partner with utilities and other companies, despite the extra planning time required. "It's a win-win on both sides," Randolph notes. "The project-based learning work...came out from casual conversation. I do that a lot more. I ask people if they've had kids work on problems; they are pleasantly surprised with the results [when they do]."

The Center for Mathematics, Science, and Technology at Illinois State University (CeMaST) is in its third year of support from the Illinois Science and Energy Innovation Foundation, funded primarily by Illinois power companies, to provide K-12 energy education.

"They were probably thinking three-ring binders and PowerPoint slides. We don't do that," declares Brad Christensen, CeMaST STEM specialist. Instead, they created a se-



WILLIAM RASOR

Granada High School's Interact Club students work with David Lunn of Friends of the Arroyo to measure water turbidity during the Tri-Valley Creeks to Bay Clean-up event.

ries of rooms—kitchen/dining room, utility room/garage, and bedroom/bathroom—contained in boxes that can be set up inside a school. In the kitchen, for example, students find all the appliances they would see in a typical kitchen, including a blender, toaster, stove, and refrigerator.

"Students plug things in to see the energy use and calculate the bill. Then they trade the standard [electricity] meter for a smart meter, and get real-time rate adjustments. They get to see what's most cost-effective, such as using the clothes dryer or oven at off-peak times. We have basically three of every appliance. Every appliance has an Energy Guide tag identifying its energy use as either a low-, middle-, or high-efficiency appliance. Students plug in different appliances with different tags, and see different usages," says Christensen.

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The program has expanded to include a construction set that challenges students to build a working power grid. The curriculum guides them through its construction just as the power grid itself evolved from a “chronological/historical perspective...Students connect various power plants, transformers, transmission and distribution lines, and meters to form a grid line. They can then combine grid lines to form a complex grid very similar to what we have today, including coal-fired plants, natural gas, renewable [hydroelectric] energy, nuclear, and most lately, a resurgence in wind and solar power,” he explains.

Teachers “download curriculum [from <http://cemast.illinoisstate.edu>]. All of our curricula are written in a learning cycle format, so [they’re] student-led... The students get the lesson plan and get started doing something immediately... This has really turned out to be good for all of us. Students really understand electrical power, the grid, and how the Smart Grid works,” Christensen asserts.

“The curriculum is not aligned to NGSS [Next Generation Science Standards] or Common Core, but the teachers do [align with them],” he adds, noting the learning cycle “approach aligns with the philosophy of NGSS. I hope we’re having some impact on pedagogy through their use of the learning cycle format.”

When Laura Spence, K–12 STEM specialist for Pinellas County (Florida) Schools, took over the district’s after-school STEM academies, she realized there wasn’t enough funding for all the district schools. She looked at current district partners and ways to expand their collaborations. “I didn’t want to just ask a business partner for money...I felt it was much more important for them to become a vested partner on many different levels,” she recalls. The investment options included sponsoring STEM Family Nights and “teacher learning journeys” at company sites.

STEM Family Night events are opportunities for STEM Academy students and their families to work on engineering projects, now with the assistance from Duke Energy (DE) employees. “The employees work side by side with families and teachers on the

engineering design projects, discussing [their role in the community and] their career path,...providing STEM expertise to families [on the project] while also sharing their long-term community goals with the Pinellas County School STEM Academies,” Spence adds. DE also sponsors STEM Learning Journey professional development for STEM Academy teachers and participates in an annual STEM Expo.

“We started four years ago with 56 STEM academies. This year, we have 250 after-school STEM academies,” Spence says. “Having half funded by the district and half funded by [DE], it’s a win-win for our students to have as many STEM opportunities as possible.”

In California, Livermore Valley Joint Unified School District STEM Coordinator Regina Brinker has partnered with the City of Livermore’s Water Resource Division (WRD) to clean trash from local waterways and monitor water quality around the area. On the third Saturday of September, students and their families can join the Tri-Valley Creeks to Bay Clean-up, part of the Adopt a Creek Spot program and Coastal Cleanup Day. WRD selects the cleanup sites, and employees share maps of the local watershed. WRD also provides water-quality test kits.

“We clean up [and quantify] trash... Adding the education component... has impacted students and adults there,” Brinker says. “It brings an element of place-based learning...By working at the creek near our schoolyard, there is higher student engagement.”

Adopt a Creek Spot helps WRD meet permit requirements from the Regional Water Quality Control Board, according to Lynna Allen, WRD water resources coordinator. In addition, the clean-up event is “getting more people involved and raises awareness,” she says. Allen, with partners at the Livermore Area Recreation and Parks Department, Zone 7 Water Agency, and Friends of the Arroyos, also has worked with Brinker and other Livermore teachers to develop K–12 curricula focused on the watershed.

Livermore teachers borrow the water-testing kits from WRD throughout the year to use with their students. “People use test kits as part of World

Water Monitoring Day. Kids can look at data worldwide. It fits nicely with NGSS; we look at local data and how does that compare internationally,” Brinker asserts.

Analyzing Utility Data

Data analysis is central to many educator-utility collaborations. In Princeton, New Jersey, Sustainable New Jersey provided a grant to make energy usage data from the elementary, middle, and high schools available to students. The data is streamed online so students can compare power usage among the schools and monitor the impact of any changes, such as replacing windows with more energy-efficient models. In addition, the schools have worked with the Princeton University power plant on projects ranging from energy audits to field trips to the plant. According to Edward Cohen, supervisor of science preK–12 for Princeton Public Schools, “When doing an energy audit, the idea is to have kids present to the facilities committee on ways to reduce costs... Kids are seeing the data and asking questions about the data...Kids are using data to construct explanations and [find ways to] reduce energy usage.”

However, schools don’t need a local utility company willing to share

data. The Solar4RSchools program is “leveraging utility-scale systems” to provide real-time, real-world data for students to analyze, according to Program Director Chaun MacQueen.

“More than 50% of utility [employees] will be retiring by [the time this year’s freshman classes] graduate,” says Parker Mullins, who works with MacQueen as program manager for energy education at the Bonneville Environmental Foundation in Portland, Oregon. “We need more students who know programming and software development, as well as engineering, science, finance, and marketing.”

Educators can access solar energy data from schools across the country at www.solar4rschools.org. MacQueen notes, “Teachers and students can look up projects around the country and [track and] graph the data...There’s so much opportunity [in this field, but there’s] also inequity of access to that opportunity. We’re working with teachers and school districts to expand access.”

Solar4RSchools offers online instructions for its use, an online educator library with “classroom- and teacher-tested lesson plans,” and professional development opportunities. ●

NSTA SEARCH

New Treasurer Post Open

The National Science Teachers Association announces the opening of the NSTA Treasurer position. Responsibilities include oversight of the association’s financial and budgetary matters. The Treasurer shall be appointed by the Board of Directors for a three-year term of office, which may be renewed for another three-year term. Appointees will be expected to devote 10–12 days of service a year for this nonstaff position.

An honorarium will be provided as well as reimbursements for required meeting attendance [travel and per diem].

For additional information about the position’s responsibilities, visit <http://careers.nsta.org>.

APPLICATION DEADLINE: November 1, 2016

Interested individuals are invited to submit their resume along with a cover letter that specifies interest in being considered for appointment to NSTA Executive Director, 1840 Wilson Blvd., Arlington, VA 22201-3000.