Project-based learning was hardly new when Purdue University launched its Engineering Projects in Community Service (EPICS) program 20 years ago this spring. But EPICS incorporated a community aspect when “not many STEM [science, technology, engineering, and mathematics] programs gear[ed] projects toward the community,” says Charese Williams, EPICS K–12 coordinator at Purdue. “The idea is for them to better their community [while learning STEM]. That service learning piece sets EPICS apart.

“At the university level, the idea was to be of service to the community while using engineering skills,” Williams continues. “Because the program was working so well, so successfully at the university level, former EPICS students from Purdue University developed the idea to offer it to younger students.” Although some expressed initial concern that middle and high school students would not have the necessary skills, Williams says there was immediate success when EPICS K–12 launched a decade ago.

The EPICS K–12 curriculum was designed in modules to guide students through the process of identifying a need in the community and a non-profit organization to work with as the students create a product to meet that need.

“The entire curriculum is based on the design cycle. We deal with five phases, or modules. At the end of each phase, students are tested to make sure they understood that phase…The first module is determining who the [non-profit] partner will be. We tell schools to start small, start in the school. The idea is once students select a project, they have immediate buy-in. If students make suggestions or determine who[m] they want to service, then it goes well.”

At the all-girls residential Foxcroft School in Middleburg, Virginia, Maria Evans has taught EPICS for five years. “The curriculum is really comprehensive if done as a full year, but I pick and choose pieces to implement” because of teaching the class as an elective on a semester basis, she explains. Her students have completed about 20 projects, include building sensory trails for therapeutic riding programs and a handicapped-accessible produce sorting station for a work training program.

“Culturally, we expect men to be engineers; we don’t expect [women] to be [them] as often. [In EPICS,] they’re doing projects they may have never imagined themselves doing before. It lets them see potential they didn’t see before,” contends Evans. “They’re not just putting in volunteer hours. This is kind of a perfect blend for girls and how they learn. They overcome their fear of engineering…We start class with [a discussion of] what kind of volunteering [that] they do. From that list, we look at agencies that match [their interests], and reach out to those agencies. Students handle it all; I coach them through it.”

Evans’ students take the lead as they visit potential partner organizations, talk to CEOs about their needs, then determine requirements such as the project budget, materials, and schedule, as well as any applicable regulations.

“This class is kind of amazing in the amount of confidence they gain with a set of skills they never had exposure to. They’re in the shop, and when they walk out of there, they aren’t afraid of anything,” she continues. “It really changes what they think they’re capable of. Students who end up in [EPICS]
are not necessarily the strongest [in science and engineering]... They have to present and defend [their designs]. What I saw this fall were industry-level presentations. They knew what they were doing, why, and who they were doing it for, and they had a detailed design to support it. It’s a different level of motivation. By the time they leave class, they have a different skill set in an adult arena: They know how to interact with adults on a professional level... They become a cohesive unit and leave with a much better understanding of diplomacy and sharing of responsibility.”

Dan Zavaleta, EPICS program instructor at Desert Vista High School in Phoenix, Arizona, was introduced to EPICS in 2013. With EPICS, students learn “engineering is not just about what they are going to do, but [also] what they are going to do for others,” he asserts. “It shows them… they can be a responsible person in the community.”

Zavaleta had used project-based learning in the past, but found the EPICS curriculum to be a “natural fit” at Desert Vista that provided “a curriculum based on why we need to get involved in the community.”

“The big thing about EPICS is kids get to see this is their idea... They take ownership of it, and once they take ownership, they’re going to complete the task,” he notes, adding that the students take pride in their work and aren’t afraid to talk about it.

After his students worked with foreign language teachers to create Spanish-language instructions for a water filtration system they designed and built for a community in Mexico, Zavaleta started thinking about how to expand the program to include other subjects. He is now working with Desert Vista’s business teachers to include marketing in future student projects.

**EPICS Resources**

The EPICS curriculum is free to educators who register online at the website [http://bit.ly/1Mc5cq](http://bit.ly/1Mc5cq). Basic members can access an overview of the curricula and participate in the online EPICS community. Professional members have full access to the curricula and are expected to complete EPICS training, either in person at Purdue or virtually. (Both membership levels are free, although a fee is charged for attending the training on the Purdue campus.)

Although the name EPICS K–12 includes the elementary level, the available curricula are for the middle and high school levels, including in-school and after-school varieties. According to Williams, the EPICS staff has discussed expanding the curriculum to the elementary level, perhaps focusing on learning about the engineering process. “We believe it will be difficult for elementary students to produce projects that will be deliverable,” she says. “Although we have found some fifth graders can do the sixth-grade/middle school curriculum.”

With more than 100 middle and high schools in 17 states and Washington, D.C., participating in EPICS K–12 and 26 university programs, Williams says they are working to develop “hubs” of schools located within a geographic area that would provide immediate feedback and support to one another. She says in the best case scenario, each hub would include a university that could show the middle and high school students they could pursue engineering throughout their education and beyond.