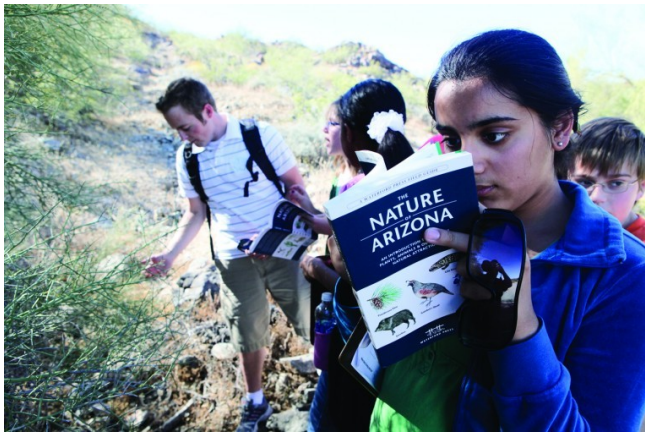
STEM education a hands-on program

By Whitney Begin Special to AFN | Posted: Wednesday, May 18, 2011 8:00 am

Editor's note: This is the last in a three-part series of stories exploring new programs the Kyrene School District may provide to students early as next school year.



STEM club

Navneet Kumar, 12, takes the opportunity to check out additional information in "The Nature of Arizona" textbook while ASU grad student Karl Wyant describes aspects of a native tree that grows near the students' school, Centennial Middle School. May 4, 2010

While Lisa Randall explained how her seventh-grade students connected circuits, created switches and set up sensors that circled the classroom, she admitted how different it was from how she learned about chain reactions.

"I was taught in all my science classes, including high school and college, through a textbook and when we did do activities they were cookbook instruction experiments where the end result was predetermined," she said.

Randall, an instructional facilitator employed through Arizona State University, has instead used inquiry-based learning and projects without the support of a textbook in the three sections of her elective class offered at Kyrene Aprende Middle School.

"We give them a real-world challenge just like engineers and scientists have and they try to solve a problem based on their designs and experiments without any direct instructions," she said.

This experimental teaching style is part of a method that Randall and Tirupalavanam Ganesh, an assistant professor of engineering education at Arizona State, developed alongside a group of educators, graduate and doctoral students.

Ganesh has partnered with Kyrene to advance his educational outreach program and enhance students' learning through what is called STEM (Science, Technology, Engineering and Mathematics) education by using real-world, hands-on experiences.

"We want students to understand large ideas through hands-on activities and taking charge of their own learning," Ganesh said. "Kids are curious. If they can act on that curiosity their interest level is high because this is something they want to do."

While STEM is not a new concept, educators at Kyrene are using inquiry-based methods to breathe

life into the classroom, said Kyrene Superintendent David Schauer.

"STEM education is really a nationwide goal for education in this country," Schauer said. "What we've learned from business and industry is that this approach is important because we have a lot of students who are graduating from high school and college that know how to follow the rules and the steps of a process, but what's missing is that ability to really take the bull by the horns and solve something."

The outreach program, which is funded by a grant from the National Science Foundation, began development in 2007 as after-school programs taught by doctoral students at four Mesa Public Schools before joining forces with the Kyrene School District in 2010.

"It's all about getting kids to explore how things work and understanding connections," Darcy Renfro from the Arizona Science Foundation said, "STEM education should be about giving children the opportunity to engage through an interdisciplinary manner where you go beyond the boundaries of science or math to figure out how things work together to make our lives better."

In addition to creative hands-on experiments, integrating subjects is key to this method.

"I think it teaches children how to apply science and math concepts in different areas of their education," Randall said. "It helps them bridge a gap between the subjects. In the real world, social studies, math, writing, science, they constantly overlap. It's necessary for kids to understand that at an early age."

The Kyrene STEM program originated at Kyrene Centennial Middle School and works with children in sixth through eighth grade after school.

Class experiments have included such diverse pursuits as exploring how microbes affect Earth's nutrient systems, how water, electricity and other energy sources can be harnessed to meet society's needs, and ideas for new state-of-the-art prosthetics.

The first 10-week program was so well received that in the second year participation nearly doubled, going from 50 to 90 students.

Kyrene Akimel A-al and del Pueblo middle schools will join the after-school program in fall 2011.

But perhaps an even bigger accomplishment than expanding the after-school program came in January when Ganesh and Randall partnered with Aprende Middle School to create the first in-school STEM class of their program, explained Kyrene Director of Curriculum Theresa Sweeney at a governing board presentation in March that discussed possible education programs.

"This class teaches students the value of science in their everyday lives as well as the career opportunities that exist in the STEM fields," Sweeney said at the meeting. "They are excited about solving problems in their own way and it seems like a lot of faculty at Aprende are very excited, too."

While Randall is thrilled with Aprende's enthusiasm for the program, she admits that this is not every teacher's reaction.

"There are teachers that resist it because they don't understand it," Randall said." It's hard to let go of control and teacher driven learning because they are afraid that if you let that go then you'll have discipline problems and the kids won't learn."

Randall said she understands the challenge. Prior to coming on board with Ganesh she taught a variety of science topics at Mesa Public Schools for 13 years and had started out teaching the traditional way as well, but in some cases that was not working.

"We had to incorporate technology and we had to incorporate a higher level of engagement to the students otherwise we were losing them," she said "This way the kids are more engaged, they want to be there, they want to learn, they want to develop and design and discover for themselves."

Randall said she experiences less discipline problems in her STEM class and feels that if other teachers give it a try they will have similar results.

"It was really difficult for me to find that balance at first because my instinct was tell them everything they needed to do and make sure they were on task all the time, but it was so worth it in the end," Randall said.

One of her best moments came when she completed a two-year cycle of the after-school program at Mesa Junior High, which is located in a low economic area. At the end of the program Randall spoke with two girls about their experience.

"They were saying, ‘We just can't believe that we are capable of doing this. We really are smart. We really can create these things and college is a real possibility.' It's a great achievement when kids gain confidence in their abilities," she said.

Another reason for teachers' aversion to the program is that they are afraid they won't be able to get through all the material they need for standardized tests, Ganesh said.

"We are asking students to really understand concepts beyond just a surface level and that takes time," Ganesh noted. "One of the criticisms of our science and math standards are that they are a mile wide and an inch deep. There hasn't been a lot of effort to learn something deeply. Instead, we expect people to know so much that it doesn't really amount to anything meaningful."

Ganesh is not the only one feeling the push for improvements in education. The United States has fallen to "average" in international education rankings released by the Organization for Economic Co-operation and Development.

If the United States expects to improve education it will not be enough for schools to try different teaching methods here and there, Ganesh said.

"There seems to be a need for a cultural valuing of learning," he said. "Learning for learning's sake, not just learning for economic improvement. That value doesn't mean taking the easy road, it means taking the hard way and actually spending time to develop a deeper knowledge and get to a point where you can understand complex ideas."

But for now, Ganesh and Kyrene are thinking local. In the beginning of 2011 they applied for a $3.5 million grant from the National Science Foundation to expand inquiry-based learning and integration throughout the district.

Sweeney said that if the grant does go through, she does not see the entire district going through drastic changes immediately.

"STEM is a very profound change in the way that teachers teach and it's not going to happen overnight," Sweeney said. "It's a whole different way of thinking and that takes time."

If the district does not receive the grant they will not have enough funding to continue working with Arizona State University on the in-school STEM classes, but that does not mean Kyrene will give up on the effort.

At the start of the school year Aprende teachers went through a two-day course on inquiry-based education and project-based learning to help them begin to understand STEM and although Schauer admits this is not enough training to fully understand the program, he said it's a step in the right direction.

"Even though we don't know for sure about the grant we are still doing a lot of work in this area," Schauer said. "STEM will revolutionize education in general. It is not something we need to focus on in one school. STEM should be everywhere. Every school and every teacher should be using it and we are willing to put in the work to make sure that our students are being taught the best way we know how."

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