Science, Technology, Engineering & Mathematics (STEM)

Blast off! 4-H launches rocketry and other science-based projects

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4-H leaders and members use GPS units to pinpoint landmarks for a two-year project that involved producing digital maps of UW-Fond du Lac’s 200-acre campus. By showing the location of trees, benches, signposts and other landmarks, the project serves as a tool administrators can use for maintenance and beautification.

“I just like building stuff,” says Claire Zander of Columbus, senior division winner of Wisconsin’s 4-H Rocketry Contest. With Claire are Charles Poppe, the junior division winner, Kirk Weese (left), National 4-H Engineering Challenge Board member, and Flash Gordon, coordinator of the state 4-H Rocketry Contest.

Situation

In the face of global competition, 21st century challenges and demand for technical solutions, America faces a knowledge gap: Only 5 percent of U.S. college graduates earn science, engineering or technology degrees. While students fall behind in science and math, U.S. corporations operating in a high-tech world economy need problem solvers, innovators, inventors and expert communicators now more than ever.
Response
Encourage students to consider science-related careers by offering 4-H projects that build technical problem-solving and critical-thinking skills. To that end, 4-H offers an array of projects, including rocketry and robotics, that fall under the umbrella of a national education initiative called STEM – Science, Technology, Engineering and Math. These projects teach kids to design and build models, develop hypotheses and record data, work as a team, solve problems, present technical concepts and handle competition. Research shows that youth who have positive experiences with STEM-related projects are more likely to pursue education and careers in math, science and engineering.

Outcomes
• The sky’s the limit – or maybe not – in Washington County, where 40 4-H members learn about aerospace and develop a host of other skills by building, launching and displaying rockets. Three members of the county’s rocketry project were invited by NASA to participate in an elite “Student Launch Initiative,” after placing 15th in the national “Team America Rocketry Challenge” or TARC. In that contest, which pits the top U.S. youth teams against each other, youth must design, build and launch a rocket, carrying an egg, to a height of 750 feet for 45 seconds. Naturally, the egg must return to earth uncracked. Washington County was the only Wisconsin county fielding a 4-H club in the rocketry challenge and one of only a handful of 4-H entries from around the country.

Doug Pedrick, co-leader of Washington County’s 4-H rocketry project and an engineer at GE Healthcare, says he’d like to see more Wisconsin 4-H clubs compete in the annual rocketry challenge. “It’s such a great program, so much fun, and the kids learn a lot.” What’s more, there’s a monetary incentive. The top 10 teams split $60,000, and Lockheed Martin Corp. awards $5,000 scholarships to the top three.

Kids competing in rocketry gain not just math, science, physics and engineering skills, they learn how to work as a team, cope with stress, come up with a plan, meet deadlines, stick to a budget and solve problems," says Pedrick. “It’s not all smooth sailing,” he notes. “They get a lot of experience in how real engineers in the real world do things.” To learn more about rocketry in Washington County, visit: http://www.4hrocketry.org/

• Washington County isn’t the only county with avid rocketeers. Due west, in Columbia County, the Zander family holds something of a rocketry dynasty. All three Zander children compete in 4-H rocketry, and their father, Tim Zander, leads the aerospace project. Claire Zander won this year’s state 4-H Rocketry Contest, open to winners of county rocketry contests. For the state contest, competitors must pass a written exam, identify rocket parts, bring a rocket to be judged, build a rocket on site and launch a rocket.

Why rocketry? “I just like building stuff,” says Claire, a high school junior who has competed in rocketry for seven years.

The project requires patience, she says, especially when the model gets stepped on, hits a fence or crumples on impact. “A lot of times the rocket gets completely destroyed and you have to start over again, so you can’t get too upset about it because it’s going to happen a lot.” Claire isn’t sure what she’ll end up doing, however, she says, “I always thought a career in science would be kind of cool.”

• Want a robot that will obey your every command? There are 40 4-H members in Waukesha County who can tell you exactly how to make one. There, 10-member teams led by volunteers compete in the “FIRST LEGO League,” learning to solve real-world problems by designing, building and programming robots. “Teamwork is the biggest thing,” they learn, says Maria Habib, Waukesha
County 4-H youth educator. “They learn how to think on the fly. They learn very quickly who’s good at programming, building, researching, and they divvy up the jobs.”

In an evaluation of robotics, Habib received these comments from 4-H members:

“I’ve learned that the robot must be designed to be versatile and to be able to fix any mistakes, because they will happen.”

“I would join the team next year because it teaches valuable design and presentation skills, teaches participants to work under pressure, and it can be very exciting and is a great way get to know other people.”

“I improved my public speaking skills. We prepared for the questions that the judges might ask us beforehand and figured out which type of questions each individual would be responsible for answering.”

Through demonstrations and competitions at county fairs, state fairs and other events, Waukesha County 4-H members have introduced several hundred youth to the joys of robotics over the past two years.

• In Kenosha County last year, Youth and Family Educator John de Montmollin introduced robotics to low-income, African American middle-school students at the Boys and Girls Club of Kenosha. The kids got so excited about the project that the club applied for and received a $1,700 grant to buy laptop computers and robots of their own. de Montmollin’s goal is to make robotics, an expensive 4-H project, available to more students. “We want to try and eliminate barriers and make sure the robotics program is offered to as many youth as possible.”

Kenosha County is off to a good start. 4-H projects featuring “the three Rs,” as de Montmollin calls them – rocketry, robotics and (pinewood derby) racing – are in place at six Kenosha County sites. In addition to having fun, kids learn science, math, designing, building and computer skills.

• In Jefferson County and around the state, Jefferson County Youth Development Agent Gail Roberts teaches young people how to “go and find and do,” using GPS (Global Positioning System) and GIS (Geographic Information Systems) equipment. She has reached more than 400 students at events such as “Family Learning Days,” “Girls + Math + Science = Opportunity” and the annual state 4-H & Youth Conference. Learning to use technical devices, such as GIS and GPS, teaches skills needed by surveyors, cartographers, naturalists, foresters, hikers, hunters and others, Roberts notes, and helps students “realize that learning GPS/GIS could turn into a career for you someday.”

In a two-year GIS project, Roberts worked with about 20 4-H members to produce a digital map of UW-Fond du Lac. The project involved photographing and digitally mapping trees, bushes, signage, lampposts and other landmarks on the 200-acre campus. Working on Saturday mornings, 4-H members used photography, record-keeping, math, tree and bird identification, and other skills, to gather data for the map. By showing the lay of the land, the project serves as a tool administrators can use for landscaping, plant disease management, maintenance and beautification.

• Solar cars, sumo robots, eggstronauts and catapults are among the subjects featured at 22 Gateway Academies, week-long summer day camps held around the state. UW-Extension 4-H coordinates the low-cost or free camps (depending on financial need), which are designed to encourage middle-school students to consider careers in science, engineering and technology. In just a year, the project expanded from nine sites to 22, and from 140 to 400 participants.
Students give the camps rave reviews. “Ninety percent of the kids said they enjoyed it and would tell their friends to come,” says Debra Ivey, 4-H Project Lead the Way coordinator and youth development agent in Iowa County. “Parents were highly complimentary, and teachers enjoyed it too.”

UW-Extension Chancellor David Wilson and UW System President Kevin Reilly have received awards for their work with Project Lead the Way and 4-H Gateway Academy. The academy is a partnership of 4-H Youth Development, UW-Extension, the Society of Manufacturing Engineers (SME) Education Foundation, the Kern Family Foundation, which sponsors the academies, and local school districts.

• “Biofuel Blast,” a science experiment created by Cathy Vrentas, a UW-Extension biotechnology outreach specialist, was selected as the featured experiment for “4-H National Youth Science Day” October 7. Wisconsin 4-H received $10,000 from the national 4-H organization for this honor. Vrentas’ experiment involves producing ethanol from cornstarch and encourages young researchers to find their own biofuel – such as stems, grasses, leaves and wood chips – and to share their results, via the web, with others.

The purpose, Vrentas says, is to capture kids’ imaginations and learn about “the process that goes into making biofuels, think about what our scientists are doing and what is the future of alternative energy.” (To learn more, visit: http://4-h.org/nysd/the_experiment.php)

• Vrentas and Bayfield County 4-H Youth Educator, Ian Meeker, are working to generate interest and train 4-H leaders to use a new energy curriculum, “The Power of the Wind,” in 4-H clubs around the state. During the past year they've held workshops for 4-H leaders, VISTA volunteers and others on how to implement the national 4-H curriculum, which is funded by a grant from the 3M Foundation. The curriculum teaches students about electricity production and energy use. In the process, they tour power plants and conduct experiments such as designing a simple wind turbine.

Why an energy curriculum? “It’s relevant,” explains Meeker, who is also co-chair of the state 4-H team that provided leadership for the STEM initiative. “We have an obligation to teach youth how their everyday lives are directly connected to both fossil fuel and renewable energy production. When they experience the connection between energy production and consumption, they become more informed consumers.”

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