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4-H and Aquatic Robotics

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Abstract

4-H is positioned to engage youth in the areas of environment and engineering. This article shares how Minnesota is engaging youth and adults to identify and solve community issues with the use of an aquatic remotely operated vehicle (ROV). After creating a new program design, the team has attracted new skilled volunteers and new youth to create youth-adult partnerships to take action in the community.

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Background

Minnesota's surface water area is one of the greatest in the nation. Minnesota contains a three-way continental divide with flowage from Minnesota going North to Hudson Bay, East to the St. Lawrence River, and South to the Gulf of Mexico. Minnesota's rural and urban communities have a distinct and compelling opportunity to engage more youth citizens in stewardship of water resources and water monitoring. The Department of Natural Resources currently engages over 2,600 volunteers annually to monitor lake levels and to care for the state's rivers. The Minnesota Pollution Control Agency engages 500 volunteers to monitor water transparency at 700 sites across the state. Minnesota 4-H Aquatics Robotics is designed to attract, engage, and educate youth who work to benefit the waters and government agencies of Minnesota while also providing abundant place-based learning opportunities in Science, Technology, Engineering and Mathematics (STEM).

The Minnesota 4-H Aquatic Robotics program provides youth with the opportunity to apply underwater robotic technology by designing and creating a Seaperch underwater Remotely Operated Vehicle (ROV) in a team setting. Overall, the main goals of the program are to provide an opportunity for young people to become more scientifically grounded and civically engaged. The program aims to provide youth with the opportunity to learn scientific and engineering concepts, to think like a scientist, and to develop positive attitudes towards science and their own abilities. Additionally, they are able to explore their local watershed, make public presentations, learn about environmental issues, and become more involved in their communities.

Creating the Program

Through Minnesota 4-H Aquatic Robotics, youth have the opportunities to become more civically engaged and scientifically grounded young people. Many of today's most difficult challenges require both innovation and scientific approaches to address them in new ways. The project is designed to assess the power of combining an engaged and inquiring mind with new technology to generate real world solutions to real world problems.

The Minnesota 4-H Aquatic Robotics team was very intentional about the model used to deliver the program. The program model includes these elements: recruiting new specialized volunteers, financial partners, community and campus partnerships, STEM club format, required training, and destination event. A common evaluation process was created to flow through all of the elements of the model. Social media was added later and used for youth to exchange ideas and share best engineering practices and community outreach. This community of learners provides an identity and network for youth who may otherwise find themselves isolated in sparsely populated areas of Minnesota.

Young people who participate in informal, out-of-school time science programs like Minnesota 4-H Aquatic Robotics learn scientific and mathematical concepts, strengthen their ability to think like scientists, develop skills using related language and tools, and gain positive attitudes about science and self. A promising finding from evaluation data is that most youth agreed that 4-H Aquatic Robotics challenges them to use their mind. This item is an indicator of the power of learning within the project.

Youth who are interested in science may be more likely to participate in 4-H and particularly in science-related programming and also to select high level science coursework in high school (Heck, Carlos, Barnett, & Smith, 2012). Through Minnesota 4-H Aquatic Robotics youth have the opportunity to become more civically engaged and scientifically grounded young people. Many of today's most difficult challenges require both innovation and scientific approaches to address them in new ways. This project is designed to assess the power of combining an engaged and inquiring mind with new technology to generate real world solutions to real problems.

The teams of youth and adults who have been trained have been using the ROV for addressing environmental issues in their communities. Some examples have been:

- Lake clean up (one team collecting 100 pop cans off the bottom of the lake)
- Watershed monitoring (creating partnerships and taking and submitting data)
- Lake and river exploration (using the ROVs to identify invasive species)

A New Model for Volunteer Development

Minnesota 4-H Aquatic Robotics created a new model for volunteer development. The use of hands-on, minds-on educational tools like robots may reverse the downward trend in STEM fields (Barker & Ansorge, 2006). Counties that sent teams to the training included an adult volunteer as part of the team. This adult would be responsible to support the team when returning to their counties, to help

pull the group together and to keep them active.

From survey feedback, volunteers' comments demonstrated an understanding of youth being engaged and the principles of positive youth development. One adult said, "The kids learn and accomplish more when you don't provide all the answers, but when they are provided opportunities to learn."

This model proves to be more sustaining for the teams. With the network of a supportive adult and a community partner, the teams were more successful for continuing and growing the program.

The Future

With the ever-changing environment there will always be work for the 4-H Aquatic Robotics program. The next area that Minnesota will be focusing on is the use of the aquatic ROV and invasive species education. Invasive species such as invasive carp and Zebra Mussels have found their way into the lakes and rivers of Minnesota. Youth will have the opportunity to educate lake homeowners and citizens about the spread of invasive species.

Recommendations

The team would like to share some examples of success as the program has been launched.

Team Success—To have genuine team success you must recruit and train adults with the team. At least one adult team member can help with the sustainability of the team. New specialized volunteers bring excitement, technical expertise and a willingness to try new ideas.

Community Partner—An adult from the community is crucial to the success of the team. DNR officers, watershed scientists and engineers are a few examples of a community team member.

Training—The training format was 10 hours over 2 days. Training elements included: hands-on engineering, hands-on water quality or invasive species training, and practicing citizenship engagement.

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