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research in brief >

Science in the Summertime: A Multi-Layered Learning Experience

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Summer offers a unique opportunity for youth to take a deep dive into science, technology, engineering and mathematics (STEM) learning. Outside of the traditional classroom, youth are in the field, connecting to environmental issues with meaningful importance in their own communities. These real-life experiences may even spark and sustain interest in a science career.

Dr. Phyllis Ault studied one such program, Salmon Camp Research Team (Salmon Camp) in the Pacific Northwest, to determine the impact of blending local tribes' traditional ecological knowledge and western science into one powerful learning experience.

about the program:

HOW DID YOU BECOME INTERESTED IN STUDYING THIS PROGRAM?

I began my career as a teacher running an outdoor program and had a lot of experience with informal, outdoor, experiential learning programs, as well as working with Native American students. The directors of Salmon Camp came to me to develop a rigorous evaluation of their program, in order to meet the requirements of their National Science Foundation grant.

DESCRIBE HOW THE SALMON CAMP PROGRAM CAME TO BE AND WHAT IT IS DESIGNED TO TEACH.

Salmon Camp was a joint project of the Oregon Museum of Science and Industry (OMSI) and the Native American Youth and Family Association. OMSI's residential camp director had developed relationships with local tribal leaders who wanted to get tribal kids more engaged in STEM and information technology (IT) career exploration. The natural resources camp experience was a way to make this learning both engaging and rigorous, with lots of depth. Not only did Salmon Camp "spark and sustain interest of Native American youth in STEM and IT careers," it developed their "abilities to use information technology to collect, analyze, and interpret data and solve real world problems." It also "promoted the participants' understanding of and appreciation for the complementary relationship between cultural knowledge and western science." This program was a beautiful collaboration between western scientists and tribal members demonstrating respect for each other's work.

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about the program:

HOW DOES THE PROGRAM WORK?

The program engaged Native American middle school and high school youth in hands-on salmon habitat preservation and restoration projects. Older students joined Salmon Camp research teams in different ecological regions throughout the Pacific Northwest and spent several weeks in the field working side-by-side with tribal leaders and western scientists on research and resource preservation and restoration. Younger students had shorter camp experiences. During the school year, students could participate in afterschool clubs, spring break field trips, and weekend projects. All students were exposed to advanced technology through contribution to an authentic research project.

I think the power of this program was the combined influence of a western science and technology approach alongside different tribal approaches to salmon habitat restoration and preservation. These kids were valued as real citizens, real contributors to both a real-life scientific project and a cultural community. They weren't just going to camp to learn out-of-context skills or have fun, nor just to learn about the history or culture of their tribes. By doing something real, they were charting a possible future career path that has tangible outcomes for their communities.

Initially the program was funded jointly by the participating tribes, OMSI, and the National Science Foundation. Since then, the Columbia River Intertribal Fish Commission has continued to sponsor the program, with four different Columbia River tribes rotating and sharing the host leadership duties. I think it was important for the tribes to take ownership of this and not have it led by OMSI and a western science perspective. Maintaining a model where western technology supports native methods has helped keep the program authentic.

data and findings:

HOW DID YOU GO ABOUT COLLECTING DATA AND EVALUATING THE PROGRAM?

Throughout the study, we collected data through student interviews, student journals and surveys, end-of-summer feedback, student presentations, and interactive family activities at the end of each session. The best part of this study was that we were able to reinforce themes of the program by involving the students in the evaluation process. At the start of every camp, we took laptops out to the field sites, so students would see us using technology tools in the field as part of the process of scientific learning. The surveys that students took in the field generated feedback immediately, so we could show the kids how to read and analyze their own data, and even had them critique the extent to which they thought the data accurately reflected their attitudes and behaviors. Giving back to the program this way was important to us, to show that data isn't just for the evaluator: when it's about you, it's your data.

Student journals were an incredibly rich source of information as well. They included gorgeous drawings of many camp activities: rivers, fish hatcheries, salmon being tagged. We found that some students appreciated the choice of artistic expression, but with the kids who aren't writers we were not able to capture as much through the journals. Later in the study, we also provided digital cameras for students to have the option of digital visual storytelling.

Salmon Club students effectively demonstrated their learning about ethnobotany through the Trading Knowledge event, an evening open house in which students shared projects through a poster session for other students, parents, and interested stakeholders.

We also built capacity among the program staff to continue the evaluation process without us. The first few times we did field interviews, we had the director or assistant director (tribal staff member) shadow us. Later we turned that piece over entirely to the camp staff, which helped them build their relationships with the kids and gather important direct feedback about camp. In another report, we highlighted that giving data back to the native community and supporting their own evaluation capacity really enhanced the goals of the project.

WHAT KINDS OF POSITIVE EFFECTS DID YOU FIND?

We found several shorter term positive effects. From the field sessions, students demonstrated high levels of learning with regards to using technological tools to collect, analyze, and interpret data in authentic, "real world" situations, and high levels of interest in learning more about how technology is used in science and resource management. Overall, students not only learned valuable technology skills, but they also greatly valued learning traditional ecological knowledge from elders and tribal members.

Students also reported that while they might not get good grades in science, their self-awareness and confidence in their science abilities definitely increased. They would say things like, "I know I can do science because I've done it and I've worked with researchers," and they could be very articulate about the science of salmon and fish hatchery issues that they had studied in the field.

Perhaps even more significant are the long-term effects I have been studying since this evaluation concluded, especially for girls in the program. I've followed several of the girls who had attended at least one year. All have engaged in either some related career or studied science teaching, ecology, resource management. I've seen other kids develop into leaders in their tribal communities too. While it's true that kids had self-selected into Salmon Camp and were likely predisposed to these choices, it has been remarkable to see the long-term interest sustained. I'm planning to do more formal, long-term follow-up of both girls and boys who attended the program, a decade later.

> "I know I can do science because I've done it and I've worked with researchers."

lessons learned and the way ahead:

WHAT ARE SOME OF THE NEXT RESEARCH QUESTIONS THAT FOLLOW FROM THIS STUDY?

A major next step for my research will be following the impact on participants longer term to learn more about how Salmon Camp has influenced students' STEM educational paths and career choices.

We were not able to verify the students' self-reported school-based findings through grades or teacher interviews, and that would be an interesting area for follow-up, with more funding.

A big piece of what youth got out of Salmon Camp was a stronger sense of their Native American identity. We know from other research that strong Native American identity results in doing better in school. It would be interesting to see how strongly academic outcomes and reduction of risky behavior are influenced by this kind of camp program.

WHAT DO POLICYMAKERS AND PRACTITIONERS NEED TO KNOW ABOUT THESE PROGRAMS?

Several factors of this program could be replicated in other kinds of STEM summer programs. A major strength of this program is the partnership across different agencies and organizations, bringing a blend of different perspectives and resources to achieve a shared vision. Another important lesson was to intentionally design the program activities so students could progressively build their skills. Afterschool clubs and field trips were added to continue the summer experience and to cultivate student learning and interest longer-term.

Study of STEM learning shows that to be effective, programs must:

- **Engage young people intellectually, academically, socially, and emotionally**
- **Respond to young people's interests, experiences, and cultural practices**
- **Connect STEM learning in out-of-school, school, home, and other settings.**

Perhaps the most important lesson learned is that people matter so much. In this particular program, the people and relationships are not replaceable parts. The involvement and leadership by native communities working side-by-side with western academic and STEM professionals brought a cultural sensitivity to rigorous STEM learning, emphasizing research focused on issues of importance to the Native American community, and including activities which teach authentic, IT-intensive research projects within the context of traditional knowledge and skills.

Like many similar programs, sustainable funding is a challenge. The initial project required major investment from the partners, and the program has been difficult to sustain without external funding. The students themselves recognized the need for better efforts at habitat restoration and the value of Native American youth who are knowledgeable about water systems and aquatic life. I would hope that policymakers see that programs like this can have several iterations of impact on our communities down the road.

At the end of the day, programs like this are an endeavor of the heart. The personal and professional commitment can't be removed from the program's success.

more stem resources

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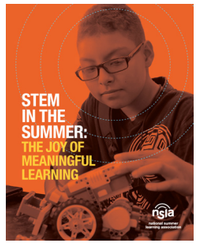

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