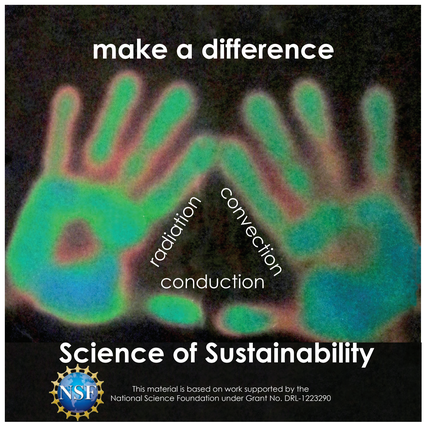

Collaborative Research, Pathways Project:

Project SOS - Making Connections using the Science of Sustainability

2014 AISL PI Meeting
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Community Partners:
Plummer, ID; Kendrick/Juliaetta, ID; and Rosalia, WA

Power Company Partners:
Avista Utilities; Kootenai Electric Cooperative; Clearwater Power Co.; and Inland Power & Light Co.

Project Overview

This Pathways Project connects **rural, underserved youth** and families in Eastern Washington and Northern Idaho to STEM concepts important in **sustainable building design**. The project is a collaboration of the Palouse Discovery Science Center (Pullman,WA), Washington State University and University of Idaho, working in partnership with rural community organizations and businesses.

The deliverables include:
1) an **Introduction to Heat Energy lesson plan with hands-on activities**, demonstrations, animations, and team challenge, 2) **interactive exhibit prototype activities**, 3)a **team cooperative learning problem-solving challenge**, and 4) **take-home materials** to encourage participants to use what they have learned to investigate ways to make their homes more energy-efficient and sustainable.

The project introduces rural youth and families to the traditionally difficult physics concept of thermal energy, particularly as it relates to sustainable building design. Participants explore how building materials and their properties can be used to control all three types of heat transfer: conduction, convection, and radiation to save energy. The interactive exhibit prototypes are coupled with a Model House Challenge in which participants, working in cooperative learning teams, use information learned from the exhibit prototype activities to retrofit a model house, improving its energy efficiency. Participants also learn how to use an audit kit with simple tools to investigate heat loss in their own home. One week later, youth participants and their families visit the Palouse Discovery Science Center to discuss what they discovered at home, receive free weatherization materials, hear about career opportunities, and explore the science center.

Goals

Goal 1. *Develop and test strategies for initiating and maintaining an* **effective collaborative regional network** *to promote youth and family involvement with science through Palouse Discovery Science Center (PDSC) outreach exhibits and programs.*

Goal 2. *Promote youth and family* **understanding of basic physics concepts** *and participants' abilities to apply their understanding to solving real-world problems (e.g., the development of more energy-efficient buildings).*

Goal 3. *Explore the possibility of developing* **effective outreach exhibits/programs** *for circulation to a variety of small, regional museums across the country.*

Accomplishments

We formed an interdisciplinary team of experts encompassing a broad knowledge-base with whom this project could not have been executed. The disciplines of the members were **Secondary Science Education**, **Physics**, **Engineering**, **Exhibit Design**, **Science Education Research**, **Community Outreach**, and **Museum/Interior Design.**


The Team and Project Partners

Additional **Project Partners** include representatives from the communities served by the project and the four local power companies that serve those communities.

The regional network of Project Team members and Project Partners met to share ideas, discuss challenges and solutions, outline lessons learned, and brainstorm future plans at an Initial and a Final Workshop and were kept informed about the project through newsletters.

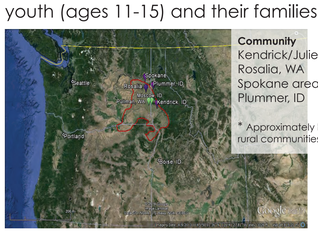
Through an **iterative process** of modifying program components after each community visit, the Project Team developed a comprehensive program with components to help youth and their families better **understand heat energy** and how to control heat transfer in their own homes.

We have shared information about Project SOS through the Association of Science and Technology Centers (ASTC) listserv and the National Education Outreach Network (NEON) and Project Team members have made eight presentations at regional, national, and international conferences.

So far, 68 individual representatives of science centers and school districts have expressed interest in Project SOS and we are still looking for additional interested parties. Newsletters and online surveys have been sent to all who indicated an interest in the project and we are developing a page on the PDSC's website to disseminate products and results.

Our Audience

youth (ages 11-15) and their families



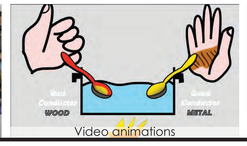
Community	Population	Youth	Family members
Kendrick/Julietta, ID	882	16	12
Rosalia, WA	550	17	19
Spokane area, WA	*	19	14
Plummer, ID	1599	9	10

* Approximately half of the participants from the Spokane area came from rural communities with populations of 265-9,000.

Project Components

An Introduction to Heat Energy


Demonstrations and hands-on activities



Video animations


Problem-solving challenge: "Keep the Hot Cocoa Hot"

Experiencing Exhibits

to become an expert in one type of heat transfer (Conduction, Convection, or Radiation) as it occurs in a house by doing four hands-on activities

conduction

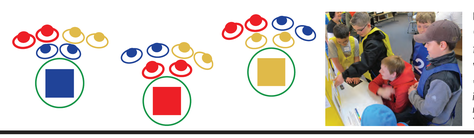
convection

radiation

Sharing Expertise through Cooperative Learning

in which teammates share how to use specific tools to show how their type of heat transfer occurs in a house.


Before today, I never knew that...
"you could use smoke for finding gaps. What we did today reminded me that... doing science is way more important then I thought."
Youth participant



Before today, I never knew that...
"there could be so many places in a house that heat could escape from."
What we did today reminded me that...
"it's SUPER important to have some form of insulation in your house – it could save you lots of money on heating and cooling."
Youth participant

Model House Challenge

in which team members work together to use the tools and share their expertise to select and apply modifications to a model house to make it more energy efficient.


"I had a lot of fun. I learned the basics of heat "physics". I worked with a team to make a model house more efficient. I explored a real building to see where heat was coming in."
Youth participant

HEAT (Heat Energy Audit Toolkit)

training in which youth and their families use simple tools and an audit form to become a "Heat Science Detective" in their own home.

What we did today reminded me that...
"science is AWESOME!"
Youth participant

Day one

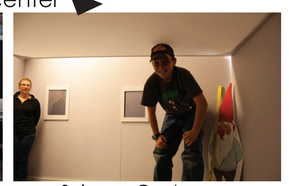
One week later

Youth and Family visit the Palouse Discovery Science Center


Sharing experiences of using HEAT audit and tools at home

"they talked a little bit about their careers, that gives me kind of an insight about what my options are, or what I could do."
Youth participant
STEM career awareness

Take home weatherization materials


Exploring the Palouse Discovery Science Center

Research and evaluation

Evaluation Instruments
The Project SOS team developed a variety of strategies and instruments to document the program's impact:

Youths and adults PRE and POST surveys
Behavioral observations
Video and audio recording
Transcription of HEAT audits
Online surveys
Telephone interviews

Interview responses from adult family members:

"He loved it and talked about it for months!"

"She had a really good time and she came home and she just wanted to experiment with all the stuff she had."

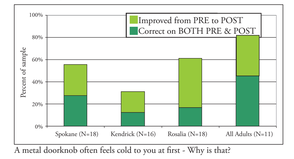
"Seeing my kids get so excited about stuff that's going to impact them as time goes on, that's cool."

PRE and POST SURVEY RESULTS*

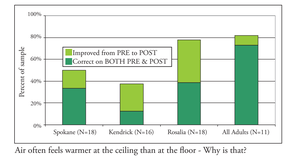
Three multiple-choice items challenged participants to recognize the best explanation for these everyday observations:

1) Metals often feel colder than other materials.
2) It often feels warmer near the ceiling of a heated room than it does at floor level.
3) Wearing mittens in the winter makes your hands feel warmer.

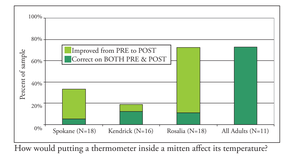
Graphs showing the degree of improvement of content knowledge of conduction, convection, and radiation.



A metal doorknob often feels cold to you at first - Why is that?



Air often feels warmer at the ceiling than at the floor - Why is that?



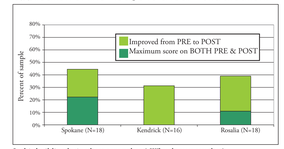
How would putting a thermometer inside a mitten affect its temperature?

* Plummer results were not included because of low numbers of participants

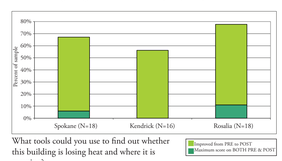
A series of three open-ended items challenged participants to recognize possible heat loss and suggest changes that would improve the building's energy efficiency.


This picture was taken in the winter. The left side of the building is a heated office, the right side is an unheated storage area.

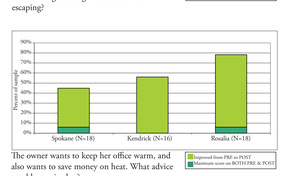
Graphs showing the degree of improvement of application of knowledge to a real-world situation.



Is this building losing heat somewhere? Why do you say that?



What tools could you use to find out whether this building is losing heat and where it is escaping?



The owner wants to keep her office warm, and also wants to save money on heat. What advice would you give her?

CHALLENGES and SOLUTIONS

CHALLENGES	SOLUTIONS
Difficult concepts	Animations, Demos, & Team challenges
Hands-on exhibits	Exhibits relate directly to a house
Recruiting youth	Involved parents!
Consistent participation	One-day event (followed by PDSC visit)
Sharing expertise	Facilitated
Following up	Interviews/online survey

Additional CHALLENGES
Survey fatigue" was an issue.
Attitudinal rating scales did not work well in this context.
It was difficult to assess the effectiveness of the cooperative learning component.

FUTURE PLANS

Adapt Project SOS materials and exhibits for other venues and logistical constraints.
(fewer personnel, smaller or larger science centers)

Add economic dimension to programming.
(set fixed budget for improvements, incorporate relative costs of improvements)

Further develop programming for parents/caregivers and possibly other audiences.
(teachers, real estate agents)

Continue to refine our evaluation strategies and expand our research agenda.
(how does the cooperative learning component enhance participants' experiences and outcomes?

CONTACT

Project SOS | the Science of Sustainability operates through the Palouse Discovery Science Center in Pullman, WA.

Contact us for more information:
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