



# Engaging the Future STEM Workforce through their Teachers

**Alison Colotelo, Project Manager**  
Pacific Northwest National Laboratory



PNNL is operated by Battelle for the U.S. Department of Energy

**We will begin shortly....**

**We value your feedback!**

<https://www.surveymonkey.com/r/PNNL120120>



## A little about me...

- Research focuses on waterpower systems:
  - improve efficiency
  - mitigate operational risks
  - reduce impacts to earth systems
- M.Sc. Biology
- Passion for “Sharing my Science”



# Acknowledgements



## Collaborators

- Educational Service District 123
  - Lorianne Donovan
  - Georgia Boatman (retired)
- MESA First Nations
  - Monet Becenti
- Kennewick School District
  - Jamie Whitney
- Prosser School District
  - Eric Larez

## Funding Support

- Washington ClimeTime grants
- Association of Washington Business

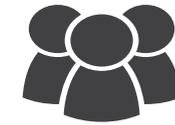
## PNNL's Office of STEM Education

- Evangelina Shreeve, Director
- Karen Kniep
- Ann Wright-Mockler
- Liz Stephens
- Peggy Willcuts (retired)

## PNNL Researchers

- Evan Arntzen
- Frannie Smith
- Huidong Li
- Janelle Downs
- Kyle Larson
- Megan Nims
- Nick Cramer

# PNNL in Washington State



**4,722**  
Employees in WA



**\$1.01B**  
Annual Spending



**265**  
Inventions



**\$1.67B**  
Total Economic Output



**8,200**  
Jobs Generated In WA



Battelle Memorial Institute has managed PNNL since 1965



**Gordon Battelle**  
(1883-1923)

*Translate scientific discovery and technology advances into **societal benefits** . . . for the purpose of **education in connection with** and the encouragement of creative and research work in the **making of discoveries and inventions** . . . to do the greatest good for humanity . . . " - Battelle's last will and testament*

50+ Years

# Developing Goodwill



Decades **\$28.5M**

FY19 **\$0.52M**

Philanthropic  
Investments

**347,000**

**30,000**

Team Battelle  
Volunteer Hours

**>120**

**56**

Community  
Organizations

# PNNL STEM Strategy

## Outcomes

- Build strong foundations for STEM literacy
- Increase diversity, equity, and inclusion in STEM
- Prepare STEM workforce for the future, particularly for DOE

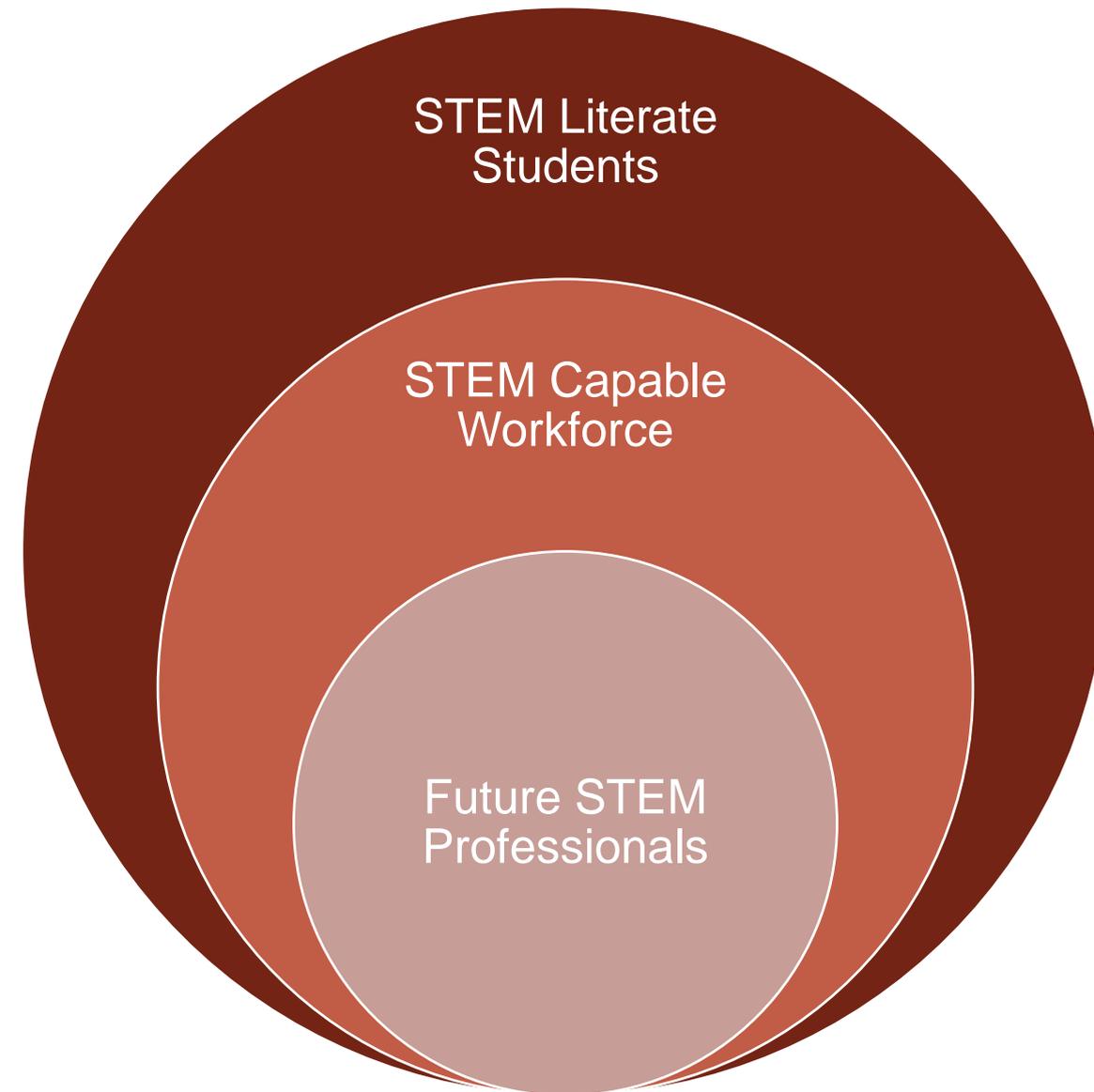
*“Every Career is a STEM Career”*

## Pathways

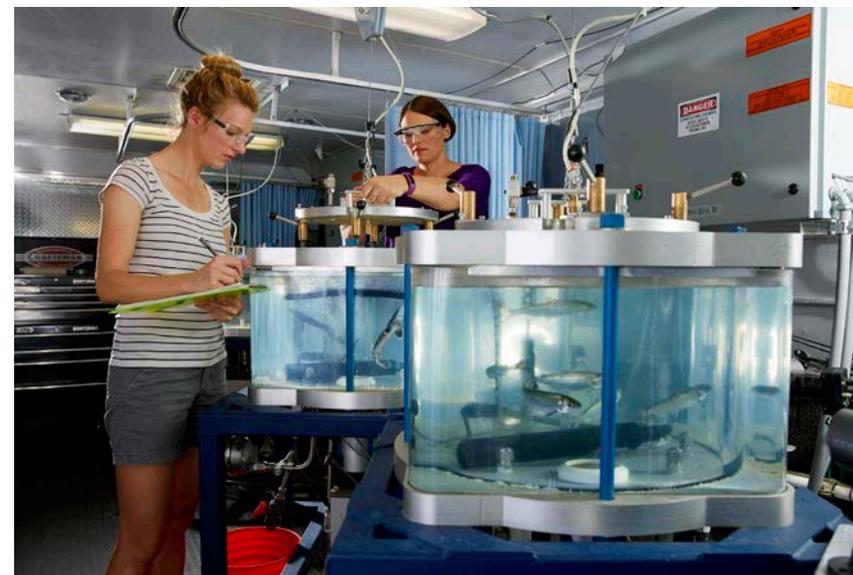
- Develop and enrich strategic partnerships
- Engage students where disciplines converge
- Build computational literacy and STEM capability



# STEM Workforce Development: Increase the number of students pursuing an advanced degree and STEM career pathways; particular emphasis on those historically underrepresented in STEM fields



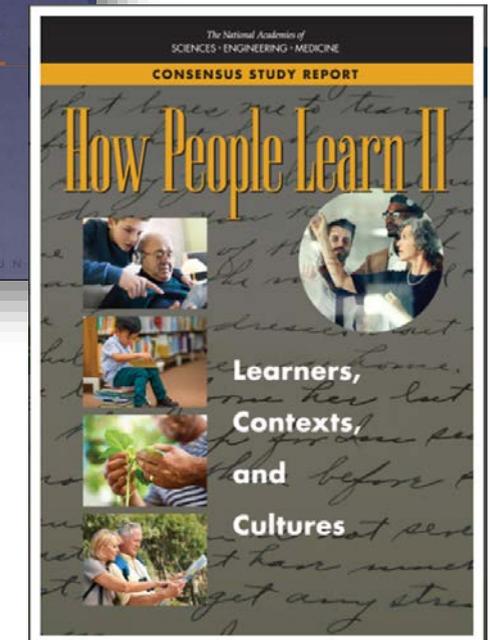
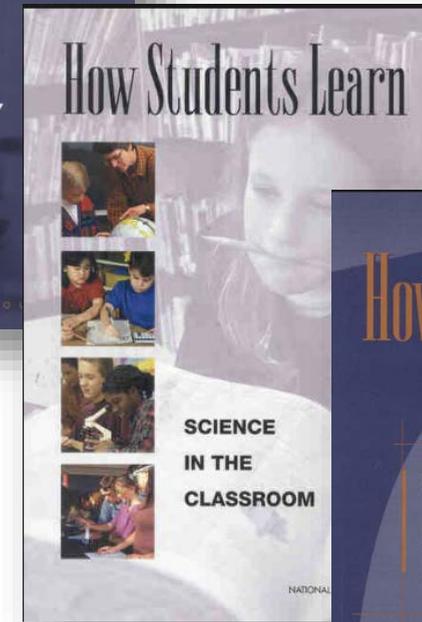
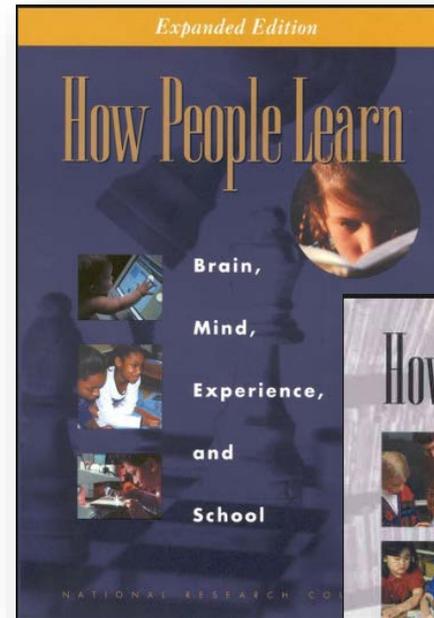
# How do we develop the STEM workforce



# Research on How People Learn is Evolving

## Key Findings:

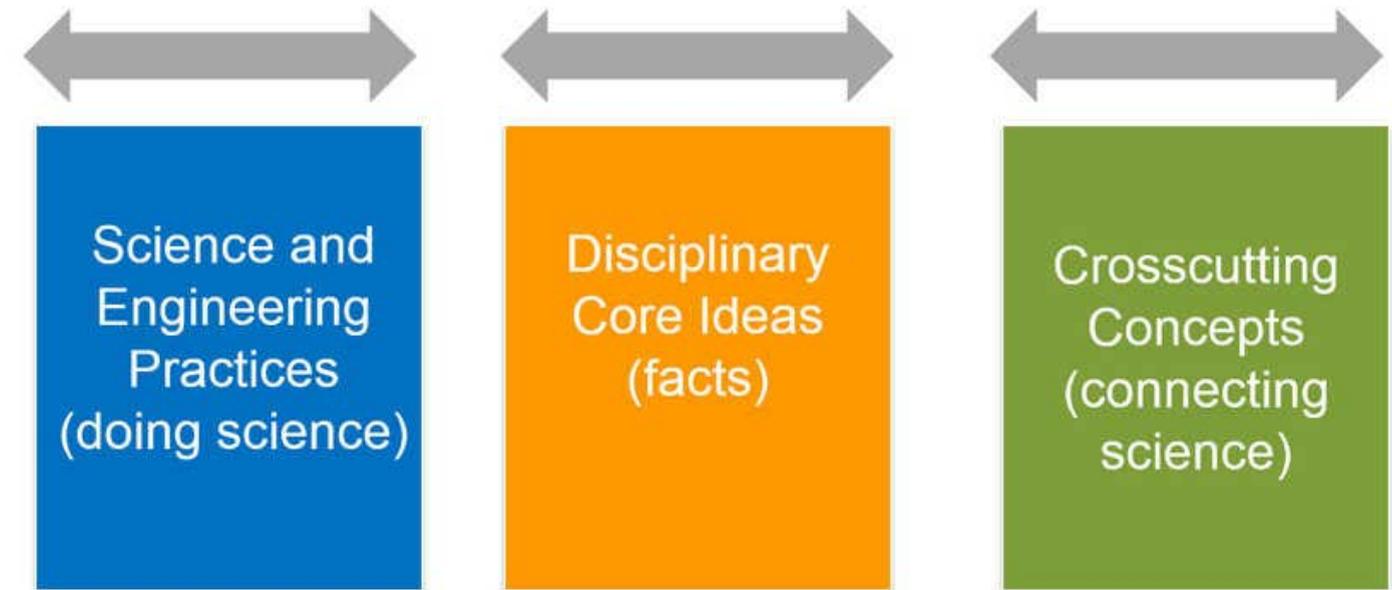
1. Uncover Prior Knowledge
2. Engage Learning/Teaching Using Multiple Senses
3. Access Metacognition/Reflection on New Learning



## Science Instruction is Changing

- New standards reflect how STEM professionals approach their work
- Critical thinking and communication skills are interwoven with content knowledge

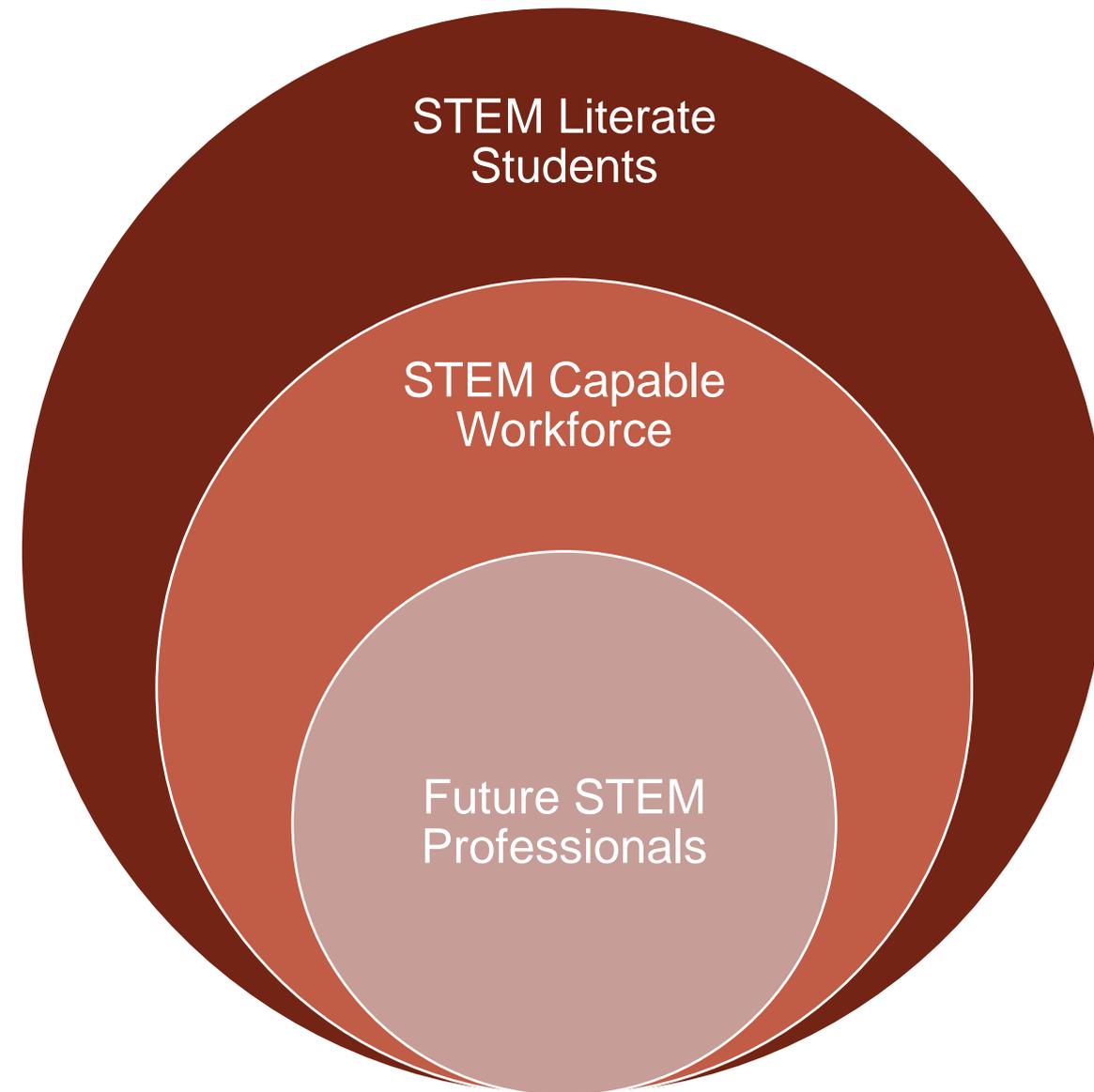
### Next Generation Science Standards (NGSS)



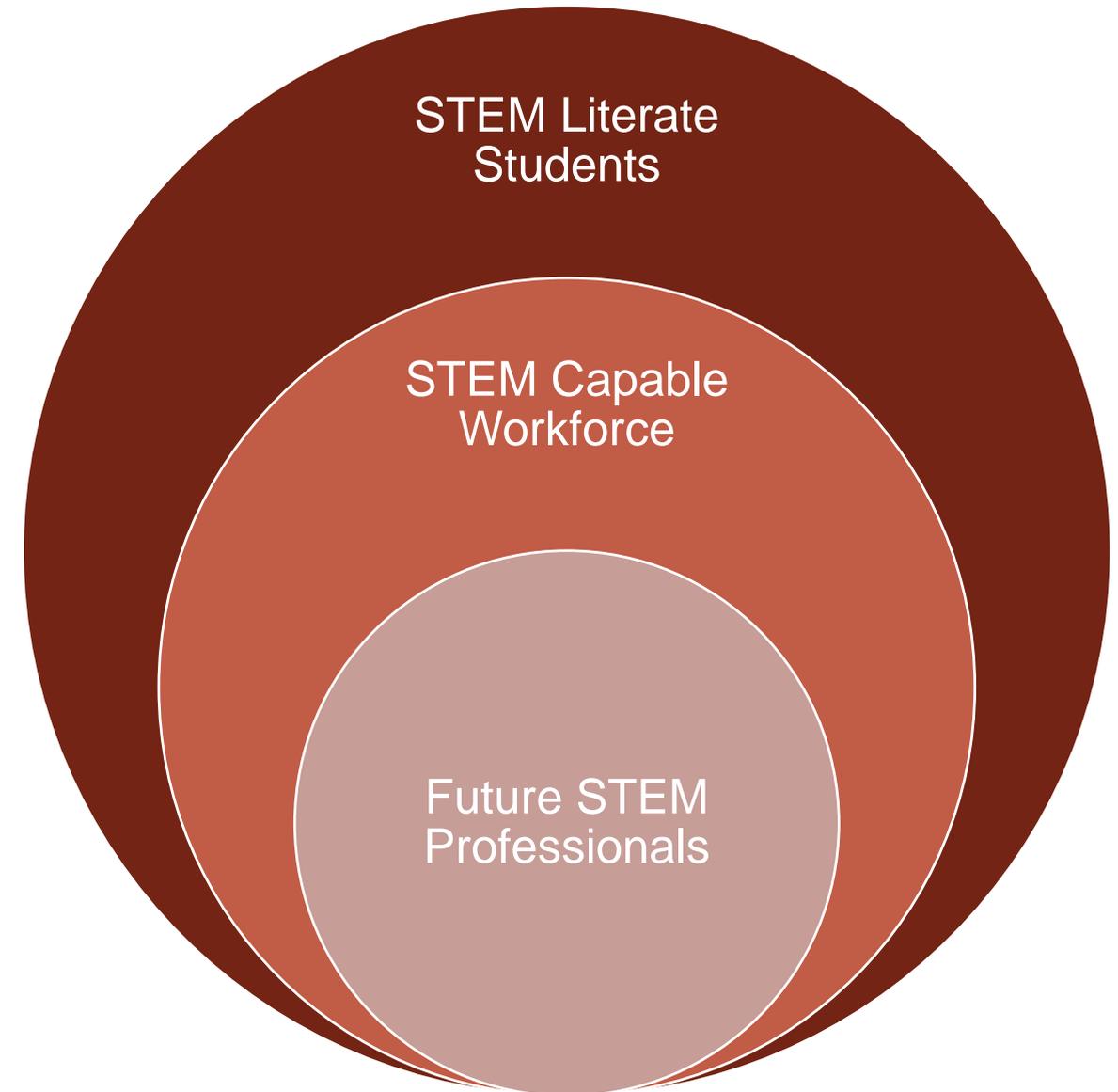
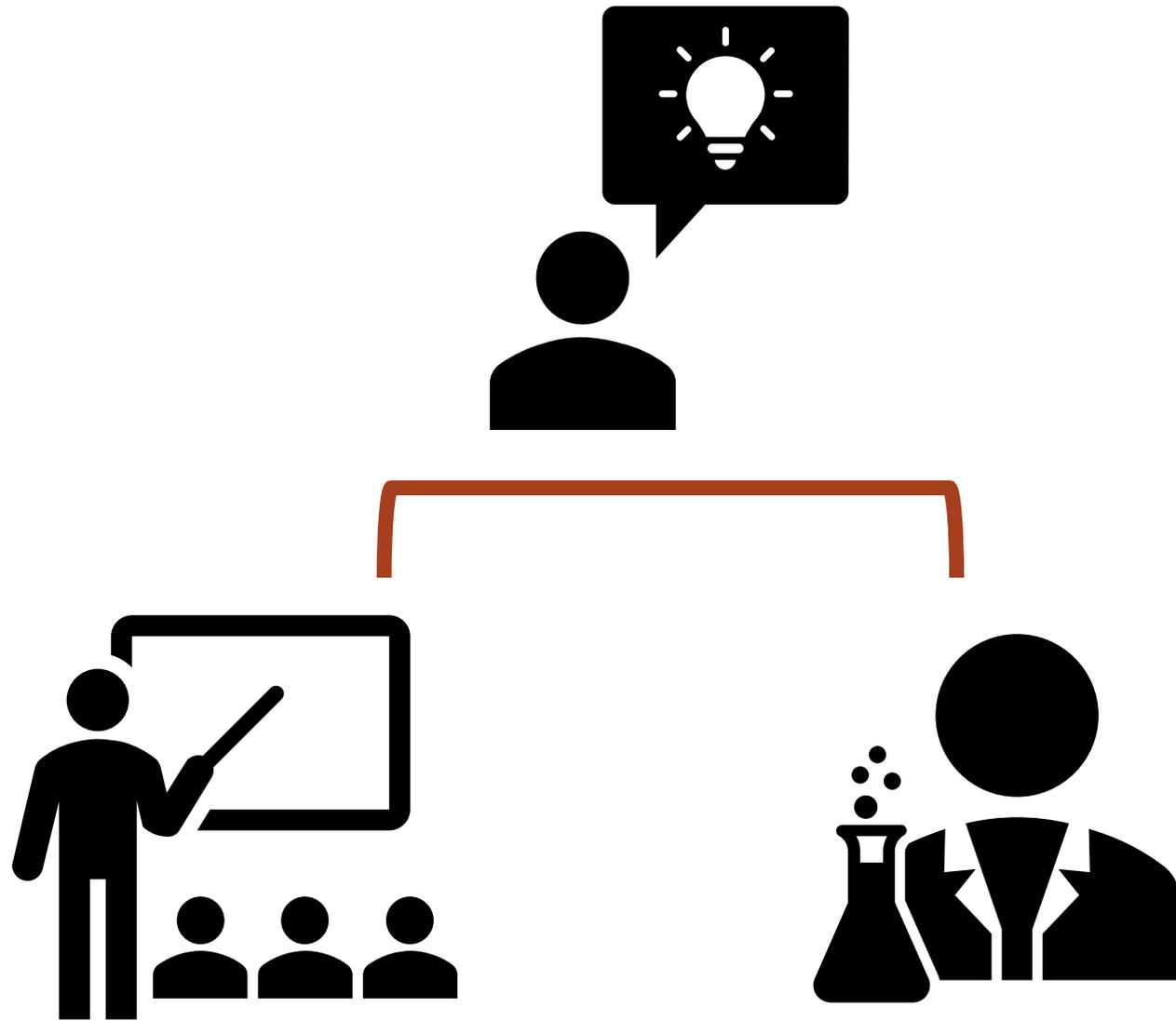
\*  is a registered trademark of Achieve. Neither Achieve nor the lead states and partners that developed the Next Generation Science Standards was involved in the production of, and does not endorse, this product.

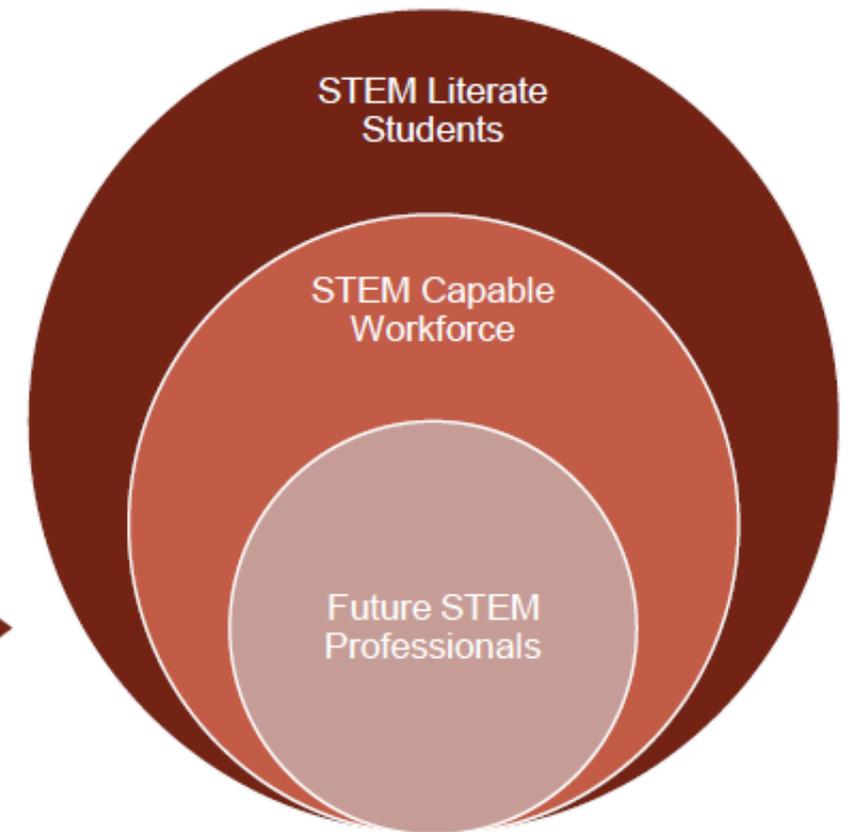
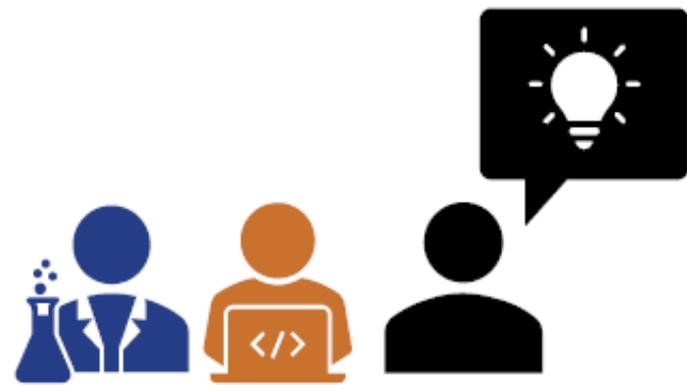
 California Academy of Sciences

# STEM Workforce Development: Increase the number of students pursuing an advanced degree and STEM career pathways; particular emphasis on those historically underrepresented in STEM fields



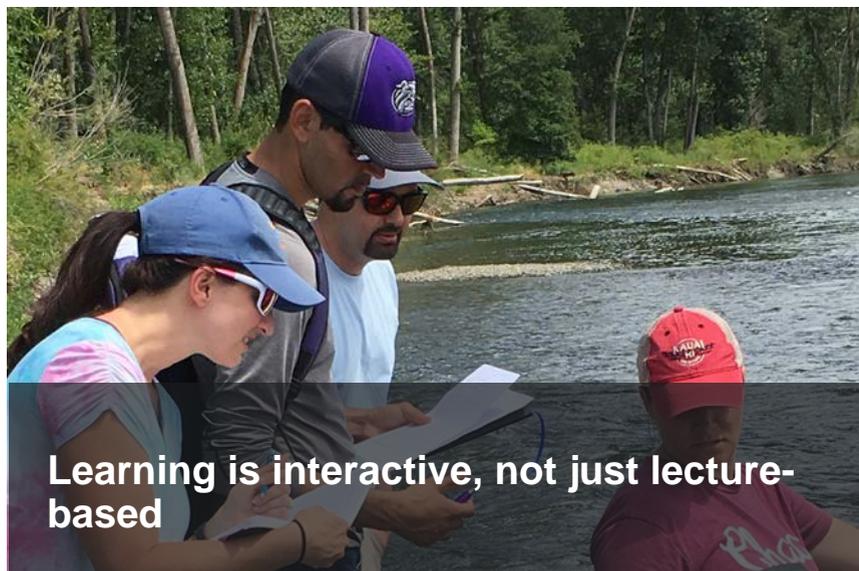
# STEM Workforce Development: Increase the number of students pursuing an advanced degree and STEM career pathways; particular emphasis on those historically underrepresented in STEM fields



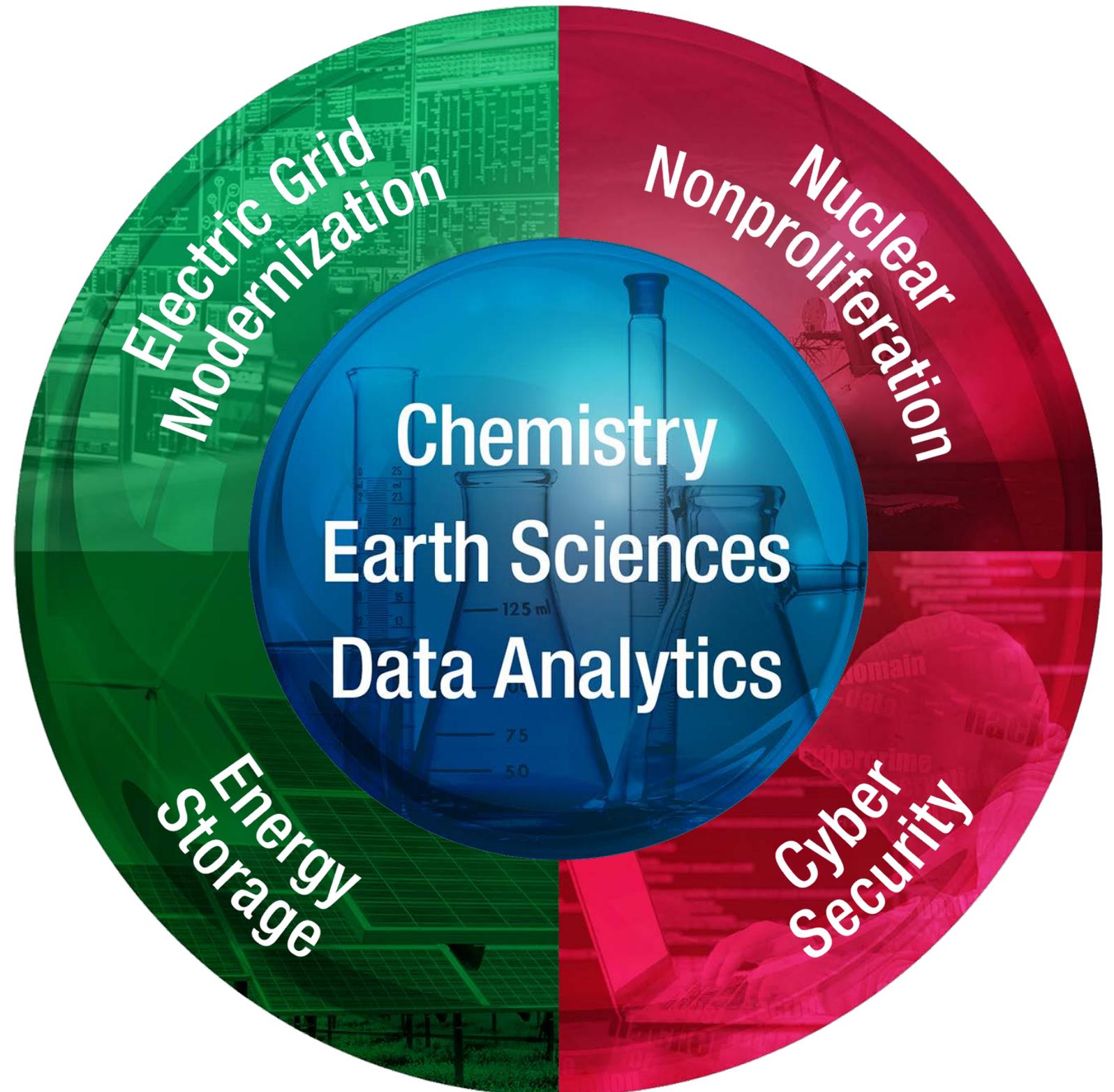


PNNL Researchers + STEM Education Specialists + 12 teachers = 1200+ STEM literate students

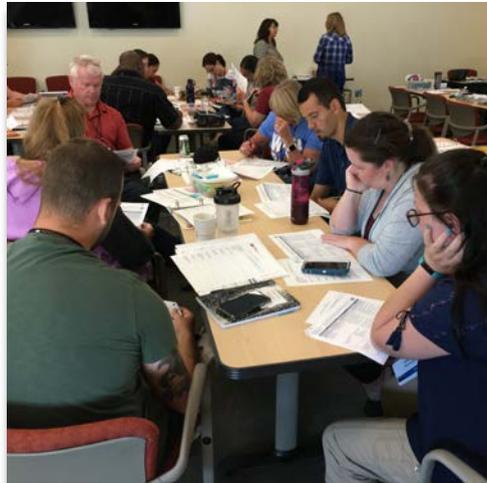
# An invitation for teachers to design a solution to a proposed problem aligned with PNNL's mission



PNNL is addressing  
**complex challenges**  
and providing  
solutions to critical  
**national needs**



# Teacher-Scientist Partnership Activities



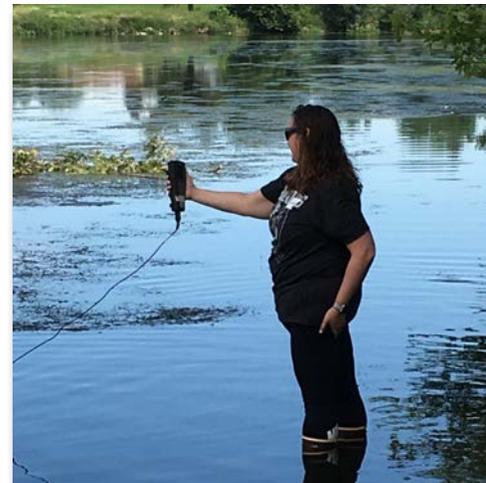
## Monday

- Preparation for the week
  - Laboratory Record Books
  - Collaboration Norms
  - "Learner hat"
- Introduction to scenario



## Tuesday

- Field site visits
- Utilize hands-on scientific tools and techniques to collect data



## Wednesday

- Additional data collection in field and classroom
- Begin data analysis



## Thursday

- PNNL Lab visits
- Data analysis and development of final presentation



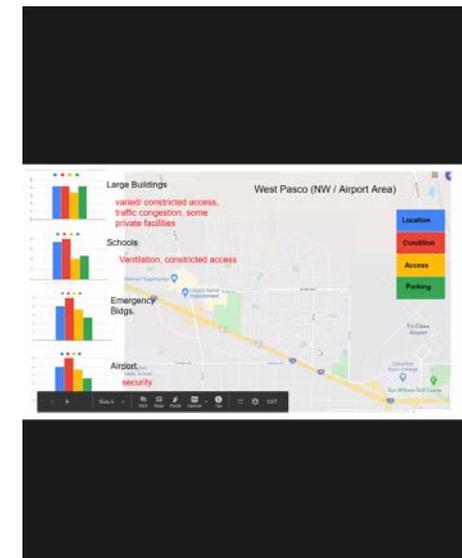
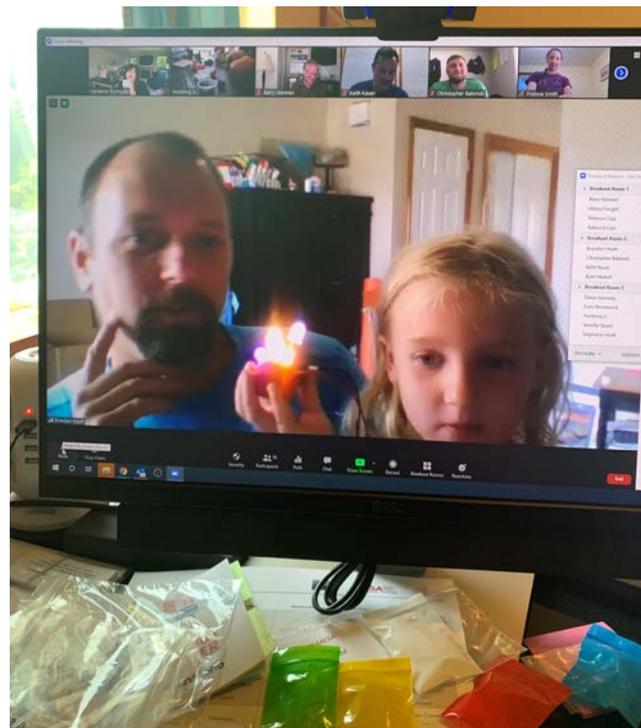
## Friday

- Final teacher presentations
- Reflections on state learning standards
- Development of ideas for classroom impact

# Teacher-Scientist Partnership Activities: 2020 Edition

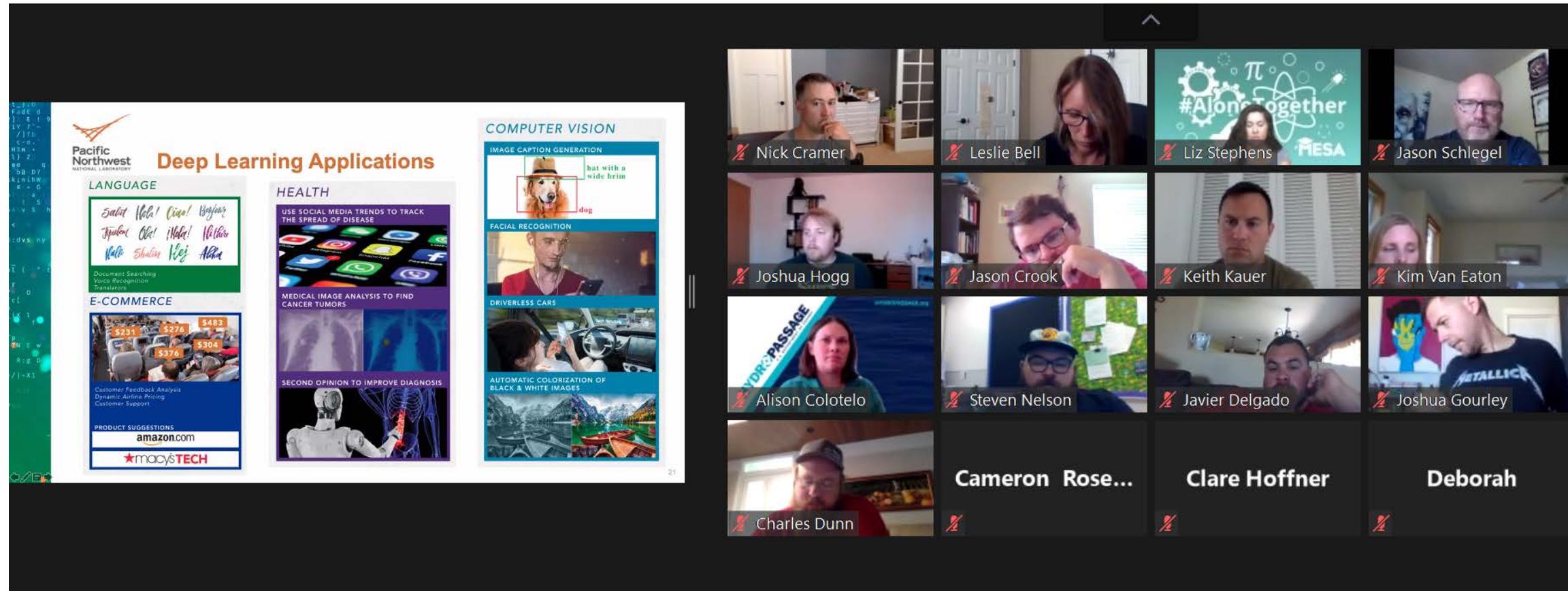


# Teacher-Scientist Partnership Activities: 2020 Edition



# How Did it Go?

*"Best training session I have participated in years - hands on, practical, relevant, meaningful, eye-opening.... The ripple effect will continue!"*



The screenshot shows a Zoom meeting interface. On the left, a presentation slide titled "Deep Learning Applications" is displayed. The slide is divided into three main sections: LANGUAGE, HEALTH, and COMPUTER VISION. The LANGUAGE section includes examples of handwritten text and lists applications like Document Searching, Name Recognition, and Translators. The HEALTH section discusses using social media trends to track disease spread and medical image analysis for cancer tumors. The COMPUTER VISION section includes image caption generation (e.g., "hat with a wide brim"), facial recognition, driverless cars, and automatic colorization of black and white images. The slide also features logos for Amazon.com and macy'sTECH.

On the right, a grid of 12 video thumbnails shows the meeting participants. Each thumbnail includes a name and a red slash icon indicating that their video is muted. The participants are: Nick Cramer, Leslie Bell, Liz Stephens, Jason Schlegel, Joshua Hogg, Jason Crook, Keith Kauer, Kim Van Eaton, Alison Colotelo, Steven Nelson, Javier Delgado, Joshua Gourley, Charles Dunn, Cameron Rose..., Clare Hoffner, and Deborah.

## What are the impacts on PNNL researchers?

*“Activities involving mentoring, outreach, and education have always been some of the most fulfilling work for me as a scientist. Working with teachers to help them prepare the next generation is a really special opportunity, both to assist the teachers and, also to learn from their shared experiences and different perspectives.”*

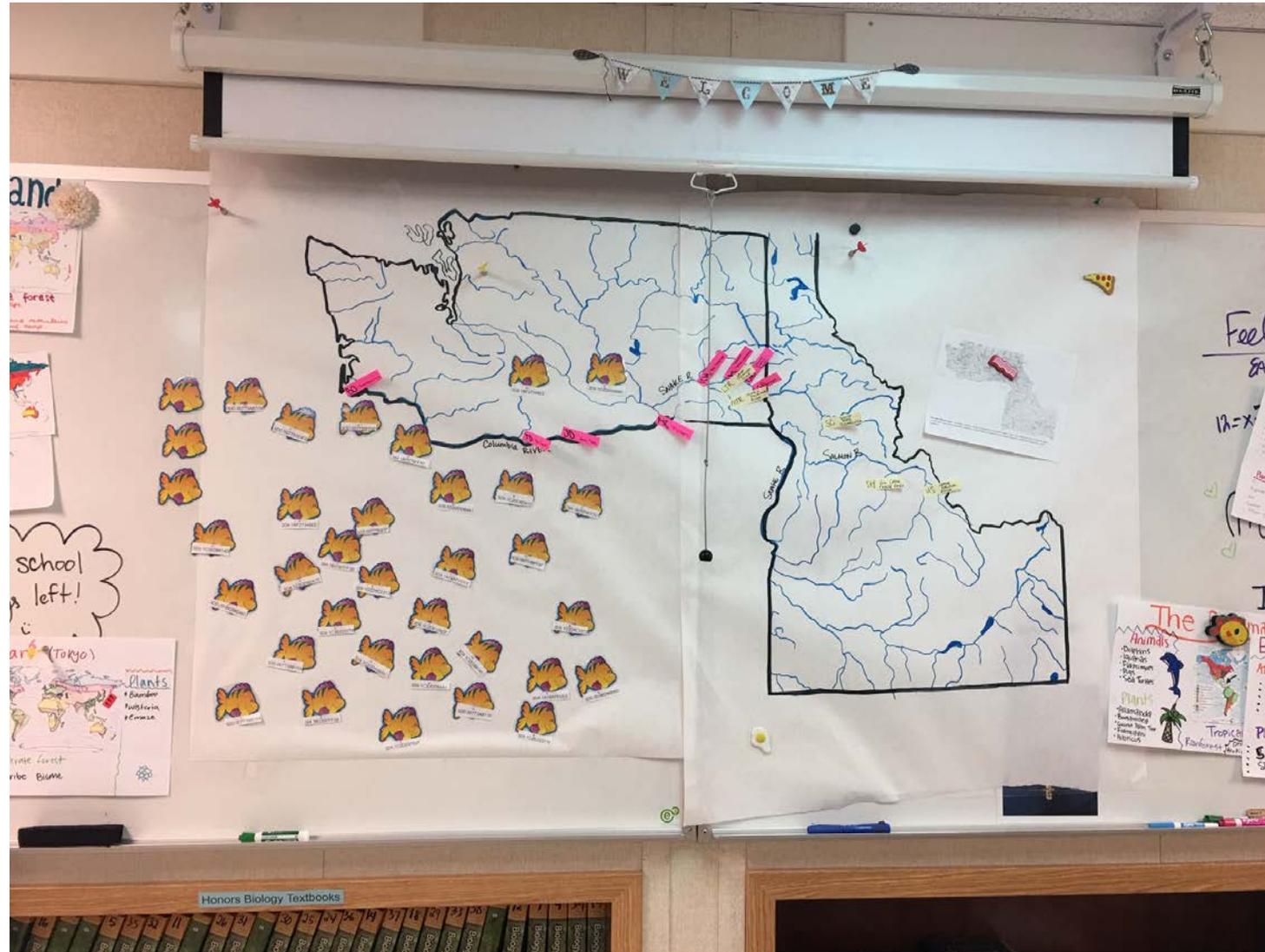
*Evan Arntzen, Geologist*



# What are the impacts on TEACHERS?



# What are the impacts on TEACHERS?



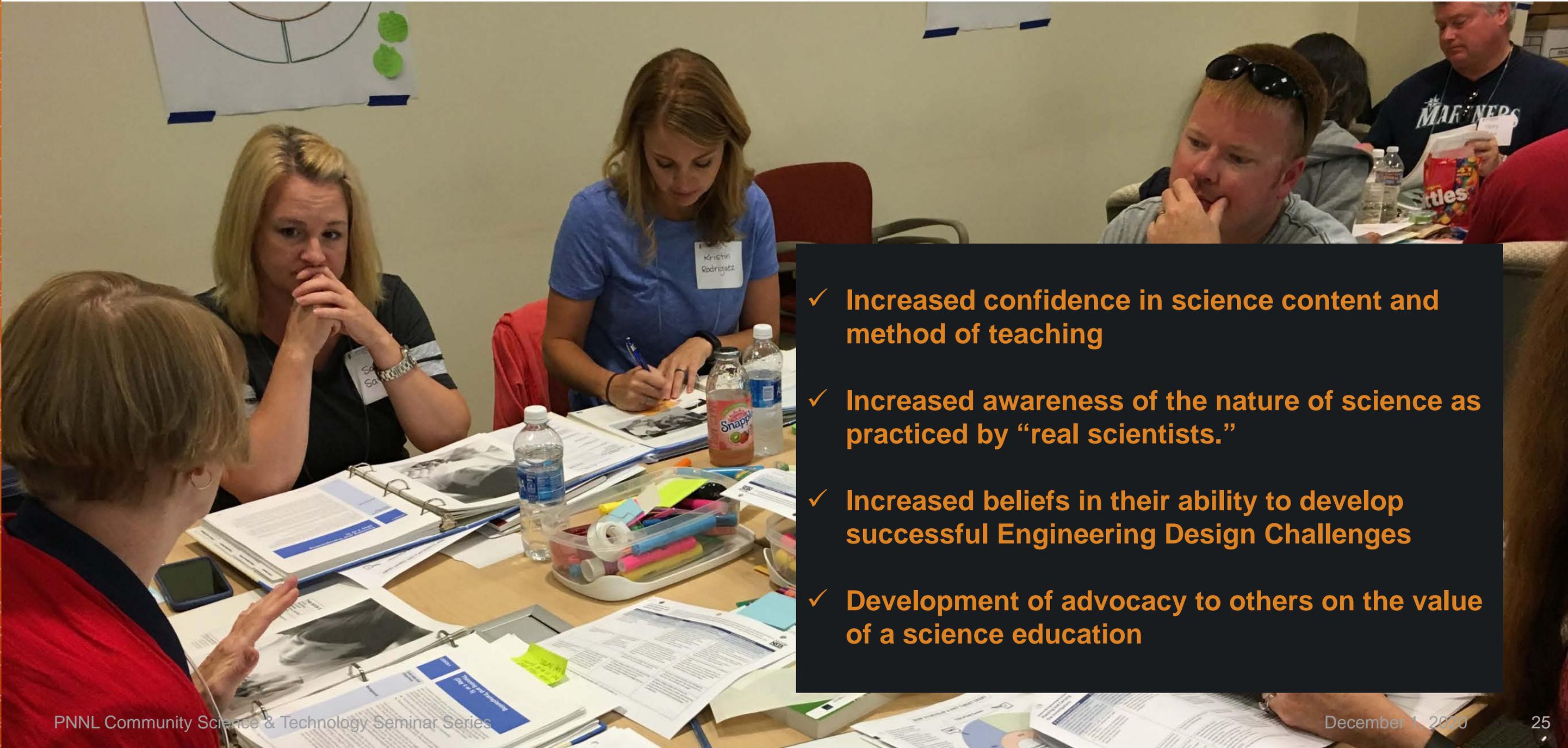
Salmon Story:  
PIT Tag Tracking

PIT Tag ID #: 3DD.00775023F2		Species: Hat. Summer Sockeye
Release date:	Mark length:	Mark weight:
05/08/2014		
Release Site:	Recapture length:	Recapture weight:
Redfish Lake Creek Trap	495	1158

Life Notes

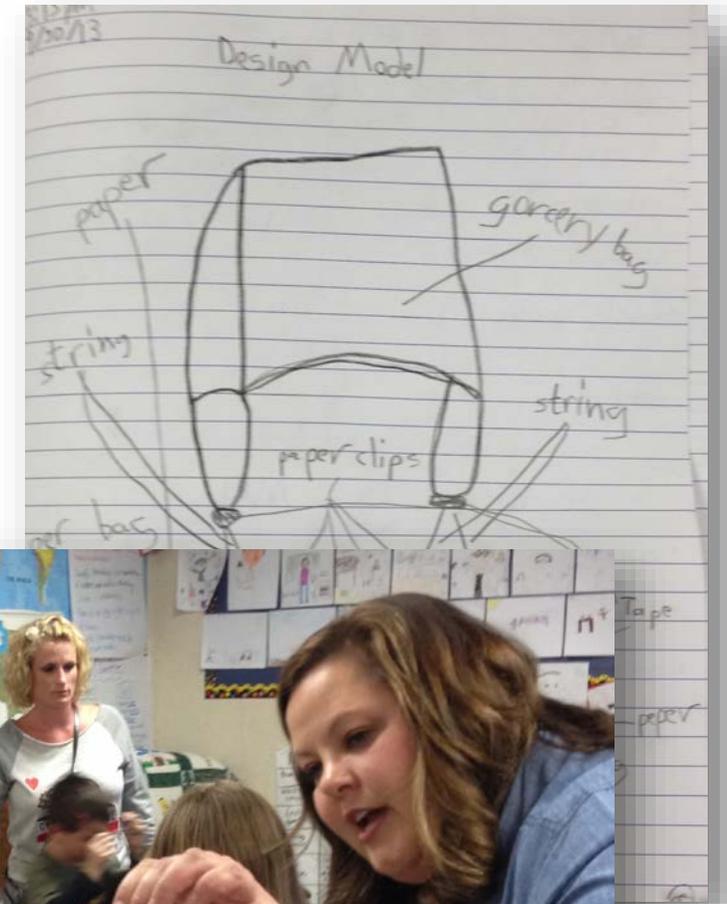
- Lower Granite Dam Juvenile - 5/17/2014
- Lower Monumental Dam Juvenile - 5/20/2014
- Bonneville WA Ladder slots - 6/7/2016
- The Dalles East Fish Ladder - 6/9/2016
- McNary Oregon Shore Ladder - 6/12/2016
- Ice Harbor Dam - 6/13/2016
- Lower Monumental Adult Ladders - 6/14/2016
- Little Goose Fish Ladder - 6/15/2016
- Lower Granite Dam Adult - 6/18/2016
- Upper Salmon River - 7/15/2016

# What are the impacts on TEACHERS?

- 
- ✓ Increased confidence in science content and method of teaching
  - ✓ Increased awareness of the nature of science as practiced by “real scientists.”
  - ✓ Increased beliefs in their ability to develop successful Engineering Design Challenges
  - ✓ Development of advocacy to others on the value of a science education

# What are the impacts on STUDENTS?

- ✓ Improved students' science attitude/confidence toward STEM challenges
- ✓ Connection to “real” scientists through in-person/virtual classroom visits
- ✓ Increased students access to data and tools used in scientific exploration
- ✓ Increased awareness and access to Department of Energy internship opportunities
- ✓ Increased awareness of career pathways that exist at a national laboratory



# Example of Impact on a Student



Dear Miss. Skomurski,  
Thank you for coming to our  
classroom. We are so glad that  
you pickt our clas to come and  
visit and take 2 holl hours of  
your job. You are the best  
scientist ever in the scientist  
world but I mean it you are  
the best there is no one  
who colde bete you at the best  
scintist ever. We are so glad  
you came but so so glad. It is  
so fun meting you for the first  
time. And that was the best  
moment of my life.

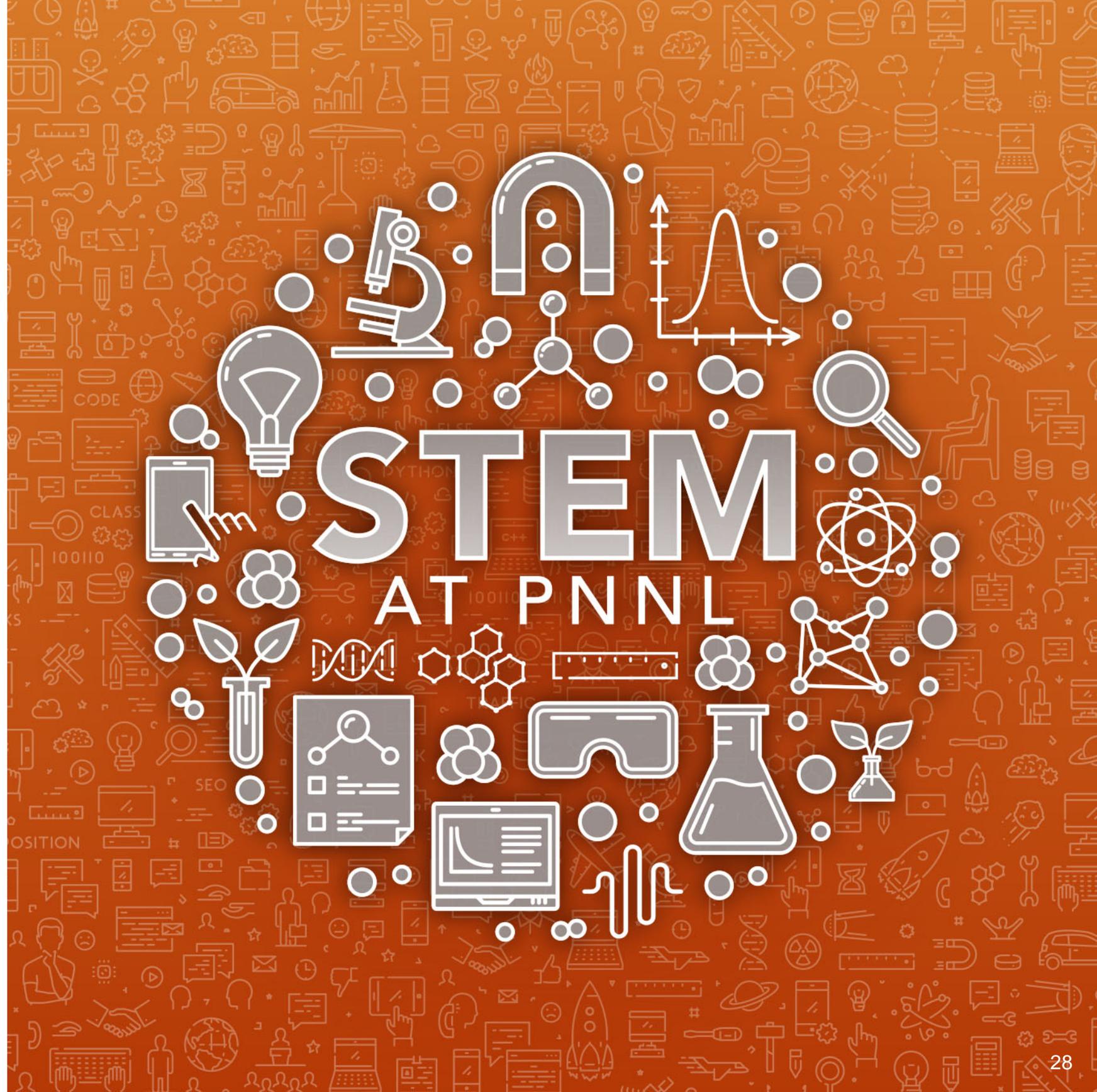
by: Jennifer





**Thank you.**

**[Alison.Colotelo@pnnl.gov](mailto:Alison.Colotelo@pnnl.gov)**

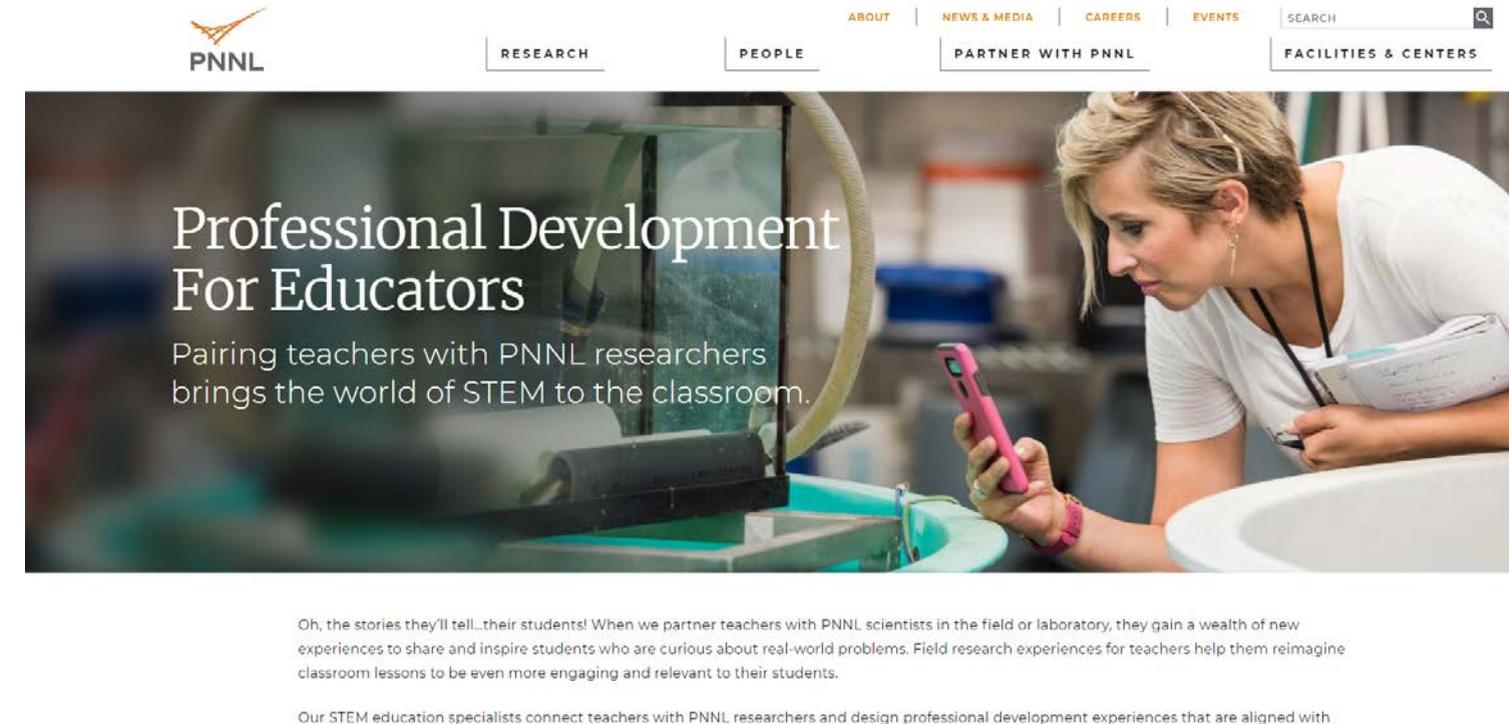


# We value your feedback!

<https://www.surveymonkey.com/r/PNNL120120>

# Interested in joining us?

- <https://www.pnnl.gov/professional-development-educators>



- Interested educators can join our distribution list for future Teacher-Scientist Partnership opportunities here:
  - [STEM.Education@pnnl.gov](mailto:STEM.Education@pnnl.gov)