

Opening the Floodgates of Experiential Learning for Students of All Ages

**Nick Tooker, Todd Brown, Annalisa Onnis-Hayden,
Nels Tooker**

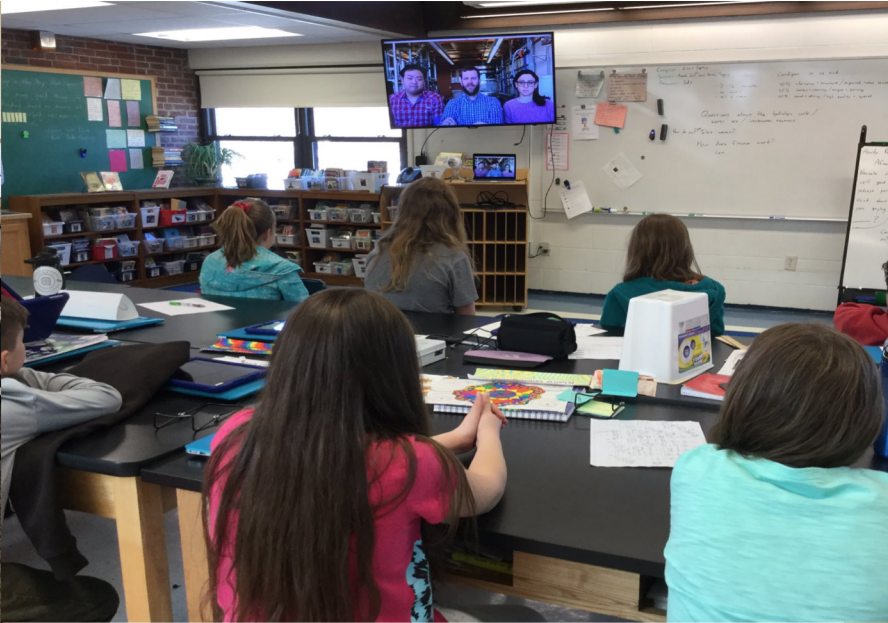
NEWEA Spring Meeting 2019 - Session 9 - Plant Operations
Wednesday, June 5th, 11:00-11:30 am

Outline

- Importance of experiential learning
- Example 1 – Desalination Engineering Project
- Example 2 – Bench-Scale Chemical P Testing
- Example 3 – Interdisciplinary Design Project
- Example 4 – Poo & Brew
- Next steps – Get out there and do it!

Takeaway Message

- Get involved!

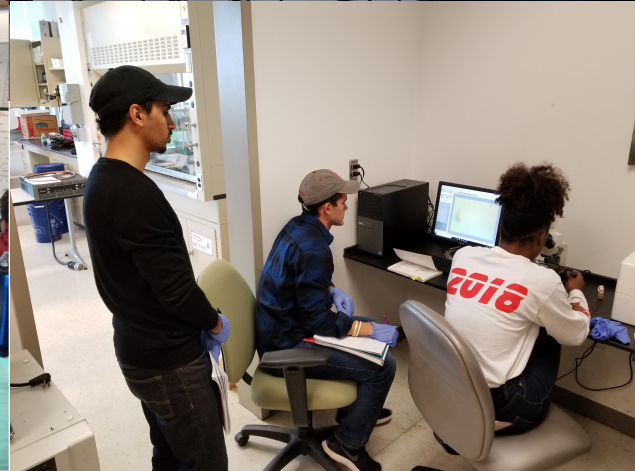
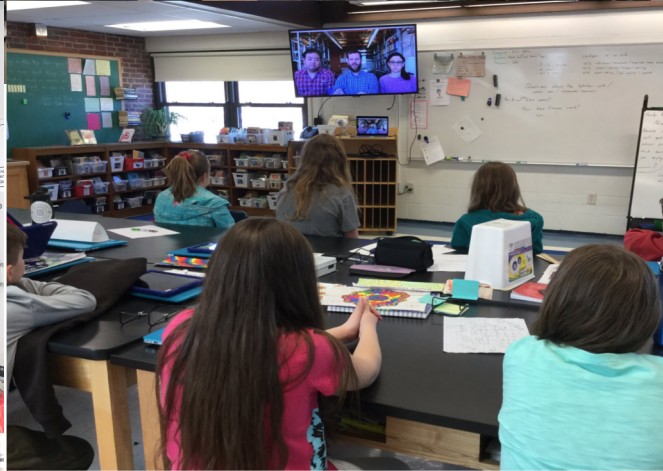
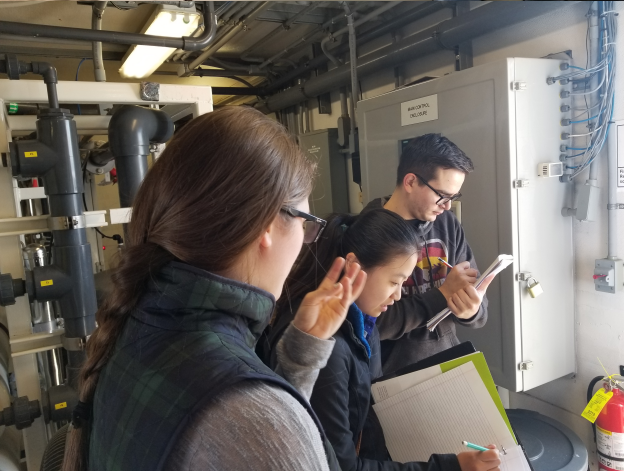


Importance of Experiential Learning

Experiential learning is a "High Impact Practice"

Most of us learned a long time ago that seeing something makes learning easier:

- Tours and hands-on activities are memorable
- Passion is contagious
- Relate classroom knowledge to field implementation
- Spatial visualization
- Listening to operators is an important design skill



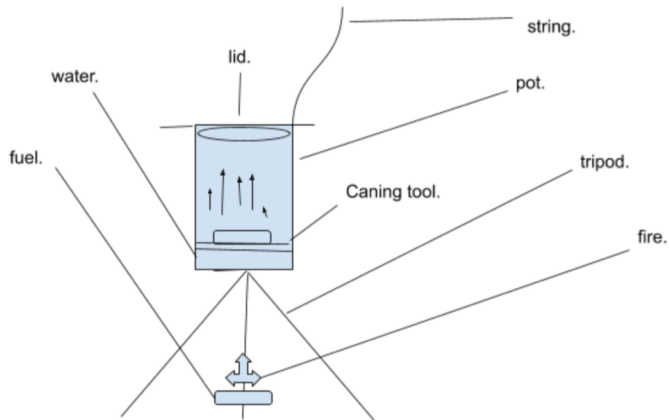
Desalination Engineering for Elementary Students

- The scenario:
 - Survive on a disabled boat/zombie apocalypse with only salt water access
 - Research to create design
 - Use materials that might be found in a fishing boat

Imagine you are stranded on a boat like the fisherman we learned about when we started this unit.

Next, outline your plans here with a drawing or a paragraph. This must be done BEFORE you build.

See inside the pot.

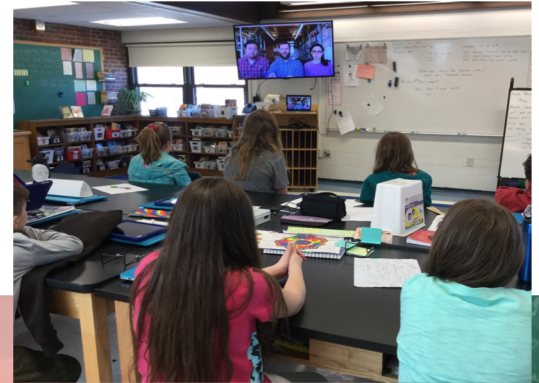


You need freshwater to survive, but the only water around is a vast ocean of salt water. However, you have some supplies in your boat that can help you. Using what you've learned about the science of water, your task is to create a device that can provide you with freshwater.

Desalination Engineering for Elementary Students

- Process:

- Learned about water distribution on Earth using [Mystery Science](#)
- Read aloud book: A Long Walk to Water
- Whole class research into wastewater treatment/ droughts on [Newsela](#)
- Conducted individual and small group research on DIY desalination
- Consulted with expert scientists via Skype



Desalination Engineering for Elementary Students

- Outcome
 - Some groups made variations of solar stills
 - Others boiled water and collected vapor
 - Students taste tested water when finished
 - Reflected on engineering and energy use

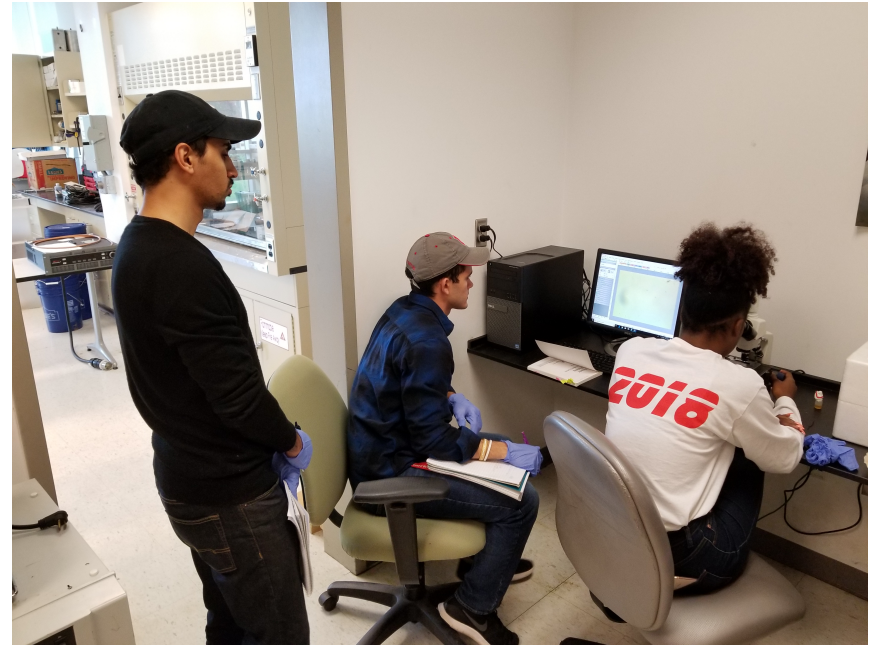


Mr. T's Class @Tooker5and6 · Feb 12
During class we are making distillers. This is mine and Claire's, I hope it works.
Michaela



Water Quality Engineering Lab - Univ of Hartford

- Senior-level course required for all civil engineers
- Semester-long laboratory project
 - Practical
 - Hands-on
 - Field work preferred
- Topics
 - Drinking water
 - Wastewater
 - Stormwater



Laboratory Goals

- High-Impact Practice:
Hands-on learning
- Partner with plant operators
- Project specifics worked out among students, mentors & prof.
- Encourage a deep dive into a narrow topic
- Learn by doing



Example Projects

- State Point Analysis at multiple plants - Woodard & Curran
- Specific oxygen uptake rate testing - Suez
- Ammonia characterization throughout plant - Suez
- Phosphorus profiling throughout plug-flow aeration basin - Suez
- Bench-scale chemical phosphorus removal – Aquarion
- Pump efficiency testing – JK Muir
- Pump and valve cutaways

Bench-Scale Chemical Phosphorus Testing

- Small SBR plant - reported successful bio-P removal
- Modified sludge holding tank operation to thicken - return decant to process
- Effluent P increased
- Speculated P release in anaerobic sludge holding tank
- Could chemical sidestream P removal potentially eliminate need for full-plant P removal in the future?



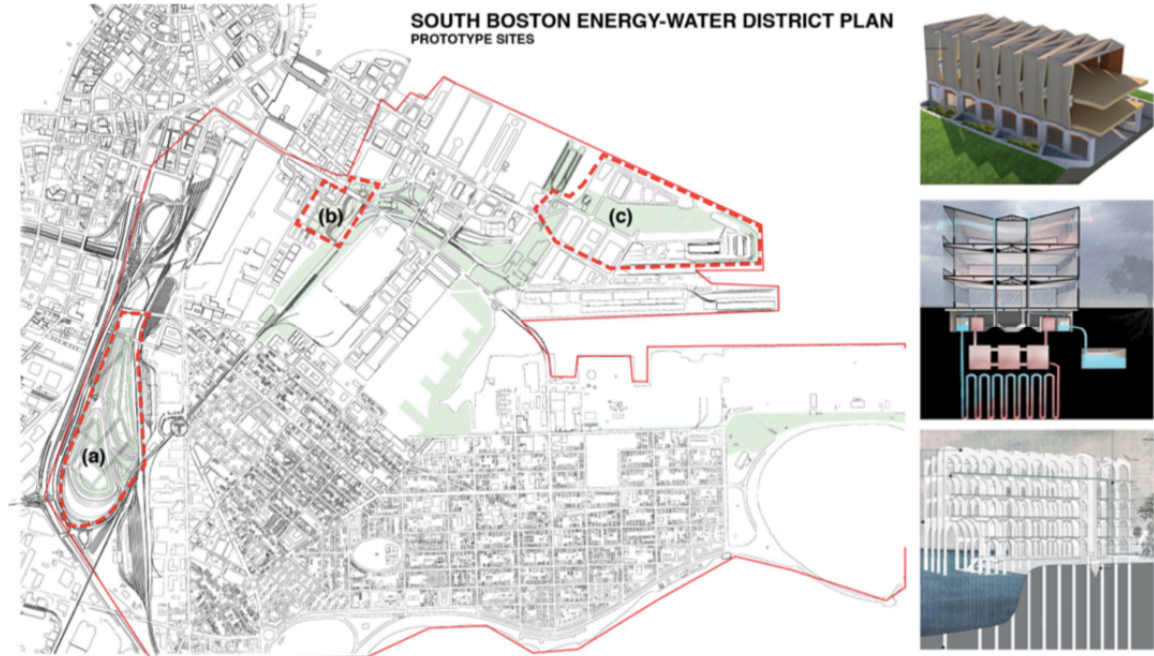
Non-technical outcomes

- Understanding of bio-P and chem-P removal mechanisms
- Challenges of working with limited existing data
- Formulate hypotheses
- Working closely with operators
- Field sampling
- Bench-scale jar tests
- Mass balance (with limitations)
- Communication
- Enthusiasm
- Real!



Interdisciplinary Capstone Design Projects

- Interdisciplinary capstone project with environmental engineers and architects



Interdisciplinary Capstone Design Scenario

- Student teams consisted of 4-5 engineers and 4-5 architects
- Teams given a scenario and paired with an industry mentor
- Frequent meetings to facilitate a cohesive final product

Interdisciplinary Capstone Design Outcomes

- Learned more about their own discipline through collaboration
- Keys for success include engagement between students and mentors
- Students thought differently about problems when working in groups

Poo & Brew Event – Amherst WRRF



- Enlisted one student to help plan the event
- Discussed the value of networking
- Practice interpersonal communication skills
- Online students can meet each other in person

Expanding Experiential Learning Opportunities

Actively seek out opportunities!!

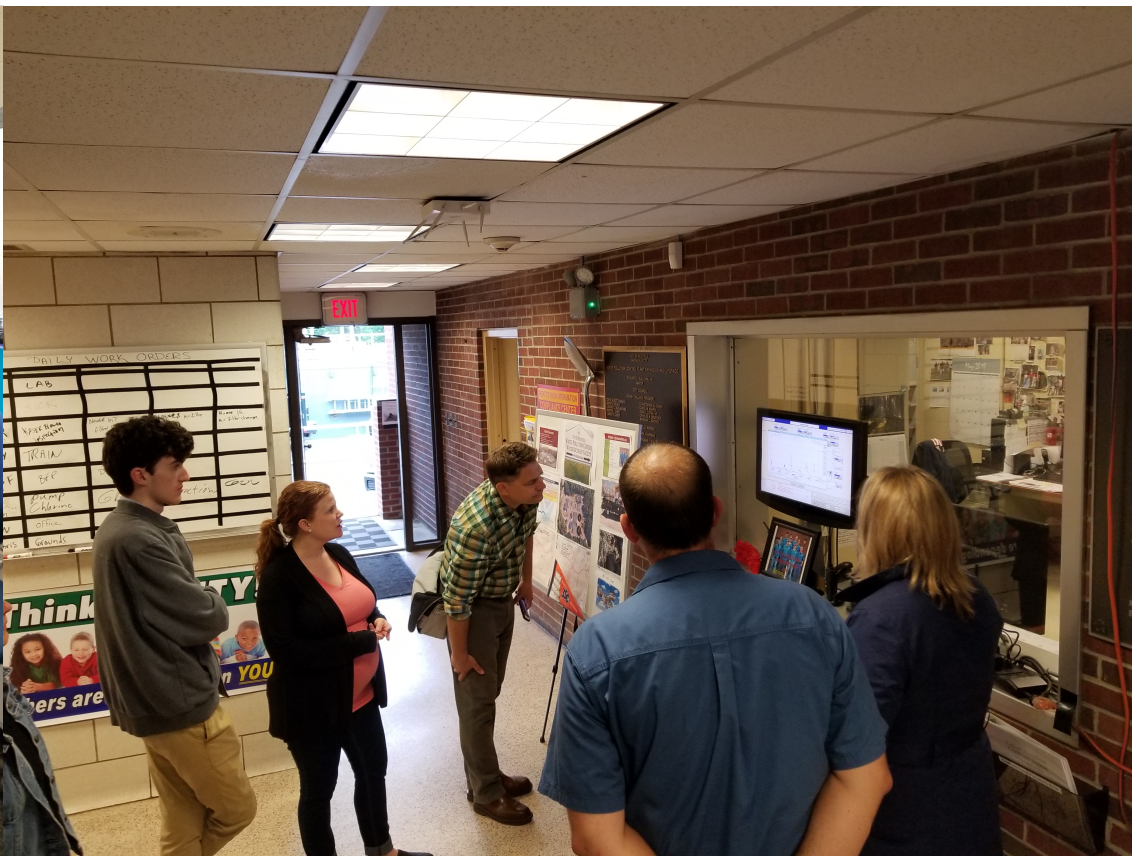
Contact universities, elementary and high schools in your area

Coordinate with NEWEA Committees

Offer to host a field trip or activity

Reach out to provide expertise for projects and samples for research

Thank You!!



Discussion



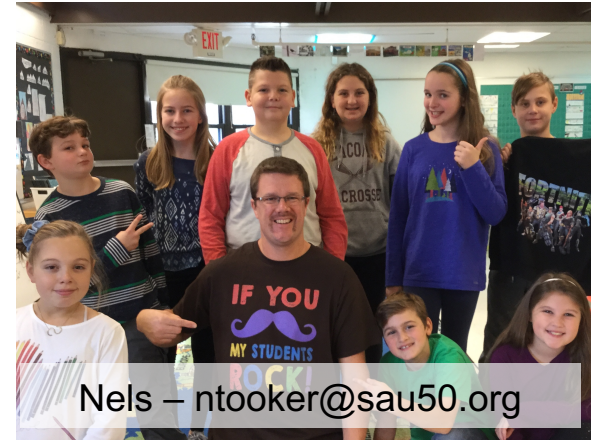
Nick – nbtooker@umass.edu



Annalisa – aonnis@coe.neu.edu



Todd – tobrown@hartford.edu



Nels – ntooker@sau50.org