Hands-On Expertise Meets Theory: Fostering Respect for Operator Knowledge and Collaboration in Water Utilities

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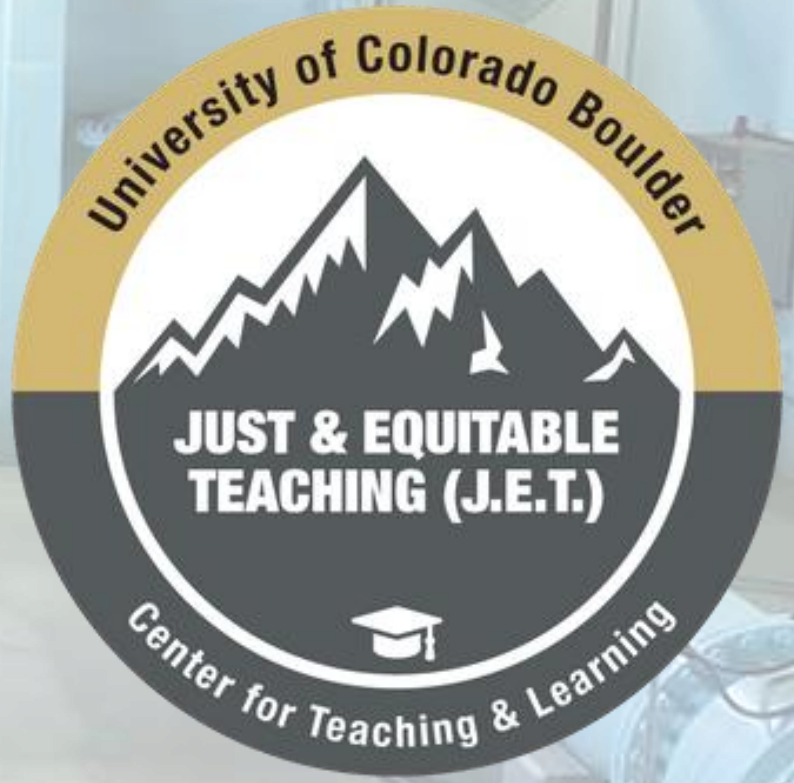
Fall 2024



Power differential between engineers and operators

Engineers

- Earn significantly more
- BS as a minimum
- Educational emphasis on theory and design
- Consultants or more removed from plant
- Decision makers

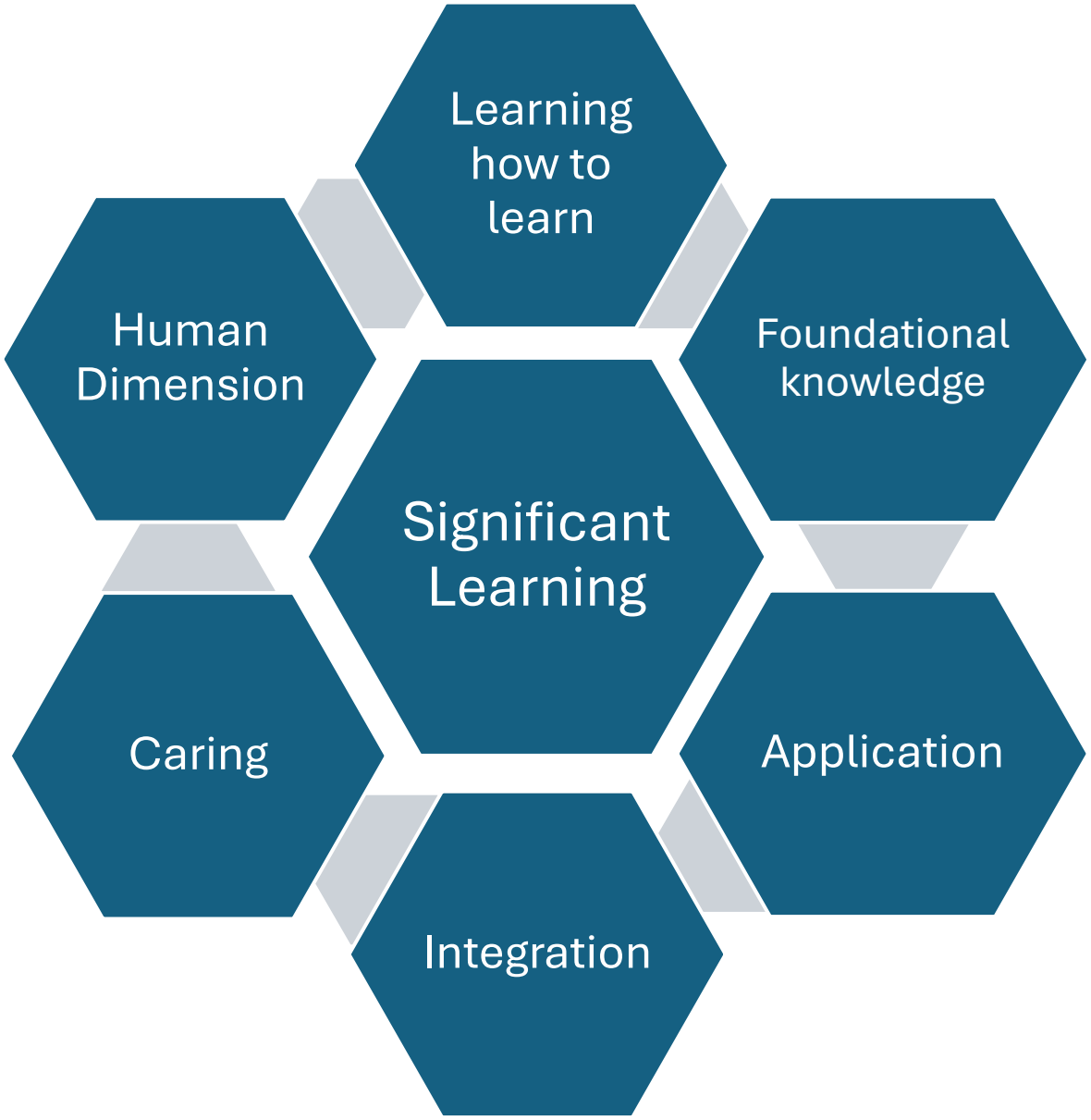
Operators

- Highschool and certificate program
- Training emphasis on hands on problem solving and plant management
- Shift-based work
- Know plant well

“There's always this little **tension**, if you will, between the engineers and the operators. What’s the joke? **The engineers, they know everything**, **but nothing works.** They know all the theories, but it doesn't really work. **The operators are the opposite. You know, everything works, but they really don't know why**”

Fink's Taxonomy

This action plan targets the **human dimension** of Fink's taxonomy with the goal of **building empathy for operators** among environmental engineering graduate students in Drinking Water Treatment class



Fink, L. D. (2013). Creating significant learning experiences: an integrated approach to designing college courses (Revised and updated edition). San Francisco: Jossey-Bass.

Integrating operator experience into curriculum

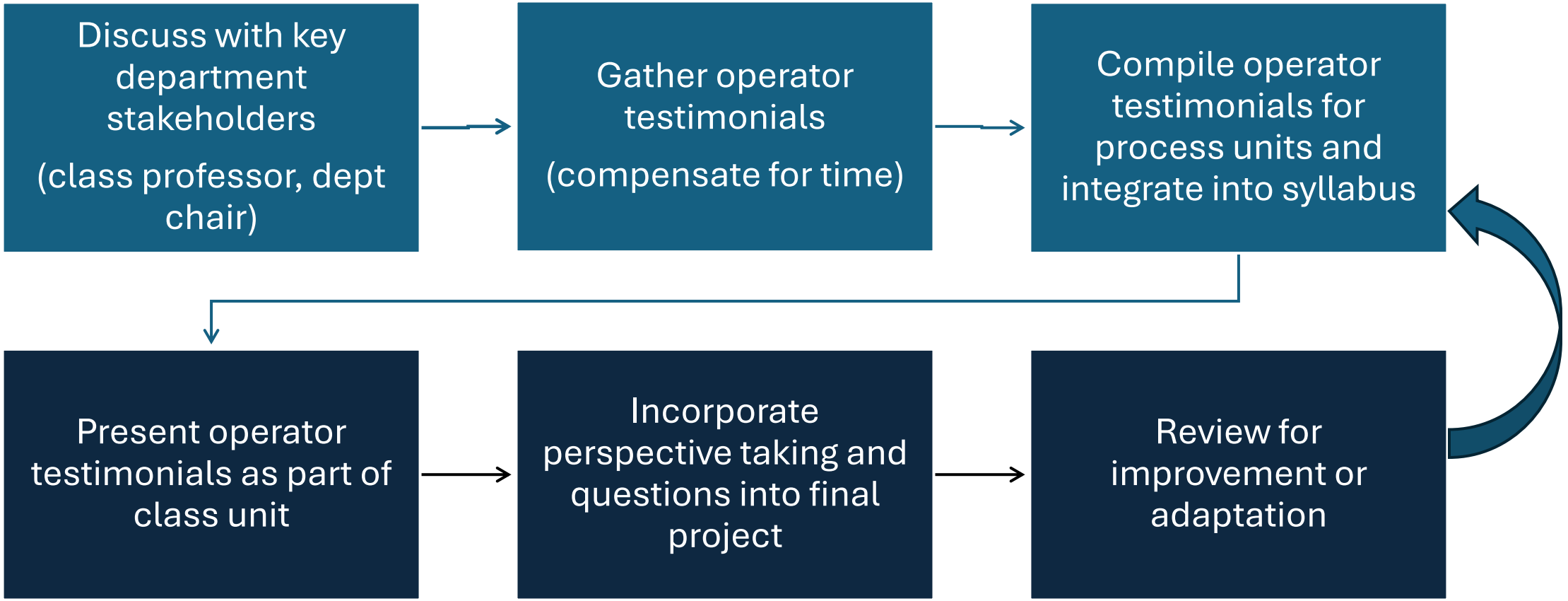
Encouraging students to consider the perspectives of operators

- Operator testimonial on their experience working on each of these processes including.
  - Day-to-day operations
  - Problem solving
  - Incident responses
  - Collaboration with engineers
- Added component in final project on contaminant treatment
  - **Reflective writing taking the perspective of an operator towards their proposed changes**
  - Questions that they would ask operators to about proposed approaches

Schedule – CVEN 5524 – Spring 2022

Wk	Date	Topic	Reading	HW or Quiz	HW due
REMOTE & SYNCHRONOUS					
1	1/11	Introduction overview	Chap 1		
	1/13	Regulations I	Chap 2/handout WQT Chap 1		
2	1/18	Regulations II		Reg paper	
	1/20	Design process/design flow	Chap 3	Quiz 1 Regs	
HYBRID & SYNCHRONOUS					
3	1/25	Disinfection 1	Chap 13/Handout		
	1/27	Disinfection 2			
4	2/1	Disinfection 3			Reg paper outline
	2/3	Organic matter	Readings – WQT Chap 3, CVEN 5404 lec 18 & 26	Quiz 2 Disinfection	
5	2/8	Oxidation – Treatment Project	Handout	Disinfection	
	2/10	Treatability Project - UV	UV Handout/Guest lecture		
6	2/15	DBP formation & Control	Handouts		
	2/17	Adsorption	MPI book Ch 1, 2 and 3		Disinfect
7	2/22	Adsorption		Act. Carbon	
	2/24	Membranes	Chap 8	Quiz 3 Ads	Reg paper draft final
8	3/1	Membranes	Chap 9	Membranes	
	3/3	Air stripping and aeration	Chap 11	Quiz 4 Mem	Act. Carb
9	3/8	Particles/Coagulation	B&L Chap 11 pg 53-62, CVEN 5404 lecture 27, Chap 5.1-5.4		
	3/10	Coagulation		Coagulation	Mem
10	3/15	NOM coagulation	MWH Chap 9, sec 9.5	NOM Coag	
	3/17	Mixing	Chap 5.5-5.6/Handouts	Jar test	Coag
Spring Break					
11	3/29	Jar test lab/Mixing		Quiz 5 Coag	
	3/31	Mixing/Flocculation	MWH Chap 9 sec 9.6 & Chap 5.7-5.10	Mixing	NOM Coag
12	4/5	Flocculation		Flocculation	Jar test
	4/7	Flocculation/Settling		Quiz 6 Floc	Mixing
13	4/12	Sedimentation	Chap 6	Sedimentation	Floc
	4/14	Sedimentation		Quiz 7 Sed	
14	4/19	Filtration - Theory	CVEN 5404 lecture 28, Chap 7	Filtration Theory	Sed
	4/21	Filtration		Quiz 8 Filter	
15	4/26	Distribution System Water Quality & Corrosion Control	Handouts		Filtration
	4/28	Corrosion Control/Presentations			Project
16	Final	Final exam	Comprehensive - Qualitative understanding		

The action plan



Incorporation into classroom and assignments

Present operator testimonials as part of class unit

- At the start of semester have discussion about empathy building through learning about other's roles
- Incorporate testimonials to each class unit

Collect mid-semester feedback

- Gather responses to the following questions:
- Likert strongly agree to strongly disagree
  - Operator testimonials helped me to understand their work
  - Operator testimonials have relevance for my future work
- What feedback do you have on the operator testimonials included in each unit?

Incorporate perspective taking and questions into final project

- Students provide their recommendations for handling a contaminant in drinking water treatment
- Include reflective writing taking the perspective of an operator regarding their recommendations

Collect end of semester feedback

- Gather responses to the following questions:
- Likert scale (strongly agree to strongly disagree) response to
  - Operator testimonials helped me to understand their work
  - Operator testimonials have relevance for my future work
- What feedback do you have on the operator testimonials included in each unit and final assignment?

Discuss with key department stakeholders (class professor, dept chair)	By end of Spring 2025 semester	-Chair: Karl Linden (my advisor) karl.linden@colorado.edu -Professor: Sheldon Masters Sheldon.masters@colorado.edu
Gather operator testimonials (compensate for time)	By end of summer 2025	-Send out request to my current network with drinking water operators as well as Dr. Master's -Testimonials from 3-4 operators
Compile operator testimonials for process units and integrate into syllabus	By end of Fall 2026	-Close collaboration with Dr. Master's -One 5-minute video per process unit
Incorporate into class and final project	Spring 2026	-Mid semester feedback - Final project
Review for improvement or adaptation	By end of Summer 2026	-Review final project for learning -Incorporate feedback and lessons learned into syllabus for next year