

Keywords: Collaborative learning, Technical Writing,
Undergraduate Laboratory



Feedforward Learning Controls Improve Technical Mastery in the Chemical Engineering Undergraduate Laboratory Reports

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Why?

What problem are you solving?

- The Unit Operations laboratory course requires the application of fundamental Chemical Engineering concepts within a substantive and summative written technical report. However, many students are so confused and overwhelmed by the scope and depth of the objectives that they can not identify the vital skills and tools they lack, resulting in poor learning outcomes. A dramatic increase in enrollment in the course demanded changes in the course structure to maintain individualized formative assessment and development.

What are your educational objectives?

- Design and conduct experiments, analyze and interpret data, and ultimately demonstrate mastery of fundamental Chemical Engineering concepts within a substantive and summative written technical report .
- Communicate experimental objectives, theoretical background, design, procedures, problems, solutions, analyses, results, conclusions, and recommendations.

When?

What is the developmental history of your innovation?

Dr. Kimberly Hunter implemented Feedforward Learning Controls in the Unit Operations Laboratory (ECH4404L) in Fall 2015 and Fall 2016. The enrollment in ECH4404L is approximately 75 students. Elements of the strategy were implemented in 2 other Chemical Engineering Undergraduate Laboratory course, Transport Phenomena Lab and Process Control Lab, in Spring 2016.

Where?

Have you tried this in other institutions?

- No. However, this strategy could be integrated into any course that requires students to formulate a unique approach to an open ended problem.

Is this developed for a single class, a full course, or a curriculum?

- Feedforward Learning Controls were implemented in the senior-level core Unit Operations Laboratory Course. The strategy has been/will be extended to other Chemical Engineering undergraduate laboratory courses.

What?

Feedforward learning controls identify “disturbances” in foundational knowledge and facilitates the acquisition of necessary tools and skills prior to the submission of the final technical report for grading. Students receive individual coaching, work collaboratively with peers, and have multiple opportunities for feedback and revision of major technical reports.

- **Formative assessment and practice:** Technical writing skills and data processing and presentation are the focus of in class exercises and assignments.
- **Collaborative learning:** Peer Review assignments provide specific critiques and encouragement.
- **Feedback and Revision:** Mandatory draft submissions to the instructor provide feedback on the report theoretical background and data analysis at draft stages, identifying gross errors and steering students toward the appropriate resources and references to address the draft deficiencies.
- **Resources:** An extensive Online Lab Library, Laboratory Manual and hard-copy Course Reserve provides the tools for tuning student “inputs”.

Prognosis?

How are you documenting impact?

- Individual progress is documented through rubric based assessment of Major Technical Laboratory Reports. Course assessments quantify the semester average performance pertaining to the ABET criteria.

What challenges are you currently facing?

- Balancing the amount and depth of resources provided is a challenge! Students need access to the tools for success, but they must also learn resourcefulness.

What advice would you like from others at FOEE?

- Translating this innovative activity into an Engineering Education Research Study
- Technical Writing Resources
- Assessment tools