Purpose of the Project
This project integrates simulation modules into the curriculum of the new ENVL program to:
• Prepare students for the 4th-year Capstone design projects
• Equip students with skills for entry into industry
Simulation allows Environmental Engineers to make decisions using virtual experiments but must be applied with skill and caution.

Gaps in the Curriculum
• At year’s start, 4th-year ENVL students indicated:
  o Low familiarity with the simulation tools they planned to use for their capstone projects
  o High interest in learning simulation and modelling software
• ENVL Faculty and industry advisors indicated the need for incorporating simulation into ENVL

Student Feedback: Familiarity with Simulations
>75% of 4th-year ENVL students were not familiar with simulation tools they planned to use for capstone at the year’s start

Student Feedback: Interest in Learning Simulation
All 4-year ENVL students expressed that they were interested in learning more about simulations

Addressing the Gap
To address the gap, teaching materials were created to introduce students to: fundamentals of simulation, simulation tools commonly used in Environmental Engineering, guidelines for selecting a software, steps for using simulation tools, limitations of simulation and critical interpretation of results.

Training Materials
Component 1: Simulation principles
• Role of simulation
• Limitations of simulation
• Liability of Engineers conducting simulation
• Commercial Environmental Engineering simulation tools:
  o Database of commercial software tools including their:
    - Basis, capabilities and limitations
  o Decision tree for the selection of a suitable software

Component 2: Software-specific training
• Software-specific training
• Frameworks to document simulation inputs, assumptions and outputs
  Focused on 4 target software tools

Component 3: Best Practices & Real-world topics
• Best simulation practices
• Result checking
• Validation and calibration
• Critical interpretation
• Real-world case studies

Instructor Guide
• Lesson plans
• Strategic integration plan into ENVL courses for all cohorts considering prior knowledge

Example: Software Tools
In component 1, a database is created to include a wide range of Environmental Engineering tools covering: process (thermodynamics, biochemical), hydraulics, hydrology, air quality, energy and resource management

Example: OLI Flowsheet
OLI Flowsheet is an electrolyte thermodynamic process simulation tool. The image shows an example of OLI Flowsheet simulations may look like for a seawater desalination system.

Students learn: software capabilities (databases), role of the simulation (desired outputs), how to build the simulation (inputs & assumptions), best practices, limitations, critically interpreting results, Engineer’s liability

Phase 1 – Implementation
The materials created through this project have been partially integrated into various ENVL courses (ENVE 200, CIVL 204, ENVE 202, ENVE 401) which will continue.
The effectiveness is being evaluated through:
• Student surveys
• Student learning and knowledge assessment
• Student work placement
• Instructor and Academic Assistants reports

Preliminary outcomes: As an outcome of integrating materials into the capstone design course (with 6 capstone design groups) in 2023:

Phase 2 – Next Steps
Phase 2 aims to further implement the materials created during Phase 1 in additional courses, assess impact, collect feedback and refine the developed materials. It also aims to strengthen the real-world component, including case studies.

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