

# HydroLearn: An online platform for collaborative development and sharing of active-learning resources in hydrology education

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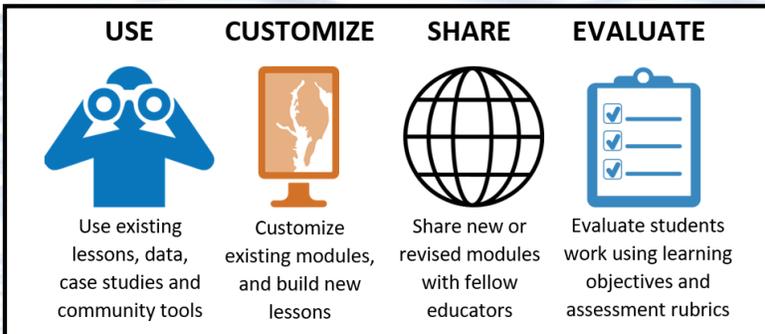
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## Abstract

This study reports on the development and implementation of the HydroLearn online platform that supports active learning in the field of hydrology and water resources engineering. The platform is designed to serve the following two main purposes: to enable instructors to collaboratively develop and share active-learning resources, and to enhance student learning in fundamental and emerging topics in the field (e.g., rainfall-runoff processes, design of flood protection measures, flood forecasting, water-energy-food nexus). Using open-source technology, the HydroLearn platform supports customization of pre-developed learning modules and allows instructors to share components of their learning resources with other interested users. HydroLearn is inspired by the need to address challenges in adoption, scalability, and sustainability identified by research on educational innovations. HydroLearn utilizes research-based active learning methods (e.g., Problem-based Learning; Collaborative and Cooperative Learning) to create authentic online learning modules. The modules engage students in real-world hydrologic problems and provide unique opportunities to expose undergraduate students to modern hydrologic analysis tools that are at the forefront of hydrologic research and engineering practice. The platform includes tools that scaffold instructors' implementation of sound pedagogical practices. The platform includes wizards and pre-populated templates on how to develop student-centered learning outcomes that ensure constructive alignment with the learning content. The platform also includes guidance for instructors on how to develop assessment rubrics to enhance student achievement through communicating the expected performance levels. The study will also share results on the implementation of a pilot learning module on flood protection. Thirty-six undergraduate students were surveyed before and after the implementation to determine their level of learning engagement. The survey measured their skills engagement, emotional engagement, participation, and performance engagement. The presentation will also report on efforts to engage the community through a fellowship program that aims to develop a network of educators who aspire to adopt active learning approaches and enhance hydrology education.

## What is HydroLearn?

HydroLearn is an educational, web-based platform that enables instructors to collaboratively develop, share and adopt active-learning resources in hydrology and water resources engineering.



## How?

- Help instructors develop pedagogically sound learning objectives and resources
- Share and collaborate in the development of learning content
- Allow others to use your learning content and draw upon the learning content of others

## Audience?

- Instructors for college level undergraduate and graduate students
- Subject areas are hydrology, hydraulics, water engineering, water resources, watershed science

## How to get involved?

- Visit our website, [www.hydrolearn.org](http://www.hydrolearn.org)
- Explore existing modules on various hydrology topics
- Adopt a module in your course

## Do you want to contribute new content to HydroLearn, or adapt existing resources?

- Apply to become a HydroLearn Fellow by scanning this QR code
- Or go to our website, click blog, then the fellowship application post



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## WHAT IS HYDROLEARN?

An open source, online platform that is a living repository of digital active learning resources guided by evidence-based pedagogical best practices

## OBJECTIVES

### Primary objective?

- Promote problem based and active learning in Hydrology and Water Resources

### How do we get there?

- Support instructors to develop pedagogically sound learning objectives and frame learning material to achieve those objectives
- Share and collaborate in the development of learning content
- Allow others to use developed learning content and draw upon the content of others

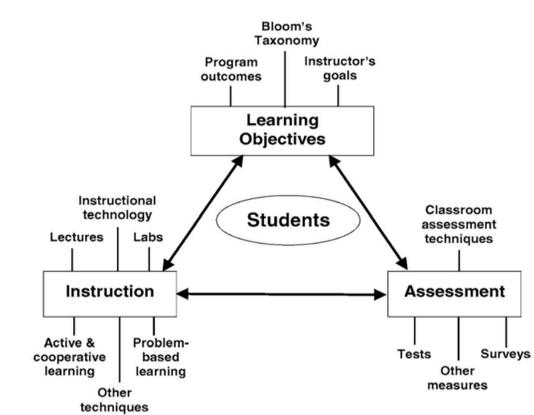
### Our audience?

- Instructors for college level undergraduate and graduate students
- Subject areas: hydrology, hydraulics, water engineering, water resources, etc

## STUDENT CENTERED LEARNING

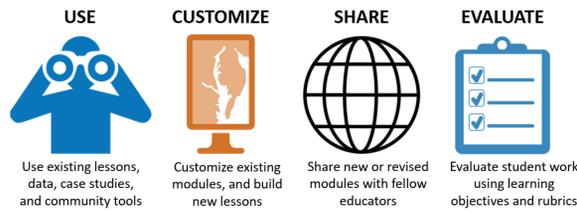
HydroLearn challenges traditional instructional methods by promoting more effective techniques of educating tomorrow's engineers:

- Instruction is tailored to our discipline
- Students demonstrate they have the knowledge and skills they are expected to learn
- Students have the flexibility to learn anytime and anywhere



Felder, R.M., Brent, R. (2003). "Designing and Teaching Courses to Satisfy ABET Engineering Criteria." *Journal of Engineering Education*, 92(1), 7-25.

We want to enable instructors to use, customize, develop, and share active-learning innovations, and alleviate existing barriers against sustained adoption.



## INSTRUCTOR SUPPORT

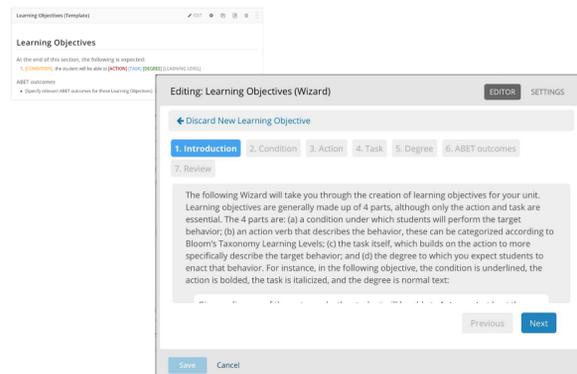
### Research-based pedagogical practices

HydroLearn combines active learning techniques with authentic online modules and tools to support implementation of sound pedagogical practices.

Pedagogical Practices	Tools to Support
Active Learning	Variety of components/content Learning Activity template
Authentic Learning	Problem-based Integration with external tools and apps
Set clear and high expectations for learners	Learning Objective Wizard/Template Rubric Template Connect to Bloom's Taxonomy and ABET student outcomes

### Learning objective tools

Support instructors in developing clear, concise learning objectives



Objectives can support new ABET/ASCE outcomes:

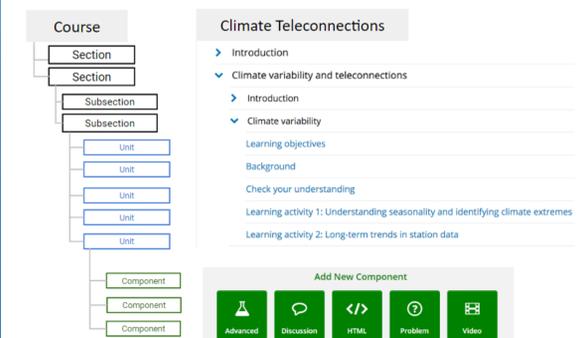
An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

## PLATFORM ATTRIBUTES

### Platform design

HydroLearn is designed in a modular and hierarchal way based on the following criteria:

- Enabling interoperability and integration with well-established data sharing and publishing tools developed by the hydrologic research community
- Supporting customization so that faculty users can create their own content modules
- Enabling collaboration, sharing, and contribution of learning content with an open-source approach.



### The four C's of sustainability

#### Contributing:

- Share an entire course with other instructors
- Clone existing courses

#### Collaboration:

- Add collaborators to your module

#### Customization:

- Customize course elements within and across different modules
- Other instructors can customize your course for their needs

#### Compatibility:

- Expose your module contents on your own Learning Management System

### Types of Content

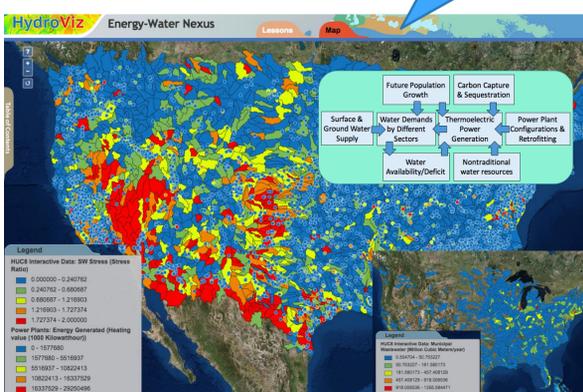
- Text editing
- Pedagogical support
  - Learning Objectives
  - Rubrics
- Embedding Apps
  - Checkbox
  - Dropdown
  - Multiple Choice
  - And more!
- Videos
- Discussion

## SEED MODULES

### Illustrative seed learning modules

- Rainfall-Runoff-Streamflow processes
- Design of flood protection measures
- Water-Energy-Food Nexus
- Twelve seed modules
- Other contributions welcome!

### A few examples...



Analysis of Water Stress across the United States

EOS Earth & Space Science News

New Online Tool Teaches Students About the Energy-Water Nexus

Hydrologic Design using HEC-HMS: Beau Bassin Watershed, LA



#### Problem:

- Flash flooding in urbanized area of Louisiana
- Design of flood protection infrastructure to protect from impacts
- Based in Carencro, LA

#### HydroLearn Appeal:

- A problem typical of what engineering hydrologists face
- Learn by doing the hydrology for the design
- Introduce essential subject matter "Just in time" in the context of solving the problem
- Exposure to industry tools

## PILOT LEARNING MODULE

Surveyed 36 undergraduate students doing HydroViz Dry Canyon Module (2018) using a Student Course Engagement Survey:

Time 1: Just before implementation of module

Time 2: Just after implementation of module, right before finals

Means, Standard Deviations, and Difference Testing (n=36)		
	Time 1	Time 2
Skills	3.88 (0.51)	4.01 (0.63)
Emotional	3.54 (0.58)	3.77* (0.69)
Participation/Interaction	3.11 (0.76)	3.50** (0.72)
Performance	3.86 (0.75)	3.81 (0.90)

## FELLOWSHIP PROGRAM

### Purpose

- Support in learning about active learning and problem based learning pedagogy
- Support in implementing these principles into modules
- Collect data on use, issues, etc to inform improvements to the platform
- Support and monitor data collection



## WANT TO (HYDRO) LEARN MORE?



HYDROLEARN.org



Award # 1726965, 1725989, 1726667

ADVANCING EARTH AND SPACE SCIENCE