# Water in Society: Interdisciplinary Undergraduate Teaching and Learning about Water

Cory Forbes[1], Nick Brozovic[1,2], Trenton Franz[1], Diane Lally[1], & Destini Petitt[1]

[1]School of Natural Resources, University of Nebraska-Lincoln

[2]Daugherty Water for Food Global Institute

Earth Educators Rendezvous

July 2017

SCIENCE LITERACY

# Why this new course?

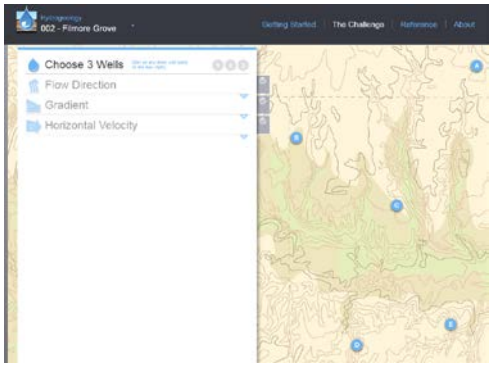
- "All human and natural systems are influenced by the distribution, abundance, quality, and accessibility of water" (NSF, 2005, pg. 6)
- Research shows significant gaps in water literacy
- "Appreciating that the subject matter of hydrology is embedded in a larger context of causes and effects, which includes human decision-making and generates complex system behaviors, is a primary step in reframing hydrology education" (King et al, 2012, pg. 4025)
- SCIL 109 – *Water in Society*

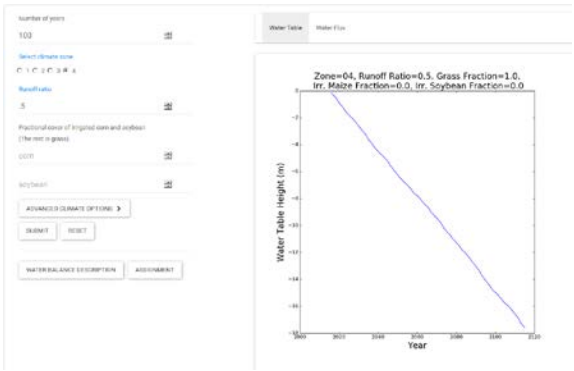
# The bigger picture

- CASNR Food, Energy, & Water in Society undergraduate minor
- Aligned with general education requirements
- Interdisciplinary
- Team of instructors
- IUSE: *Fostering Undergraduate Students' Disciplinary Learning and Water Literacy* (DUE #1609598)

# Course Foundations

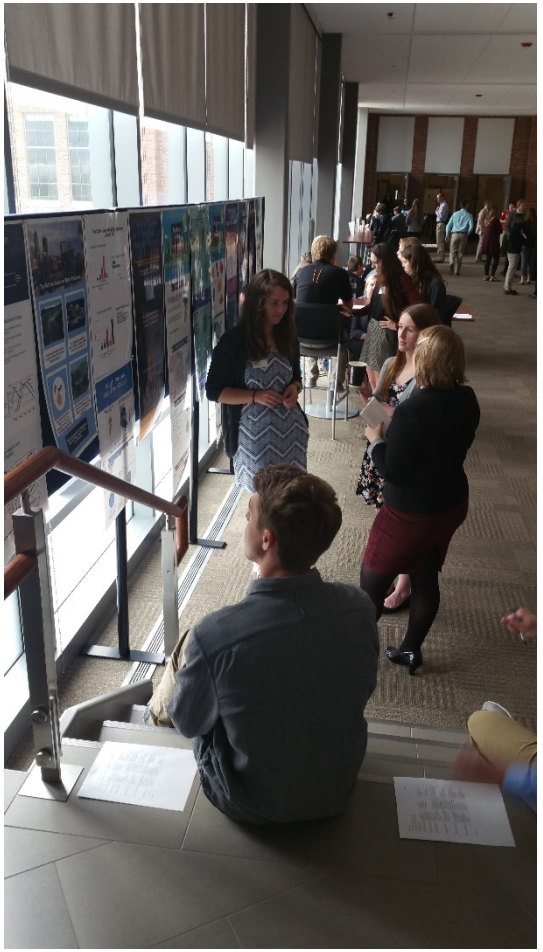
- Core hydrology concepts
- Active learning and effective STEM instruction
- Science communication (i.e., infographic)
- Use of computer based models: *Hydrogeology Challenge* and *Water Balance Model*




- Real-world scenarios, data-based decision making, systems thinking

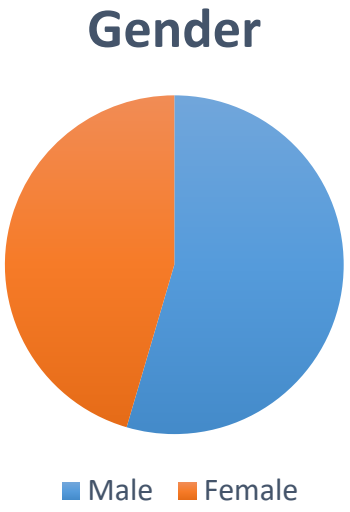
# Who were the students?

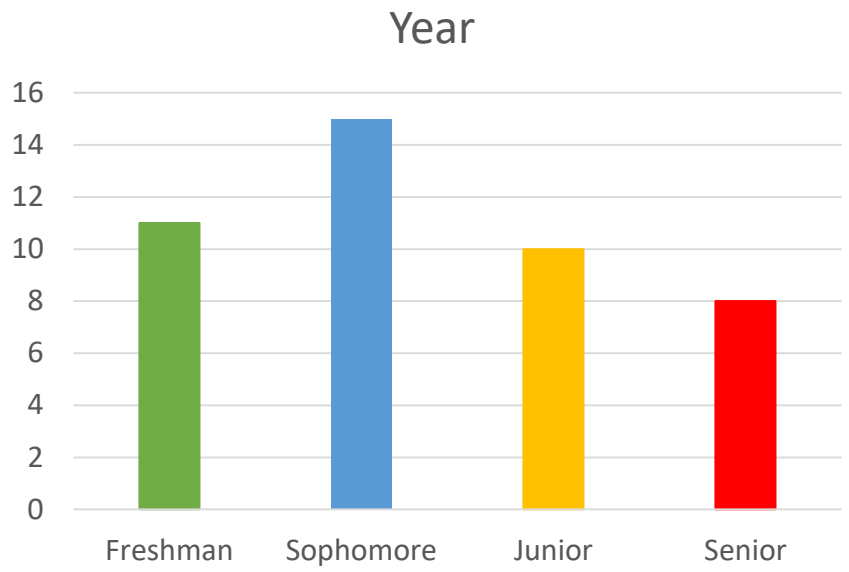




SCIENCE LITERACY

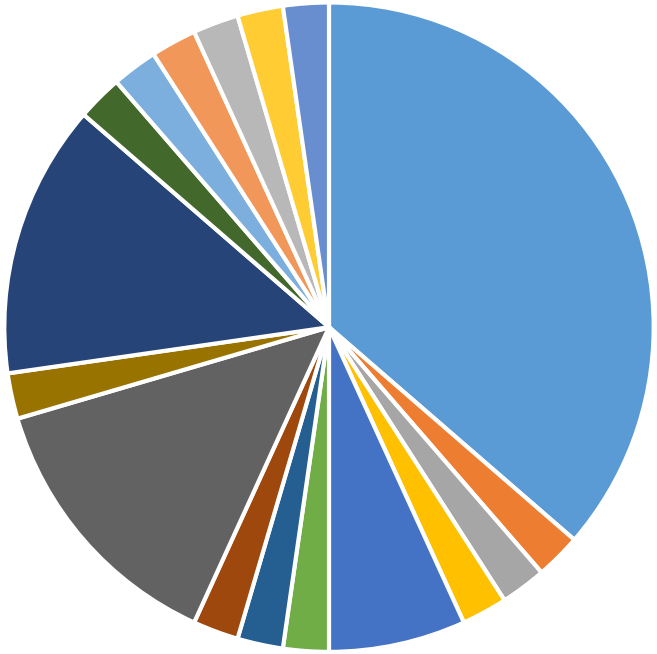
# Who were the students?




Spring, 2017 (N = 45)

# Student Majors

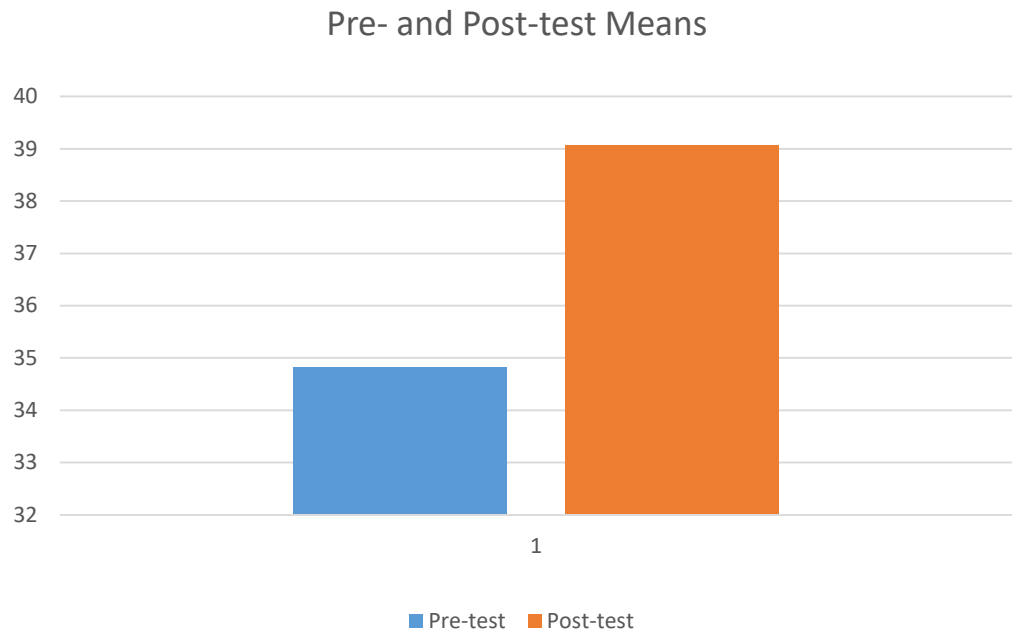


# Spring, 2017 Research

- Instruments/data sources
  - Pre-/post-course content knowledge assessment
  - Modeling tasks
  - Reasoning chains
- Research questions
  - What are levels of students' knowledge of fundamental hydrology concepts at the beginning and end of the semester? Does students' knowledge of hydrology concepts improve during the semester?
  - How did students perform on computer-based water modeling tasks and reasoning chains?
  - What relationships are observable between content knowledge, modeling tasks, and disciplinary reasoning?

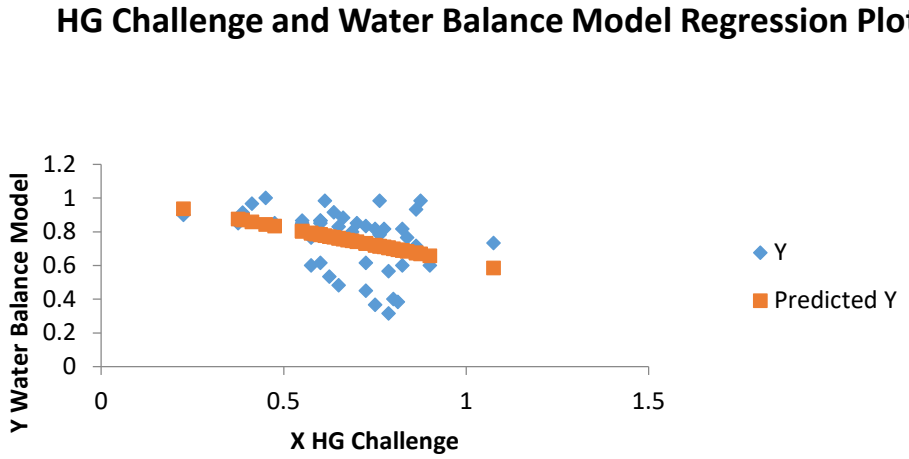
# Pre-/Post-test Results

- Positive gains in students' knowledge of hydrology concepts as measured by pre- and post-test ($t(45) = 8.64$, $p < 2.51E\text{-}11$, $d = 2.012$).
- Multiple linear regression indicated pre-test scores are predictive of post-test scores ($F(1.83)$, $p < 2.27E\text{-}13$).



# Hydrogeology Challenge and Water Balance Model

- Students' scores on the Hydrogeology Challenge and the Water Balance Model were equivalent (no statistically-significant difference between the two)
- Results of multiple linear regression suggest HG Challenge score is predictive of Water Balance Model score ($F(6.33)$, $p<2.04E-11$).
- Appears to be an inverse relationship



# Content Knowledge, Modeling, and Reasoning

- Student performance on the Hydrology Challenge was not predictive of performance on the post-test or associated reasoning chain.
- Student performance on the Water Balance modeling task was predictive of post-test performance (F(5.16), p< 1.8E-33) and reasoning chain (F(6.4582), p<2.38E-09).

# Summary and Discussion

- Students developed understanding of core hydrology concepts over the course of the semester
- Hydrogeology Challenge and Water Balance Models seemed to eliciting the same skills and abilities
- Students who did better on one modeling task performed less well on the other
- Water Balance model predicts content knowledge and reasoning, but not Hydrogeology Challenge – WHY?
- Ongoing data analysis to try to better understand these findings

# Next steps with the course

- Continued emphasis on active learning, moving toward flipped-style classroom
- Enhanced scaffolding for modeling activities that enable students to explore and address real-world water-related challenges
- Exploring additional computer-based modeling tools to integrate into course activities
- Utilizing InTeGrate water-focused modules
- Enhancing students' experiences with cross-curricular content – looking for optimal integration

# For More Information


**Cory Forbes**

Associate Professor
Coordinator, IANR Science Literacy
Director, NE Collaborative for Food, Energy, & Water Education
School of Natural Resources
University of Nebraska-Lincoln
523 Hardin Hall
3310 Holdrege Street
Lincoln, NE 68583-0995
402.472.7844 (phone)
402.472.2946 (fax)
cory.forbes@unl.edu



NEBRASKA COLLABORATIVE FOR FOOD, ENERGY, & WATER EDUCATION


This material is based upon work supported by the National Science Foundation under Grant No. DUE-1609598. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.