

# Dr. Daniel King

- Chemical Education

Using technology and climate change topics to improve student learning in general chemistry

# Chemical Education

- Practice

- development and/or implementation of teaching strategies

- Research

- assessment of effectiveness of teaching strategies
- use of teaching strategies or assessment to answer research questions

# Research Topics

- incorporating environmental data into curriculum
- assessment of effectiveness of active learning techniques and technology
  - clickers/gender studies/etc.
  - online vs. in-person resources
- real-world, in-class demonstrations/activities
- relationship between course resource usage and student attitudes towards science

# Potential projects

- **Assessment of technology effectiveness**
  - Does the use of clickers increase student learning?
  - How does “flipping the classroom” impact student learning?
  - Is there specific content that technology benefits?
  - Are there differences in the use/effectiveness of technology based on gender/major/etc.?
- **Student work:**
  - spreadsheet calculations
  - error analysis

# Flipped Classroom

- Inverts traditional classroom
- Lecture content moved online
  - Recorded lectures
  - Podcasts
  - Instructional videos (e.g., Khan Academy)
- Class time devoted to active learning activities
  - Group work
  - Homework exercises
  - Problem-based learning

# Implementation

- CHEM 122 Majors Chemistry II
  - 23 students (all chemistry majors)
- Partial lectures posted online
  - 5-20 minute lectures recorded (screen + audio)
  - Basic content and calculation examples
  - Posted the day before class
  - Clicker question(s) asked at the start of class to ensure students watched the video
  - Video before most classes starting in week 4

# Performance on exam questions

	<b>Video</b>	<b>Lecture</b>	<b>Both</b>
Exam 2	79	66	87
Exam 3	68	79	100
Final Exam	81	79	84

**Video** = questions related to content covered only in pre-lecture video

**Lecture** = questions related to content covered only in lecture

**Both** = questions related to content covered in lecture and videos

# Future analysis

- detailed error analysis
  - are differences statistically significant?
- compare scores with student viewing data
- what is effect of exam question difficulty?
- what is effect of content difficulty?
- are results reproducible year-to-year?



# Current Project – Victor Haeffner

- Student use of online review session videos
  - what factors affect which videos students are more likely to watch?
    - individual question vs. full review session
    - hard question vs. easy question
    - complex topic vs. simple topic
    - quantitative vs. conceptual
  - does watching review video correlate to improved exam performance?

# Current Project – Devin Morse

- Effectiveness of active learning recitations
  - does use of POGIL activities correlate to improved performance?
    - POGIL = Process Oriented Guided Inquiry Learning
    - exam questions related to POGIL activities vs. exam questions not related to POGIL activities
    - clicker questions related to POGIL activities vs. clicker questions not related to POGIL activities
  - do new climate-change activities help students learn chemistry content?
    - two-question assessments

# Climate Change Concepts and POGIL

- NSF TUES DUE-I044344



- creation of in-class POGIL activities that use climate change context to teach general chemistry topics
- investigation of student conversations during group activities
- 5-member authoring team
- 8 institutions involved



# Questions?