



# Hybridizing inorganic chemistry: Increasing student engagement by reserving lecture for high-impact practices

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# OVERVIEW

- face-to-face teaching with the best features of online learning.
- A fully online course
- A fully face-to-face course
- A hybrid course is when some in-class sessions are completely replaced with online instruction.
- A flipped course is when the number of in-class hours remains the same, with content delivery and homework merely switching places.

# OVERVIEW

Hybrid course format allows for

- More interaction between students and professor
- More interaction between students
- More schedule flexibility for instructor and students
- Opportunities to use technologies that are available at home

# OVERVIEW

- At the University of Wisconsin - Eau Claire, a hybrid course is required to have at least 25% of the course shifted to online instruction and activities.
- Last spring (2014) two undergraduate inorganic chemistry courses were redesigned using a hybrid format
- **Introduction to Inorganic Chemistry** - a 200-level course required for all chemistry majors and minors
- **Bioinorganic Chemistry** - an 300-level elective for chemistry and biology majors
- These were the first upper-level hybrid courses offered in our department.

# OVERVIEW

In both courses:

- Outside of class, students completed a combination of online tutorials, videos, self-testing exercises, simulations and online discussion groups, which introduced students to foundational concepts.
- During face-to-face meetings, instructor lectures were replaced with group collaboration activities and application of concepts, which facilitated interaction among students and between students and their instructor.

# OVERVIEW

This presentation will describe

- 1) implementation of this curricular revision
- 2) discuss lessons learned
- 3) address how well the revision achieved the goals.

# Intro to Inorganic Chemistry - CHEM 218

## COURSE AND HISTORICAL PERSPECTIVE

- A one-semester, lecture only course that covers introductory inorganic principles. Primary areas of coverage: structure, bonding, and reactivity of transition metal complexes, solid state materials, main group compounds.
- A 200-level course to be taken before Physical Chemistry
- Enrollment has grown steadily from 30 students/yr in late 90s to >100/yr currently distributed across face-to-face and online environments.
- Audience = 60% chemistry majors, 25% allied sciences (physics, mat sci, bio, geology), 15% other.

# Intro to Inorganic Chemistry - CHEM 218

## INITIAL ONLINE OFFERING AND OBSERVATIONS

Developed 100% online course in 2013

- Offered as a 4-week summer course.
- Content and structure paralleled face-to-face course. Included ~12 mini lectures (6-12 minutes) to introduce new topics, with bulk of content from textbook reading and some limited web resources.
- Also had several active discussion groups (peer-to-peer Q&A, virtual office hours, instructor-led discussion) that helped students to remain engaged.

# Intro to Inorganic Chemistry - CHEM 218

## INITIAL ONLINE OFFERING AND OBSERVATIONS

Two problems identified with 100% online course:

(a) pace of course somewhat aggressive for the online environment

(b) limited opportunities for exposure to course materials from other, outside perspectives.

### Results:

- Marginally successful: 50% W rate after 1 week.

# Intro to Inorganic Chemistry - CHEM 218

## EVOLUTION OF HYBRID COURSE

Developed hybrid course in Spring 2014

- Goal: use online environment to present majority of content and to reserve face-to-face meetings for discussions, development of relationships between content pieces, other high-impact teaching/learning methods including group problem solving, model usage.

# Intro to Inorganic Chemistry - CHEM 218

## EVOLUTION OF HYBRID COURSE

Hybrid Schedule for 75-min, 2x/week lecture-only course

- 1 face to face (75 min) and 1 online meeting per week.
- All face to face meetings recorded and distributed by YouTube to entire class.
  
- Online 50% / Face-to-Face 50%

# Intro to Inorganic Chemistry - CHEM 218

## EVOLUTION OF HYBRID COURSE

### Hybrid Offering

In addition to video lectures from online course, more web resources were added which significantly enhanced outside of class activities:

- provide additional perspectives on content.
- Also made use of MIT's OpenCourseWare for additional lectures and solved problem sets

Course material was restructured into three inter-related modules: Structure, Bonding, and Properties and Reactivity.

- This allowed for more discussion and bridging between topics

# Intro to Inorganic Chemistry - CHEM 218

## EVOLUTION OF HYBRID COURSE

### Student feedback (to instructor and to CETL):

- Students loved the high-impact teaching/learning practices during face to face meetings.
- Use of models and group work very helpful in developing understanding of core concepts.
- Appreciated flexibility in digesting bulk sections of content online.

### Results:

- Significantly decreased W rate (5%), 5% D/F rate.

# Intro to Inorganic Chemistry - CHEM 218

## SUCCESSFUL HYBRID OFFERING LEADS TO ENHANCED ONLINE COURSE

Offered 100% online course summer 2014

- Using lessons learned from online and hybrid courses
  - Extended to 8 weeks vs 4 to deal with pace issue
  - Enhanced content using materials developed for hybrid course and also used hybrid course's recorded lectures to help provide students with access to important student-led discussions

### Results:

- Combination led to much reduced W rate (12.5%) and 0% D/F

# Intro to Inorganic Chemistry - CHEM 218

## SUCCESSFUL HYBRID OFFERING LEADS TO ENHANCED ONLINE COURSE

### Conclusion:

- Hybrid and online offerings can go hand-in-hand, with content pieces and lessons learned from one course format helping to improve and enhance the other format.

# Bioinorganic chemistry - CHEM 318

## COURSE AND HISTORICAL PERSPECTIVE

- A one-semester, lecture only course explores the biological chemistry of the transition metals, including metalloprotein structure and function, small-molecule synthetic modeling systems, metal ion trafficking in biological systems, and the uses of metals in medicine.
- First developed mid 2000s and is taught every other year. Upper level elective for chemistry and biology majors.
- Enrollment is capped at 22 students and fills quickly every semester it's offered.
- Audience = 60% chemistry majors, 27% biology majors, 13% other (mat sci, etc).

# Bioinorganic chemistry - CHEM 318

## INITIAL OFFERING AND OBSERVATIONS

Offered 100% traditional lecture course in 2008, 2010 and 2012.

- Included instructor-driven lectures to introduce new topics, some limited web resources, and assigned readings from textbook and relevant journal articles.
- In 2012 had weekly in-class group activities that helped students to apply concepts learned from lecture and the reading assignments.

### Two problems identified:

- students struggled with reading primary literature sources assigned for homework outside of class
- lecture-heavy course was tedious for instructor (and students)

# Bioinorganic chemistry - CHEM 318

## EVOLUTION OF HYBRID OFFERING

Offered Hybrid course format in Spring 2014

- Goals: use online environment to present majority of content, reserve face-to-face meetings for discussions, development of relationships between content, de-coding primary literature articles in small groups, other high-impact teaching/learning methods

# Bioinorganic chemistry - CHEM 318

## EVOLUTION OF HYBRID OFFERING

Hybrid Schedule for 50-min 3x/week lecture-only course

- 1 face to face and 2 online meeting per week for the first 6 weeks (review and background heavy)
- 2 face to face and 1 online meeting per week for the next 8 weeks (new bioinorganic concepts).
- The last two weeks were all face to face for student presentations.
  
- Online 37% / Face-to-Face 63%

# Bioinorganic chemistry - CHEM 318

## EVOLUTION OF HYBRID OFFERING

### Hybrid Method:

- Created own online content using Camtasia software to record voice over Powerpoint presentations and uploaded videos to YouTube. Kept all lectures between 5-15 minutes long.
- Used notes and slides from previous semester, but did have to reformat for time and clarity - took two weeks before semester began to create four weeks of video content
- Created an associated online quiz after every online day to test concepts learned in video lectures. Heavily used UW-EC's learning management system (D2L).

# Bioinorganic chemistry - CHEM 318

## EVOLUTION OF HYBRID OFFERING

### Hybrid Method:

- During lecture, after briefly reviewing the online content, I assigned daily in-class activity which consisted of group problem solving exercises, reflection notecards, group and individual quizzes. I also gave mini lectures and discussed articles during class.

# Bioinorganic chemistry - CHEM 318

## EVOLUTION OF HYBRID OFFERING

Student feedback (to instructor and to CETL):

- Students enjoyed being able to watch and re-watch videos at their leisure
- Students liked having quizzes and course materials online in one place (D2L).
- Students liked being able to catch up with the professor once a week to recap important ideas and answer questions.
- Students appreciated the ability to go at ones pace. This part really captured the student's interest!

# Bioinorganic chemistry - CHEM 318

## EVOLUTION OF HYBRID OFFERING

### Difficulties with hybrid course (Student Feedback):

- The transition between online and face to face days was sometime difficult -helped to have a good review at beginning of F2F lecture
- Remembering in-class days and online days and assignment due dates was a challenge (daily email reminders were helpful)
- Students procrastinated until they had to do work rather when they should have done the work.

# Bioinorganic chemistry - CHEM 318

## EVOLUTION OF HYBRID OFFERING

### Results:

- no significant increase or decrease in exam scores or overall average grade between traditional course (2012) and hybrid course (2014)
- DFW rate 0% for both courses

# Bioinorganic chemistry - CHEM 318

## SUCCESSFUL HYBRID COURSE

### Lessons learned:

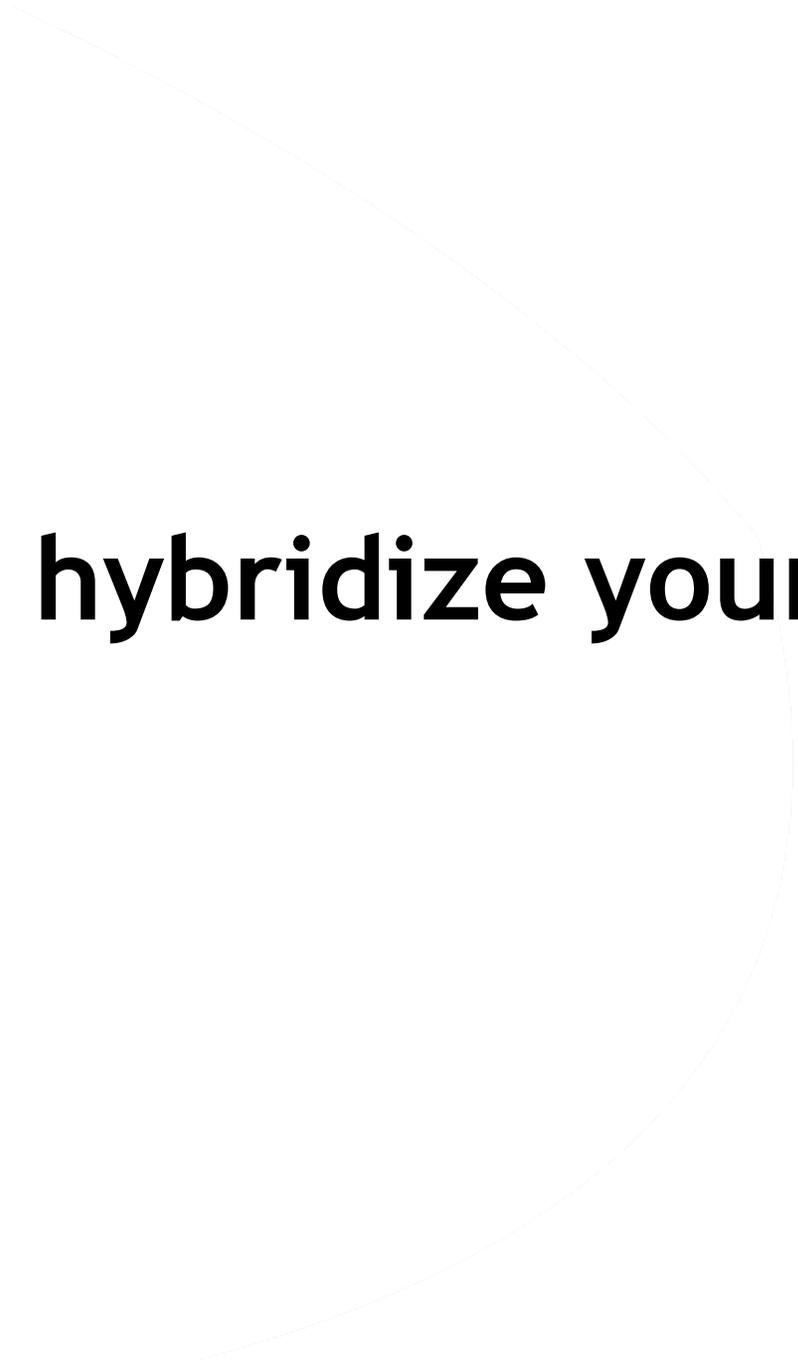
- Students perspective: While a good portion of the class is online, the professor was seen as very available for student questions and concerns. This is helpful for direction in a hybrid course.
- Instructor perspective: liked schedule flexibility, liked having more time to interact with students as opposed to talking at them, liked having more time to assist in them in decoding articles
- Conclusion: Hybrid offerings combine the best parts of online and face to face teaching

# Did the revisions achieve the goals?

- While the numbers didn't show increased learning gains for either hybrid course, there was not a decrease in learning gains, or an increase in D/F rates
- Both courses used online environment to present majority of content, reserve face-to-face meetings for discussions, development of relationships between content pieces, other high-impact teaching/learning methods including group problem solving, model usage.
- Both courses implemented more active learning strategies into the lecture part of the course which kept students engaged during lecture

# Getting Started

- Start small
  - 
  - 
  - course
  - Ideas...
- Be an online student yourself
  - enroll in a Massive Open Online Course on [edx.edu](https://edx.org/) or [coursera.org](https://www.coursera.org/)
  - to see what it's like to be a student in an online environment
  - Get an idea of what your students are doing while watching your online content
  - Get an idea of what formats work for you and what formats don't work
- Because there is no standard approach to hybrid courses - you can be creative and redesign your course so that it makes sense for the material covered



**Can you hybridize your  
course?**



# Hybridizing inorganic chemistry: Increasing student engagement by reserving lecture for high-impact practices

## Acknowledgements

- ✧ University of Wisconsin - Eau Claire
  - ✧ Department of Chemistry
  - ✧ Center for Excellence in Teaching and Learning
    - ✧ Cindy Albert, director
  - ✧ Learning and Technology Services
    - ✧ April Pierson

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