CHEM 5599: Special Topics in Chemical Education Research
Chemical Education Research
4:30 - 5:45 214 BHC (Blank Honors Center)

Instructor: Prof. Nicole M. Becker
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Office hours: By appointment

Course Description: Chemical Education Research, as a field within Discipline-based Education Research (DBER) examines challenges faced by learners in university-level chemistry courses and the ways in which intellectual and instructional resources can be designed to improve student learning. This course will examine the nature of CER and DBER relative to other areas of inquiry into teaching and learning, (e.g. Scholarship of Teaching and Learning), and will examine current research trends in DBER fields such as chemistry, biological sciences, and physics. The course is appropriate for students engaged in discipline-based education research as part of a graduate degree, those interested in pursuing academic careers, and those broadly interested in learning about teaching and learning at the undergraduate level. Students will have opportunities to develop and receive feedback on instructional units designed to translate DBER research into practice.

Course Learning Goals:

Upon completion of the course each student will have demonstrated knowledge of:

1. The history and relationship of DBER to other fields of inquiry into teaching and learning
2. Key theoretical perspectives underpinning discipline-based education research and evidence-based instructional practice
3. The generative promise of different paradigms of discipline-based education research, including qualitative, quantitative, and mixed methods research
4. Research on current trends in CER addressing student motivation, problem solving with visual representations, engagement in science practices, and characterization of learning environments
5. The use of backwards design approaches for facilitating assessment design and alignment between learning theory, curricular goals, and assessment
6. Applications of DBER to classroom practice

Textbook and Other Resources:
No textbook will be required for this course. Readings will be made available on the course website, ICON.

For those interested in supplementary reading, see the list of resources and journals at http://www.divched.org/CER/resources
Course website:
Assignments, readings and other resources will be made available on the course website: http://icon.uiowa.edu. After the first week, we will use ICON for assignment submission.

Course assignments:

* **Preparation for and participation in class discussions.** Each week we will discuss readings that address various aspects of discipline-based education research. Students are expected to come to class prepared and ready to participate actively in class discussions, having carefully and critically read the assigned text(s).

* **Reflective reading journal.** Students will be expected to write weekly written reflections on the assigned readings, which will be periodically reviewed (once every two weeks). Most weeks, you will use a general template for reflections (see attached). Some reading assignments will also have more specific guiding questions.

* **Lead discussant.** Students will be asked to facilitate, in pairs, a discussion related to one of the course readings/topics during the latter half of the semester. Core readings will be provided by Dr. Becker, but students are encouraged to identify supplementary materials and develop active learning activities that will engage the class with the reading.

**Final project.**

* **Course portfolio.** Students will develop 1) a lesson plan for a curricular activity, 2) example assessments for knowledge and skills addressed, and 3) a statement of teaching philosophy. For the lesson plan, students will conduct an analysis of the content domain, which will include a brief review of research literature on how students understand the relevant concept and skills. Course activities will be developed around design features that align with learning theories and key research findings from DBER that have been discussed in the course.

**Final presentation:** Students will give a 10-minute presentation on their final project during the last week of the course.

**Assessments**
- Preparation and engagement in class discussion 20%
- Facilitation as lead discussant 20%
- Reflective reading assignments 20%
- Final project 30%
- Final presentation 10%

**Grading scale:**
- 90-100% = A
- 80-89% = B
- 70-79% = C
- 60-69% = D
- 59% or lower = F

+/- grades may be assigned
List of course topics (subject to change)

- History and context of discipline-based education research
- Learning theories in DBER
- Research paradigms within DBER
- Research trends in DBER, such as:
  - Representational competence
  - Epistemological beliefs
  - Motivation, affect, and identity
  - Three-dimensional learning and engagement in science practices
  - Faculty’s teaching beliefs and practices
  - Integrating authentic research experiences in the classroom (e.g. through Course-based undergraduate research experiences (CUREs))
- Creating inclusive learning environments
- Translating research to practice: Evidence-based instructional practices in the post-secondary classroom
- Design of learning environments and assessments
- Scaling up instructional innovation

Specific readings and due dates will be posted in ICON.
Why reading reflections? Often, when we read the words on a page we do not fully integrate that new information into our existing knowledge structure, and so we miss opportunities to gain new understanding of the world around us. Research in cognitive science and learning tells us that “deep learning” requires that the learner to actively reflect on new knowledge and create personal meaning from it.

To help us reflect more deeply on readings in this course, we will use reading reflections. These reading reflections are designed to help the reader engage with the material in a deeper way, and to construct new meaning from it. The reflections also have the advantage of providing me as the instructor with detailed information about your learning in the course. This not only helps guide my preparation of course activities, but also helps connect us as a community of learners. Your response need not be long, but must clearly indicate careful reading and thoughtful reflection. Please respond to at least two of the three main questions listed above.

**What were the main points made in this reading?** Reading assignments often contain a lot of information. What is the main concept that the author is trying to get across? This may, or may not, have been explicitly stated in the reading. Why did the author choose to emphasize this point, and not some other? Your response is not a summary of the chapter, but an analysis of it in a way that creates new meaning for you.

**What did you learn?** Your response to this question should be reflective. Did you learn something that is in conflict with your previous notions of the world? Did you learn something that fascinates you in a way that you didn’t expect? How does this new knowledge connect with material in other courses, or with other parts of your life?

**What do you want to know more about?** Responses to this question require careful reading and reflection on what your prior knowledge about the topic; it is through the process of reconciling new information with our existing knowledge structure that we become aware of inconsistencies or gaps in our understanding. Responses to this question should be specific and actionable – that is they should outline a clear path to understanding. Discuss not only what you found confusing, but also what about the new information doesn’t fit with what you are currently thinking?

### Grading Rubric for reading reflections

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<thead>
<tr>
<th>Points</th>
<th>Description</th>
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<tbody>
<tr>
<td>10</td>
<td>Responses to both questions are labeled and clearly indicate careful reading and deep reflection. Responses submitted on time.</td>
</tr>
<tr>
<td>5</td>
<td>Responses are not specific, do not clearly indicate reflection in some instances, or are late.</td>
</tr>
<tr>
<td>0</td>
<td>No response</td>
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</tbody>
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ATTENDANCE AND CLASSROOM EXPECTATIONS
Students are responsible for attending class and for knowing an instructor’s attendance policies, which vary by course and content area. All students are expected to attend class and to contribute to its learning environment in part by complying with University policies and directives regarding appropriate classroom behavior or other matters.

ABSENCES
Students are responsible for communicating with instructors as soon they know that an absence might occur or as soon as possible in the case of an illness. Delays in communication could result in a forfeit of what otherwise might be an excused absence.

ABSENCES: ILLNESS, UNAVOIDABLE CIRCUMSTANCES, AND UNIVERSITY SPONSORED ACTIVITIES
Students who are ill, in an unavoidable circumstance affecting academic work, or who miss class because of a University sponsored activity are allowed by UI policy to make up a missed exam. Documentation is required by the instructor except in the case of a brief illness. Students are responsible for communicating with instructors as soon as the absence is known (https://opsmanual.uiowa.edu/students/absences-class#8.1).

ABSENCES: HOLY DAYS
Reasonable accommodations are allowed for students whose religious holy days coincide with their classroom assignments, tests, and attendance if the student notifies the instructor in writing of any such religious Holy Day conflicts within the first days of the semester and no later than the third week. (See the University Operations Manual: https://opsmanual.uiowa.edu/students/absences-class#8.2).

ABSENCES: MILITARY SERVICE OBLIGATIONS
Students absent from class due to U.S. veteran or U.S. military service obligations (including military service-related medical appointments, military orders, and National Guard Service obligations) must be excused without penalty. Instructors must make reasonable accommodations to allow students to make-up exams or other work. Students must communicate with their instructors about the expected possibility of missing class as soon as possible. (For more information, see https://opsmanual.uiowa.edu/iv-8-absences-class%C2%A0-0).

ACADEMIC MISCONDUCT
Plagiarism and the process for addressing academic misconduct of graduate students are defined in Section IV, Article F “Plagiarism by Graduate Students” of the UI Graduate College Manual of Rules and Regulations. Please contact the CLAS Associate Dean for Graduate Education for any necessary assistance in navigating the process mandated by the Graduate College.

ACADEMIC ACCOMMODATIONS
UI is committed to providing an educational experience that is accessible to all students. A student may request academic accommodations for a disability (such as a mental health, attention, learning, vision, and a physical or health-related condition) through the Student Disability Services (SDS) office. The student is responsible for discussing specific accommodations with the instructor. Note that accommodations are not granted retroactively but from the time of the student’s request to the instructor onward; additionally, accommodations must be requested at least two weeks in advance of the related assignment or exam (https://sds.studentlife.uiowa.edu/). Graduate students serving as Teaching Assistants, Research Assistants, or Fellows must contact Faculty and Staff Disability Services (https://hr.uiowa.edu/support/faculty-and-staff-disability-services) for assistance with accommodations.

CLASS RECORDINGS: PRIVACY AND SHARING
Course lectures and discussions are sometimes recorded or live-streamed. These are only available to students registered for the course and the intellectual property of the faculty member. These materials may not be shared or reproduced without the explicit written consent of the instructors. Students may not share these recordings with those who are not enrolled in the course; likewise, students may not upload recordings to any other online environment. Doing so is a breach of the Code of Student Conduct and could be a violation of the Federal Education Rights and Privacy Act (FERPA); also see https://dos.uiowa.edu/policies/code-of-student-life/.
COMMUNICATION: UI EMAIL
Students are responsible for all official correspondences sent to their UI email address (uiowa.edu) and must use this address for any communication with instructors or staff in the UI community (Operations Manual, III.15.2). Emails should be respectful and brief, with complex matters addressed during the instructor’s drop-in hours, for example. Faculty are not expected to answer email after business hours or during the weekends.

FREE SPEECH AND EXPRESSION
The University of Iowa supports and upholds the First Amendment protection of freedom of speech and the principles of academic and artistic freedom. We are committed to open inquiry, vigorous debate, and creative expression inside and outside of the classroom. Visit Free Speech at Iowa for more information on the University’s policies on free speech and academic freedom: https://freespeech.uiowa.edu/.

COMPLAINTS ABOUT ACADEMIC MATTERS
Students with a complaint about a grade or a related academic matter should first visit with the instructor and then with the course supervisor (if applicable), and finally with the director of the school, department, or program offering the course. If a graduate student has not been able to resolve the issue through the director of the school, department, or program, they should contact the associate dean for graduate education in the College of Liberal Arts and Sciences.

FINAL EXAMINATION POLICIES
The final exam schedule is published during the fifth week of the fall and spring semesters or on the first day of summer classes; students are responsible for knowing the date, time, and place of their final exams. Students should not make travel plans until knowing this information. A student with exams scheduled on the same day and time or who have more than two final exams on the same day should visit this page for how to resolve these problems by the given deadline (https://registrar.uiowa.edu/makeup-final-examination-policies). No exams are allowed the week before finals, but with some exceptions made for labs, language courses, and off-cycle courses (https://registrar.uiowa.edu/final-examination-scheduling-policies).

HOME OF THE COURSE
The College of Liberal Arts and Sciences (CLAS) is the home of this course, and CLAS governs the policies and procedures for its courses. Graduate students, however, must adhere to the academic deadlines set by the Graduate College. See https://grad.uiowa.edu/academics/deadlines.

MENTAL HEALTH
Students are encouraged to seek help as a preventive measure or if feeling stressed or overwhelmed. Students should talk to their instructors for guidance with specific class-related concerns and are encouraged to contact University Counseling Service (UCS) at 319-335-7294 during regular business hours to schedule an appointment. UCS offers group and individual therapy as well as counseling for couples about relationships while making referrals to other resources (https://counseling.uiowa.edu/). Student Health can also address related concerns (https://studenthealth.uiowa.edu/). These visits are free to students. After hours, students are encouraged to call the Johnson County Community Crisis Line at (319) 351-0140 or dial 911 in an emergency.

NONDISCRIMINATION IN THE CLASSROOM
The University of Iowa is committed to making the classroom a respectful and inclusive space for people of all gender, sexual, racial, religious, and other identities. Toward this goal, students are invited in MyUI to optionally share the names and pronouns they would like their instructors and advisors to use to address them. The University of Iowa prohibits discrimination and harassment against individuals based on race, class, gender, sexual orientation, national origin, and other identity categories indicated by the University’s Human Rights policy. For more information, contact the Office of Equal Opportunity and Diversity at https://diversity.uiowa.edu/division/office-equal-opportunity-and-diversity-eod.

SEXUAL HARASSMENT
Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff; all members of the UI community are expected to conduct themselves in a manner that maintains an environment free from sexual harassment and sexual misconduct. Those experiencing Incidents of sexual harassment are strongly encouraged to report incidents and to seek help (https://osmrc.uiowa.edu/).