

Teaching College Science

BIOL/EDUC 705 3 credits
Spring 2014

TR, 8:00-9:15 a.m.
Dunbar 152



Whether in a traditional lecture hall (left) or in a modern scale-up classroom (right), science can tell us a lot about how to create opportunities for meaningful student learning in undergraduate science courses.

Course description and goals

This course is designed for graduate students interested in teaching and student learning in STEM-related disciplines at the undergraduate level. Specifically, this course asks (1) What do we know about learning, (2) How do we assess learning, and (3) How do we facilitate learning? Discussions of readings, observations and activities will help students develop (1) a robust, personal definition of teaching and learning, and (2) an understanding of what facilitates learning in STEM.

This course is based on empirical literature in science and mathematics education and evidence-driven applications of that literature. Coverage will include biology, chemistry, earth sciences, mathematics, and physics as well as collegiate learning in general with emphasis on disciplines of the students enrolled in the course.

By the end of this course, students will be able to:

- Read, comprehend, critique, and synthesize primary literature in DBER
- Apply DBER findings to develop learning objectives, assessments, and evidence-based teaching strategies that promote student learning in undergraduate STEM courses
- Create and maintain an electronic teaching portfolio to use for academic job applications and documenting scholarship in teaching and learning

Instructor

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Office hours TR 1 p.m. or by appointment

Our Learning Environment

Throughout the semester, we will work together to create and sustain an environment that deepens our understanding of discipline-based education research and how the results of this research can be applied to transform undergraduate STEM teaching and learning. To accomplish this, be mindful of the following:

Intellectual curiosity and tolerance. Be open to new ideas. Ask questions when you're not sure you understand. Reflect on what you are learning. Try thinking about things in new ways.

Analytic thinking. Look for hidden assumptions in readings. Compare and contrast perspectives. Check ideas against your own experience. Notice inconsistencies in arguments. Entertain counter-arguments.

Effort. Complete readings before class. Give careful thought to writing assignments. Proofread writing before turning it in. Participate in discussions.

Discussion. Share your thoughts. Listen carefully to the thoughts your peers share. Be respectful towards other students' ideas, especially when you disagree. Participate in discussions and small group tasks. Address your comments and questions to each other as much as to the instructor. Learn from each other.

Materials	<p>Readings. No text is required for this course. However, readings will draw from peer-reviewed journal articles and books as well as national reports.</p> <p>Blank paper. Periodically you will be asked to complete and submit in-class assignments on your own or in a group. Please do NOT use spiral-bound notebook paper. You may use the back side of used paper.</p>
Attendance	<p>Attendance in class is expected, per NDSU policy 333. Moreover, attendance is necessary for active participation, one of the performance tasks required to earn a passing grade in this course. Active participation is critical to your growth as a scholarly teacher and professional. Communicate absences to me with as much advance notice as possible. While email is preferred, you may also leave a phone message at the number above. Failure to attend class regularly will likely result in a failure to earn a passing grade in the course.</p>
Correspondence	<p>All correspondence, including email, is considered a formal means of communication. You are advised to use your official NDSU email account, as email from personal accounts are likely to get filtered into junk mail. Please be aware of your tone, spelling, and grammar. I typically respond to email within 24 hours during the work week. Email received on weekends or during holidays may not be answered within this time frame.</p>
Evaluation	<p>The overarching goal of this course is to develop you as a scholar of teaching and learning, as such it is not about points, grades, or GPA. The assignments in this course will not be assessed on a point system; rather assessment of your learning will be guided by the choice of a contract, thus giving you more control of your own learning: you, the learner, decide how much work you wish to do this semester. Each of the contracts below is defined by a number of performance tasks. If you meet the expectations for a contract's performance tasks, you will <i>earn</i> the grade for which you contracted.</p> <p>Each assignment in this course will be assessed as "expectations met" (task mastery), "expectations not met", or "not submitted". Student work assessed as "expectations not met" can be revised and resubmitted within a reasonable time frame, typically three days after the assignments (with feedback) are returned in class or electronically. The assignments aligning with each of the performance tasks identified below will be described in more detail on our Blackboard site.</p> <p>C contract</p> <p>To earn a C, you must meet expectations for the following performance tasks:</p> <ol style="list-style-type: none"> 1. Commit to and fulfill an individual learning contract for this course. 2. Contribute to in-class conversations by reading assigned articles prior to class, asking thoughtful questions, and respectfully listening and responding to the ideas of others. 3. Generate an electronic teaching portfolio using Google sites that will become a dynamic record of your (1) ideas and beliefs about teaching and learning, (2) methods for teaching and assessing student learning, and (3) courses taught and/or prepared to teach. 4. Conduct two observations of undergraduate teaching to describe and reflect on the opportunities available for students to make sense of the information and what a student would be expected to do to make sense of that information. 5. Ask questions and/or create prompts that successfully uncover student understanding. 6. Reflect on student understanding about a science-related concept of your choice.

B contract

To earn a B, you must meet expectations for the performance tasks listed below **and** the performance tasks listed in the C contract above.

7. Create and/or refine an existing observation protocol to collect evidence in an undergraduate teaching environment.
8. Observe an undergraduate STEM course and compose an evidence-based letter of peer evaluation summarizing the quality of teaching and learning observed and referencing literature to support claims.
9. Create sample formative and summative assessments that reflect all Bloom's levels and align with explicit learning objectives.

A contract

To earn an A, you must meet expectations for each of the performance tasks listed below **and** for all the performance tasks listed in the B and C contracts.

10. Analyze and present data summarizing student understanding of a science-related concept.
11. Create and annotate a literature map of references and/or resources for scientific teaching within your discipline.
12. Actively reflect on the course, especially the course readings and the teaching portfolio.
13. Draw on course readings and research in DBER to review and provide written critique of a peer's teaching portfolio.
14. Work collaboratively to lead and assess one in-class discussion pertinent to the question, "how do we facilitate learning?" This includes identifying and posting to Blackboard suitable reading material.

Commitment to a contract does not automatically guarantee the grade sought. For example, if you meet expectations for ALL the performance tasks on the A and B contracts but fail to meet expectations for one of the performance tasks on the C contract, you may earn a D for the course UNLESS you revise and resubmit the work for the performance task that did not meet expectations.

Students with Special Needs

Any students with disabilities or other special needs, who need special accommodations in this course are invited to share these concerns or requests with the instructor and contact the Disability Services Office as soon as possible.

Academic Responsibility

All work in this course must be completed in a manner consistent with NDSU University Senate Policy, section 335: Code of Academic Responsibility and Conduct (<http://www.ndsu.edu/fileadmin/policy/335.pdf>).

Course schedule

The following schedule is *tentative*. Ordering and selection of topics and readings are subject to change based on the needs of the course.

Date	Topic	Reading	Assignment(s)
What do we know about learning?			
14 Jan	Course Introduction What is learning?	Slater 2003	
16 Jan	What motivates student learning?	Markell and Courtney 2006	
21 Jan	Self-regulated learning and metacognition	Ch 9 Driscoll, Tomanek and Montplaisir 2004	Teaching Philosophy Due
23 Jan	Gaming in Education		
28 Jan	How do people learn?	How People Learn, Ch 2	
30 Jan		How People Learn, Ch 3	
4 Feb	Conceptual Change	Chi 2008	
6 Feb	Conceptual Change (cont'd) Peer review of interview questions	Tanner and Allen 2005, Mason chapter	
11 Feb	What is epistemology? How does it frame student learning?	Hammer 2005, Redish & Hammer 2008	
13 Feb	What does cognitive psychology tell us about learning and transfer?	Schwartz et al 2011	
18 Feb	Process Observation Report and Student Interviews		Observation Report #1 and Interview due
20 Feb	Course Design Review sample syllabi	Wiggins & McTighe, Ch 1 Scientific Teaching, Ch 1	
What do we assess learning?			
25 Feb	Cognitive skills	Crowe et al 2008; Zheng et al 2008	
27 Feb			
4 Mar	Formative assessment	Bell & Cowie 2001; Tanner & Allen 2004; Handelsman 2007, Ch 3	
6 Mar			
11 Mar	Summative assessment	Davis Ch. 28, 30 and 31; Sundberg 2002	
13 Mar	Rubrics	Allen & Tanner 2006	Observation Report #2 due
17-21		Spring Break	

25 Mar	Putting it together Peer review of assessment plans	Handelsman et al 2004; Handelsman et al 2008, ch 5	Syllabi due
How do we facilitate learning?			
<i>The following days are available for A contracts to sign up and facilitate. A list of sample topics and readings will be made available on Blackboard.</i>			
25 Mar			
27 Mar			
1 Apr			
3 Apr			Observation report #3 due
8 Apr			
10 Apr			Formative assessment due
15 Apr			
17 Apr			Summative assessment due
22 Apr			
24 Apr			
29 Apr	Instructional Technology	Dr. Jeff Boyer	
1 May			Final drafts due
6 May			
8 May			Critiques due
14 May			10:30 a.m. Final Exam