EDUC 831: SCIENCE LEARNING – THEORIES AND RESEARCH
Mondays, 1:00 p.m. – 4:00 p.m.
Room 2229 SEB

Professor: Leah A. Bricker, Ph.D.
Office: #4047
lbricker@umich.edu
734-647-2975 (office phone)
Office Hours: by appointment

CTools: Log onto the CTools site (www.ctools.umich.edu) with your uniqname and password. You will see a tab titled EDUC 831 001 F14. I will use this site to post all course materials (e.g., weekly reading, handouts, assignments). You will use this site to post to forums, submit assignments, etc. It is your responsibility to check CTools regularly. Please let me know if you do not have regular Internet access.

COURSE DESCRIPTION
“The literature on science learning [and teaching] is diverse. It has been conducted by researchers from different cultural and intellectual backgrounds, using different methods, working in different settings. These researchers have based their work on different ideas about the nature of science, the purposes of science education, and the nature of science learning…This diversity of methods and viewpoints can make reading research on science education a frustrating experience. There seem to be no rules that everyone follows, no beliefs that everyone shares, no findings that everyone agrees on…One way to find order and to see the progress in the literature on science learning is to recognize that within the broad field of science education there are groups of researchers who share common intellectual heritages and seek to build on one another’s work. By recognizing the differences among those research traditions, we can see how researchers in each tradition are advancing knowledge as they understand it. We can also see how, in spite of their differences, researchers in all traditions are contributing to a collective effort that deepens and enriches our understanding of science learning [and teaching]” (pp. 3-4).

-- Charles W. Anderson from Chapter 1 (“Perspectives on Science Learning”) from Handbook of Research on Science Education (2007)

Course Overview
This course is designed to engage you with a sample of the various theoretical perspectives related to learning that scholars in science education use in their research. As Professor Anderson notes in the quotation above, the field of science education can seem quite fragmented given the many theoretical perspectives, types of methods used, topics of interest, populations studied, contexts in which those populations are studied, etc. Through our work together in this course, we will explore some of these different perspectives, and how scholars actively use those perspectives in all phases of their research. We will do this through readings, discussion, dialogues with various science educators, investigations of examples, and course assignments. A major goal is to ensure that course participants are not only able to identify various theoretical perspectives, discuss them intelligently, and cite examples, but also that course participants are able to begin to think about using some of these perspectives substantively.
in their own science education research. Another major goal is to frame the sheer complexity of how science education communities draw on these perspectives, combine them in various ways, construct new ideas related to these perspectives, and the like. Lastly, participants should leave the course with a better understanding of what theory/theories of learning they will use in their own science education related research, outreach, teaching, etc., as well as their rationale(s) for adopting whatever stance(s) they choose.

The following questions will guide our work throughout the course (these are listed in no particular order):

1. What are some of the main theoretical perspectives and lenses used in science education research related to learning?
2. How do science education scholars actively utilize these theoretical perspectives in all aspects of their research (and their teaching)?
3. How do course participants plan to use any given perspective(s) in their own research, outreach activities, teaching, and the like?

**COURSE POLICIES**

This is a seminar-style course, with an emphasis on deconstruction of text thorough and thoughtful in-class discussion, and out-of-class explorations related to course themes. Given the sheer breadth of the applicable literatures, it should be quite clear that a 14-week course will NOT ensure that course participants are “expert” with respect to all theories of learning that science education scholars use in their research (and their teaching). However, through course readings, discussions, writings, and explorations, course participants should have a much more detailed understanding of this terrain, and which theoretical perspective(s) they might wish to use in their work (and why).

**Course Evaluation**

Grades are based on total points earned. No curve is used. The course grading scale is as follows:

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<thead>
<tr>
<th>Percent Range</th>
<th>Corresponding Grade</th>
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<tbody>
<tr>
<td>94% - 100%</td>
<td>A</td>
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<tr>
<td>90% - 93%</td>
<td>A-</td>
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<td>88% - 89%</td>
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<td>84% - 87%</td>
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<td>80% - 83%</td>
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<td>78% - 79%</td>
<td>C+</td>
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<td>Below 60%</td>
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NOTE: See “Course Assignments and Projects” for a list of course assignments and their accompanying points.
Additional Policies and Expectations

1. Academic and Professional Integrity
It is expected that all members of this learning community will conduct themselves with integrity related to all aspects of our academic and professional lives. This includes making certain that plagiarism never occurs. If you are unsure about how to correctly attribute ideas, words, work, etc. to others, please ask. Please refer to the following website for specific policies and procedures related to academic and professional integrity: http://www.soe.umich.edu/file/academic_integrity/

2. Accessibility
Every member of this learning community has the right to full participation. If you need an accommodation(s) for a disability, please let me know at your earliest convenience. We can work with Services for Students with Disabilities (http://ssd.umich.edu/) to ensure that your learning is fully supported. I will, of course, keep our discussions private and confidential.

3. Discrimination/Harassment
No member of this learning community should be subject to discrimination of any kind and/or harassment, as these practices have no place in this community, and in a just society. Please refer to the following websites for University policies related to discrimination and harassment:
http://urespect.umich.edu/report/what/#Report3
http://www.rackham.umich.edu/policies/discrimination_harassment/

4. Diversity/Social Justice
It is my intention to facilitate this course in ways that acknowledge and respect all aspects of diversity. This includes respect for ideas and practices related to gender, sexuality, disability, religion, age, socio-economic status, race, ethnicity, and culture. Not only must we have respect for each other relative to diversity but we must also examine how issues of diversity interact with course themes.

5. Classroom Community
Our work together relies on honest, open, and respectful dialogue so that all participants feel free to express their views. Disruptive behavior (e.g., inappropriate language, talking over others, inappropriate use of technology) has no place in our course and will result in the loss of participation points at the very least. Here are a few guidelines to help facilitate our conversations and activities each week:
   a. *There is no such thing as a stupid question.* Please ask any and all questions that you have and remember that by asking your questions, you are allowing us to learn as a community because you are helping to make ideas visible.
   b. *Be respectful of others’ ideas and experiences* even if they are different from your own. We do not have to agree but we do owe it to each other to listen and consider each other’s points of view. On a related note, please respect confidentiality both in the class and outside of it (as related to course assignments, for example).
   c. *Listen to others* by trying not to interrupt until whoever is talking is finished and until you have heard and considered what others have said. *Do not assume that silences are unproductive.* Give others time to think, consider, and formulate ideas.
   d. *Monitor your participation.* If you are outgoing and tend to dominate conversation, use this course as a chance to practice allowing others a space to participate. If you are less outgoing and tend to let others do the talking, use this course as an opportunity to practice speaking up and adding to the conversation.
e. Please turn cell phones off or to vibrate before each class session out of respect for our community. On a related note, use laptops appropriately (e.g., note taking, presentations). Unless directly related to this course, please refrain from texting, visiting Facebook, etc. Please turn off all MP3 players.

6. Attendance, Participation, and Communication
Regular, on-time attendance and thoughtful participation during class discussions and other activities are essential not only to your individual performance but also to the success of the course and our community. We all share responsibility for the learning and teaching in this course. Because you will not be able to participate in the class community if you are not present, absences will result in the loss of participation points, except in cases of extreme circumstances (e.g., family emergency, illness). If you know that you have to miss a class session, please notify me PRIOR to your absence. You are responsible for obtaining all materials (including summaries of class activities and discussions) and making up any missed work. I expect excellent communication (e.g., notifying me prior to any absence, notifying me about any issues regarding assignments).

7. Late Work, Extension Requests, and Revisions
LATE WORK: Unless I state otherwise, all assignments are due on the dates listed in the syllabus. You may submit your work via email to me directly, and/or by uploading it to your DropBox on CTools.

EXTENSIONS: I understand that we are all busy people and sometimes we are not able to adhere to stated due dates. If you need an extension, please talk with me in person or contact me via email or phone. Make sure you contact me prior to any given due date or I may not be able to grant you an extension request. Please do not abuse my liberal extension policy.

REVISIONS: You may revise and resubmit assignments that you submitted on time (this policy does not apply to late work unless I have granted you an extension). Should you find yourself in this situation, I will give you detailed instructions about how to revise your work. I will expect that you take account of my feedback when creating your revisions.

8. Format for Assignments & Assignment Submission Guidelines
Unless I note otherwise, all assignments must be typed. Please double-space your work, use 1” margins all around, and use 12 point Times New Roman font (these details are part of utilizing APA style guidelines). Please make sure your last name appears somewhere in the document file name. As with all assignments, I expect you to attend closely and carefully to spelling, grammar, and other conventions. When referencing course and other materials, please follow the American Psychological Association style guidelines (APA – 6th edition). You can access the APA style manual through University of Michigan’s libraries or online at http://www.apastyle.org. Purdue University also has a very helpful online APA guide: http://owl.english.purdue.edu/owl/resource/560/01/
COURSE ASSIGNMENTS

NOTE: When necessary, more information (i.e., detailed assignment guidelines and evaluation criteria) will be posted to CTools in a timely fashion and discussed in class.

1. Participation – 3 points per class session; 40 points total – 15% of final course grade

*Due Date: Rolling throughout the semester*

As noted above, you are expected to participate in all aspects of this course. Participation will take many different forms throughout the semester. For example, I might ask you to bring questions to class, post to a CTools discussion forum, design an activity that relates to the readings, find various web sites, etc. You are expected to come to class having already done the readings and ready to participate in discussions and other activities.

2. Paper: Initial Ideas about How People Learn – 20 points – 8% of final course grade

*Due Date: On or before September 22*

In order to identify your ideas about what it means for someone to “learn” something, you will write a paper describing your thoughts about this. What do you think this word “learning” means exactly? What does it look like if someone is learning something? What evidence do you look for to convince yourself that you (or someone else) have/has learned something? What questions do you have about learning? You might use your own experiences as fodder for this assignment (e.g., use an experience that you identify as a particularly rich learning experience). Perhaps you have taught someone how to do something, and you wish to use that experience as fodder for this assignment. Write no more than 5 pages (double-spaced), and follow course-writing/formatting guidelines. You do not have to include citations, but you can if you want (and if you do, please make sure you are using APA style guidelines). We will revisit these papers, and your ideas, at the end of the semester.

3. Paper: Theoretical Perspective Summary, and Implications for Practice – 40 points – 15% of final course grade

*Due Date: Depends on your choice; Rolling throughout the semester, but regardless of choice, no papers will be accepted later than Nov. 17th*

*NOTE: More detailed assignment guidelines will be posted to CTools (Resources → Assignments)*

You will select a focal theoretical perspective from our work together this semester (i.e., cognitive, situated, sociocultural historical, or critical). You will summarize the perspective using “base” literature (e.g., Piaget, Bruner, Lave, Vygotsky, Freire), and other readings listed in the syllabus. You will select 1 or 2 additional readings from the reference lists of the readings listed in the syllabus, and weave those into your discussion. Lastly, you will discuss some example implications, as you see them, for science education research (e.g., study design) and practice (e.g., teaching, outreach, museum exhibit design).

4. Review: Science Education Journal – 60 points – 23% of final course grade

*Due Date: On or before October 20*

*NOTE: More detailed assignment guidelines will be posted to CTools (Resources → Assignments)*

In order to concretize some of the course themes, and in order to introduce you to venues science education scholars use to publish their work, you will conduct a journal review. This will involve selecting a science education journal (e.g., Journal of Research in Science Teaching, Science Education, Journal of Science Teacher Education, Journal of Chemical Education, Cultural Studies of Science Education, International Journal of Science Education), or a journal that publishes research in science education (e.g., Cognition and Instruction, Journal of the Learning Sciences, Linguistics and Education, Journal of Curriculum Studies, Elementary School Journal). You will then identify 5-7 empirical articles to analyze in order to determine what theoretical perspectives scholars are using, and how. You will then write about your results, citing
applicable course literature.

The following due dates will help you stay on-track to complete this assignment by October 20th:

- a. Submit to me (via email or by telling me in class) which journal you wish to use for this assignment – no later than September 22
- b. Submit the list of articles from your chosen journal that you will use for this assignment (remember, select 5-7 articles), along with a brief rationale for why you have selected each article – no later than October 1
- c. Submit your review – no later than October 20

5. Final Course Project – 100 points – 39% of final course grade

*Due Date: On or before Dec. 12*

You will have your choice of final course projects in order to ensure that the work is maximally useful to you moving forward. No matter what project you choose, it will involve a synthesis of course ideas, and remaining and/or new questions related to the course’s themes that you wish to explore. The following are your options:

**A. A Second Journal Review**: Perhaps you wish to continue exploring science education literature. This project involves conducting a second journal review using a different journal(s), and different empirical articles.

**B. A Literature Review**: Perhaps you have become quite interested in one or several of the course topics and/or perhaps you want to more deeply explore themes that you surfaced during your Journal Review assignment. This project will involve selecting a core set of literature, reviewing it, and writing an analysis of the literature you have reviewed framed by a guiding question.

**C. An Analysis of an Educational Artifact**: Perhaps you want to explore what theoretical perspective(s) an educational artifact embodies and embraces. An artifact could be a course or lab syllabus, a piece of curriculum, an assessment, a research protocol, a website, a few museum exhibits, etc. You will select an artifact, conduct this analysis, and then write about your findings.

**D. A Theoretical Stance Paper**: Perhaps given where you are in your PhD/Master’s program and your career, you think it would be helpful to clarify your theoretical stance(s) and commitments so moving forward, you can concentrate on substantively using that stance(s) and those commitments in your research and/or your teaching. For this project, you will write a paper exploring, unpacking, and warranting the theoretical stance(s) and commitments you wish to adopt as part of your work. (You might choose to re-envision, deepen, and/or extend the initial paper you submitted on Sept. 22.)

**E. Other?** Do you have another idea for a project that will be useful to you? Please see me, and we will discuss it.

Regardless of what project you choose, the following due-dates will help you stay on track:

1. Submit project idea – no later than October 27 (via email to me)
2. Submit an outline for review – no later than November 19
3. Submit final project – no later than December 12
COURSE SCHEDULE*
*I reserve the right to revise this schedule whenever necessary, and based on our progress in the course. I am in the process of securing guest speakers for the course, which might impact the draft schedule listed here.

NOTE: Some of you might have read some of the texts listed in this syllabus in EDUC 791 and/or in other classes. If this is the case, use these occasions as an opportunity to re-read, remind yourself of main ideas and arguments, and look for new insights that you did not identify during previous readings.

NOTE 2: I will post pdfs of all readings to the course’s CTools site in the Resources section (in the Readings folder).

WEEK 1 – SEPTEMBER 8, 2014 – COURSE INTRODUCTION
READINGS:
None

ASSIGNMENTS (DUE ON OR BEFORE SEPT. 22):
1. Select the journal you wish to use for the Journal Review assignment.
2. Write and submit your “Initial Ideas about How People Learn” paper. Be ready to discuss your ideas in class on Sept. 22.

WEEK 2 – SEPTEMBER 15, 2014 – NO CLASS
READINGS FOR SEPT. 22:


→ Read Parts I & II (Introduction & Learners and Learning; Chapters 1-5; pp. 3-127)

ASSIGNMENTS (DUE ON OR BEFORE SEPT. 22):
1. Select the journal you wish to use for the Journal Review assignment.
2. Write and submit your “Initial Ideas about How People Learn” paper. Be ready to discuss your ideas in class on Sept. 22.
WEEK 3 – SEPTEMBER 22, 2014 – OVERVIEW OF LEARNING THEORIES & SCIENCE EDUCATION

REMINDER – READINGS FOR TODAY:


→ Read Parts I & II (Introduction & Learners and Learning; Chapters 1-5; pp. 3-127)

→ You can find this text on-line (free download once you register with National Academies Press):
  http://www.nap.edu/catalog.php?record_id=9853

ASSIGNMENTS:
** Begin to identify the 5-7 articles you will use for the Journal Review assignment. Remember that your list of articles, plus a brief rationale for each article’s selection is due on or before October 1 (a Wed.).

WEEK 4 – SEPTEMBER 29, 2014 – COGNITIVE IMAGES OF LEARNING SCIENCE

READINGS:


→ Everyone should read the Introduction. Then, select a life science, or physical science chapter based on your content area and interests.


OPTIONAL READING:
If you have not read any of **Piaget’s work**, you should. Piaget is often thought of as the “father of constructivism.” Nothing is a substitute for Piaget’s original writings but if you are looking for a summary, I suggest:


In addition, if you have not read any of **Jerome Bruner’s work**, you should. Bruner is credited with helping to lead the cognitive revolution (away from behaviorism) in the 1950s and 1960s, using Piaget’s ideas (among others). Bruner is a prolific writer (one could easily construct a seminar based solely on his work). His manuscript, *The Process of Education* (1960), is a good place to start, as it showcases his thinking about science education (for example).
ASSIGNMENTS:

** Finalize your identification of the 5-7 articles you will use for the Journal Review assignment. Remember that your list of articles, plus a brief rationale for each article’s selection is due on or before October 1 (a Wed.).

WEEK 5 – OCTOBER 6, 2014 – COGNITIVE IMAGES OF LEARNING SCIENCE CONTINUED...

READINGS:


ASSIGNMENTS:

1. Your Journal Review assignment is due on or before Oct. 20th.
2. Begin to think about what you want to tackle for your final project (your project idea is due on or before Oct. 27th).

WEEK 6 – OCTOBER 13, 2014 – NO CLASS: FALL STUDY BREAK

READINGS FOR OCT. 20:


OPTIONAL READING:

If you have not read any of Jean Lave’s work, you should. Lave and her college, Étienne Wenger, are widely credited with developing the theory of situated learning. I suggest the following as a starting point:


ASSIGNMENTS:

1. Your Journal Review assignment is due on or before Oct. 20th.
2. Continue to think about what you want to tackle for your final project (your project idea is due on or before Oct. 27th).
**WEEK 7 – OCTOBER 20, 2014 – SITUATED IMAGES OF LEARNING SCIENCE**
**GUEST SPEAKER: PROFESSOR BRIAN COPPOLA (U-M CHEMISTRY)**

**REMINDER – READINGS FOR TODAY:**

**ASSIGNMENTS:**
**Identify what you want to tackle for your final project. Notify me about your plans no later than next week. Based on what you want to do, I will send you specific guidelines.**

**WEEK 8 – OCTOBER 27, 2014 – SOCIOCULTURAL, HISTORICAL IMAGES OF LEARNING SCIENCE**
**GUEST SPEAKER: PROFESSOR PHILIP BELL (UNIVERSITY OF WASHINGTON; LEARNING SCIENCES)**

**READINGS:**

**OPTIONAL READING:**
If you have not read any of Vygotsky’s work, you should. Vygotsky and other Soviet psychologists (e.g., Luria, Leontiev) are credited with the development of social constructivism, and sociocultural historical learning theory more broadly. Again, nothing is a substitute for Vygotsky’s original writings but if you are looking for a summary, I suggest:

**ASSIGNMENTS:**
**Based on what you want to do for your final project, and based on my specific guidelines, begin to create your outline. It is due on or before Nov. 19th (a Wed.).**
**WEEK 9 – NOVEMBER 3, 2014 – SOCIOCULTURAL, HISTORICAL IMAGES OF LEARNING SCIENCE CONTINUED…**

**GUEST SPEAKER: PROFESSOR MEGAN BANG (UNIVERSITY OF WASHINGTON – LEARNING SCIENCES)**

**READINGS:**


**ASSIGNMENTS:**

***Based on what you want to do for your final project, and based on my specific guidelines, continue to work on your outline. It is due on or before Nov. 19th (a Wed.).***

**WEEK 10 – NOVEMBER 10, 2014 – CRITICAL IMAGES OF LEARNING SCIENCE**

**GUEST SPEAKER: PROFESSOR KATE MCNEILL (BOSTON COLLEGE – SCIENCE EDUCATION)**

**READINGS:**


**Pick Two:**


**OPTIONAL READING:**

Critical theories in education (and science education is no exception) stem from the works of Paulo Freire, Pierre Bourdieu, and the like. As I have noted elsewhere, there is no substitute for reading their original writings. However, for some summaries, see:


ASSIGNMENTS:
**Based on what you want to do for your final project, and based on my specific guidelines, finalize your outline. It is due on or before Nov. 19th (next Wed.).

WEEK 11 – NOVEMBER 17, 2014 – CRITICAL IMAGES OF LEARNING SCIENCE CONTINUED…

GUEST SPEAKER: PROFESSOR ANNEMARIE PALINSAR (U-M – EDUCATIONAL STUDIES; READING AND LITERACY WITH AN EMPHASIS ON SCIENCE EDUCATION)

READINGS:
Continue our discussions of last week’s readings.

ASSIGNMENTS:
**Based on feedback on your outline, continue to work on your final project. It is due on or before Dec. 12th.

WEEK 12 – NOVEMBER 24, 2014 – CURRENT POLICY TRENDS IN SCIENCE EDUCATION

GUEST SPEAKER: PROFESSOR ANGELA CALABRESE BARTON (MICHIGAN STATE – SCIENCE EDUCATION)

READINGS:

Familiarize yourself with the *Next Generation Science Standards:*


ASSIGNMENTS:
**Continue to work on your final project. It is due on or before Dec. 12th.
**WEEK 13 – DECEMBER 1, 2013 – SPECIAL TOPICS – LEARNING TRANSFER**

**GUEST SPEAKER: PROFESSOR TIM MCKAY (U-M PHYSICS)**

**READINGS:**

**PICK ONE OF THE FOLLOWING READINGS:**


**ASSIGNMENTS:**
**Continue to work on your final project. It is due on or before Dec. 12th.**

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**WEEK 14 – DECEMBER 8, 2013 – SPECIAL TOPICS - EXPERTISE & COURSE WRAP-UP**

**READINGS:**

**PICK ONE OF THE FOLLOWING READINGS:**


**ASSIGNMENTS:**
**Reminder: Final projects are due on or before Dec. 12th.**