EDUC 834 – DESIGNS OF SCIENCE LEARNING ENVIRONMENTS
Tuesdays, 9:00 a.m. - 12:00 p.m.
Room 2346 SEB

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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 834 001 W15. 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
“Rather, the master question from which the mission of education research is derived: *What should be taught to whom, and with what pedagogical object in mind?* That master question is threefold: what, to whom, and how? Education research, under such a dispensation, becomes an adjunct of educational planning and design. It becomes design research in the sense that it explores possible ways in which educational objectives can be formulated and carried out in the light of cultural objectives and values in the broad” (p. 408, italics in original).


Course Overview
This course will focus on issues of, and related to, design, specifically in the context of science learning environments. Throughout the semester, we will interrogate text, talk with designers, visit designed spaces to investigate their learning affordances, and engage in design work ourselves. We will examine concepts of design in a wide variety of science learning environments from K-12 education, including informal science education (e.g., science centers and museums). We will also explore research methods that enable researchers to study designed environments.

The following questions will guide our work:
1. In any given design context, what is meant by “design”?
2. In any given design context, what are the apparent design principles in play?
3. In any given design context, what perspective(s) on learning and teaching are in play?
4. How do we create equitable designs for science learning and what do we mean by equitable in any given context?
Course Objectives
In order to interrogate the course’s guiding questions…

1. Participants will engage a broad conception of “design” and “science learning environments” (e.g., K-12 school science instruction, curriculum, & assessment; informal science spaces such as museums).
2. Participants will dialogue with designers.
3. Participants will explore issues of equity with respect to design.
4. Participants will learn more about design-based research methods (e.g., DBR, DBIR, studio pedagogy).
5. Participants will design a draft of a science learning environment or artifact, and accompanying design documentation, including how they might go about researching elements of their design.
6. Participants will continue to hone their competencies related to academic literacies (especially identifying, interpreting, and producing academic arguments).

COURSE POLICIES

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

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<tr>
<th>Percent Range</th>
<th>Corresponding Grade</th>
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<tbody>
<tr>
<td>94% - 100%</td>
<td>A</td>
</tr>
<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>
<td>B-</td>
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<td>78% - 79%</td>
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<td>70% - 73%</td>
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<td>60% - 63%</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/](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 a just society. Please refer to the following websites for University policies related to discrimination and harassment:
- [http://www.rackham.umich.edu/policies/discrimination_harassment/](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 the designs of learning environments and artifacts.

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, harassing others) 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 to and consider each other’s points of view. On a related note, please respect confidentiality both in the class and outside of it.

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 and beyond. 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 assignments via email directly to me, or by uploading them to your DropBox in 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 your 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, and I expect you to take into account the feedback I provided.

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 consistent with APA formatting guidelines). Please make sure your last name is located somewhere in your 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 applicable, more information (i.e., detailed assignment guidelines with 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 – ~12% 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. Lead a Class Discussion – 40 points – ~12% of final course grade
*Due Date: Rolling throughout the semester*
In order to gain practice in facilitating dialogue, you will lead a class discussion over the readings during a week of your choosing.

3. Interview a Designer – 60 points – ~17% of final course grade
*Due Date: February 10*
Several people who are involved in design work in a variety of settings and contexts will be speaking with our class this semester. However, in order to gather even greater perspective, you will interview someone who designs environments and/or artifacts for science learning. In the course of reflecting on this interview, you will compare and contrast your interviewee’s perspectives with those found in the readings and discussed in class.

4. Analysis of a Science-Related Designed Learning Environment or Artifact – 60 points – ~17% of final course grade
*Due Date: March 17*
You will analyze, using course readings, course focal questions, discussions, etc., a science-related designed learning environment or artifact. This might be a piece of curriculum, a syllabus from a course, a museum exhibit, a segment of instruction, a science-related “serious” video/computer game, a professional development experience, etc.

5. Design Some Aspect of a Science-Related Learning Environment or Artifact – 145 points – ~42% of final course grade
You will gain some practice designing a science-related learning environment or artifact. You will have various due dates related to this project throughout the semester. The following is a summary of those dates:
- Design Ideas Document (due Jan. 20; 10 points)
- Design Story Board & Target Scenario(s) of Use (due Feb. 3; 20 points)
- Prototype & Annotated Bibliography (due March 24; 40 points)
- Final Design Documentation (including draft proposed research plan) (due on or before April 21; 75 points)

**NOTE: We will have two different design studio days (Feb. 3 & March 10). You will be able to workshop your designs during these studios and receive feedback from your peers and others. We might also consider holding a final science learning environments design open house to present final projects, but we will decide that as a group later in the semester.**
COURSE SCHEDULE*
*I reserve the right to revise this schedule whenever necessary given our progress in the course.

WEEK 1 – JANUARY 13, 2015 – FRAMING SCIENCE EDUCATION

READINGS:
   → Chapters 2 & 3
2. National Science Teachers Association’s position statement on the *Next Generation Science Standards*.

ASSIGNMENTS:
1. Draft your *Design Ideas* document. Before the start of class next week, email it to me or upload it to your DropBox on CTools. Remember to follow all course writing guidelines. Be ready to share your design ideas next week in class.
2. At some point this week, email me your top two selections for the weeks you would like to lead and facilitate the class discussions.
3. Begin thinking about an interviewee. We will discuss specific assignment guidelines for this interview next week in class.

WEEK 2 – JANUARY 20, 2015 – INTRODUCTION TO DESIGN AND DESIGN BASED RESEARCH IN EDUCATION

READINGS:

OPTIONAL READINGS:

ASSIGNMENTS:
1. Begin drafting your *Design Storyboard and Target Scenario(s) of Use* document. You will studio this on Feb. 3.
2. Solidify your interviewee. Interviews are due on Feb. 10.
**Week 3 – January 27, 2015 – Designs in “Informal” Science Spaces**  
**Guest Speaker: Kira Berman (class held at the U-M Museum of Natural History; Anthropology Seminar Room 4027)**

**Readings:**

**Optional Readings:**
→ Chapters 1 & 5  
→ NOTE: You can download this publication for free at: [http://www.nap.edu/catalog.php?record_id=12190](http://www.nap.edu/catalog.php?record_id=12190)

**Assignments:**
1. Your *Design Storyboard and Target Scenario(s) of Use* document is due next week (email the document to me or upload it in your DropBox on CTools). We will workshop your design storyboards in class next week amongst ourselves, so be prepared to talk with others about your ideas.
2. Remember that interviews are due on or before February 10.

**Week 4 – February 3, 2015 – Designs of Science Education Curricula**  
**1st Design Studio**

**Readings:**

**Optional Reading:**

**Assignments:**
*Remember that your interview is due next week (Feb. 10). Email it to me or upload it to your DropBox in CTools. Be ready to share what you learned from your interviewee.*
**WEEK 5 – FEBRUARY 10, 2015 – DESIGN & ENGINEERING EDUCATION**

**GUEST SPEAKER: PROFESSOR CHARLES DERSHIMER**

**READINGS:**

**OPTIONAL READINGS:**

**ASSIGNMENTS:**
1. Remember that your *Design Prototype and Annotated Bibliography* document is due on March 10 (our 2nd studio day).
2. Start to think about what science-related designed learning environment or artifact you would like to analyze. Analyses are due on March 17.

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**WEEK 6 – FEBRUARY 17, 2015 – DESIGNS OF TECHNOLOGY-FACILITATED LEARNING ENVIRONMENTS**

**GUEST SPEAKER: PROFESSOR CHRIS QUINTANA**

**READINGS:**

**ASSIGNMENTS:**
1. You should be starting to analyze whatever science-related designed learning environment or artifact you have chosen for your analysis. Analyses are due on March 17.
2. Remember that your *Design Prototype and Annotated Bibliography* document is due on March 24.

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Week 7 – February 24, 2015 – Designs of Science Education Curricula
Continued...(Focus on Intersections of Science and Literacy Curricula)
Guest Speaker: Professor Gina Cervetti

Readings:
→ Read the Introduction, and Chapter 4.

Optional Reading:

Assignments:
1. Remember that next week is Spring Break – NO CLASSES.
2. Remember that our second design studio is on March 10 (outside perspectives). You will studio your design work with “outside” participants, so be sure to come prepared to talk about, and show your work. You will want to have at least one question about your design work or one identified piece on which you want feedback.
3. Remember that your analysis of a science-related designed learning environment or artifact is due on March 17. You will either email that to me or upload it to your DropBox on CTools. Be prepared to discuss your analysis in class.
4. Remember that your Design Prototype and Annotated Bibliography document is due on March 24.

Week 8 – March 3, 2015 – No Class – Spring Break

Assignments:
1. Remember that next week is our 2nd design studio. You will studio your design work with “outside” participants, so be sure to come prepared to talk about, and show your work. You will want to have at least one question about your design work or one identified piece on which you want feedback.
2. Remember that your analysis of a science-related designed learning environment or artifact is due on March 17. You will either email that to me or upload it to your DropBox on CTools. Be prepared to discuss your analysis in class.
3. Remember that your Design Prototype and Annotated Bibliography document. It is due on March 24.
WEEK 9 – MARCH 10, 2015 – DESIGNS OF SCIENCE ASSESSMENTS
2ND DESIGN STUDIO

READINGS:

ASSIGNMENTS:
1. Remember that your analysis of a science-related designed learning environment or artifact is due next week. Either email that to me or upload it to your DropBox on CTools. Be prepared to discuss your analysis in class.
2. Remember that your Design Prototype and Annotated Bibliography document is due on March 24.

WEEK 10 – MARCH 17, 2015 – DESIGNS OF PROFESSIONAL DEVELOPMENT EXPERIENCES
GUEST SPEAKER: PAULA WISHART; RACKHAM GRADUATE SCHOOL

READINGS:
   ➔ Read chapters 1 and 2.

ASSIGNMENTS:
1. Remember that your Design Prototype and Annotated Bibliography document is due next week. Email it to me or upload it to your DropBox on CTools.
2. Remember that your final design documentation is due on or before April 21 (emailed to me or uploaded to your DropBox in CTools).

WEEK 11 – MARCH 24, 2015 – DESIGNS OF PROFESSIONAL DEVELOPMENT
CONTINUED...
GUEST SPEAKERS: ELYSE AURBACH & KATHERINE PRATER; RELATE

READINGS:

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**Optional Readings:**

**Assignments:**
* Remember that your final design documentation is due on or before April 21 (emailed to me or uploaded to your DropBox in CTools).

**Week 12 – March 31, 2015 – Designs of Science Learning Environments in Higher Education**

**Guest Speaker: Heidi Phillips; Using Writing-to-Teach in an Introductory Physical Chemistry Course**

**Readings:**

**Optional Readings:**

**Assignments:**
* Remember that your final design documentation is due on or before April 21 (emailed to me or uploaded to your DropBox in CTools).

**Week 13 – April 7, 2015 – Design-Based Implementation Research**

**Readings:**
**OPTIONAL READING:**

**ASSIGNMENTS:**
* Remember that your final design documentation is due on or before April 21 (emailed to me or uploaded to your DropBox in CTools).

**WEEK 14 – APRIL 14, 2015 – NO CLASS**
NOTE: There is no class this week due to the National Association of Research in Science Teaching (NARST) conference.

**ASSIGNMENTS:**
* Remember that your final design documentation is due on or before April 21 (emailed to me or uploaded to your DropBox in CTools).

**WEEK 15 – APRIL 21, 2015 – WRAPPING UP AND MOVING FORWARD**

**READINGS:**
TBD