Originating Course Information

Offering of Education: Teaching & Learning 5741: Learning, Cognition, and Teaching in STEM Education
Fiscal Unit/Academic Org School of Teaching & Learning - D1275
Requirement/Elective Designation Not A General Education course

General Information

Type of Request Off Campus
Term of Offering Summer 2012 - Seven Week Summer Session
Level/Career Graduate
Previous Value Graduate, Undergraduate
Rationale for proposing this offering This course is requested by CCS as an outreach course for the mathematics teachers. We intend to cater this offering to Learning and Cognition in an urban environment.
Description for this offering This course explores theories, which seek to explain the development of students' knowledge and practices in mathematics. Policy, teaching, and research in mathematics education are often informed by tacit assumptions about the nature of learning.

Attachments

• TL5741_syllabus LrnCogn.docx: 5741 syllabus
  (Syllabus. Owner: Brosnan,Patricia A)
• one time ccs.doc: Off campus form
  (One Time Form Supplement. Owner: Brosnan,Patricia A)

Comments

• Approved by GSC. (by Mercerhill,Jessica Leigh on 04/15/2012 11:34 AM)

Workflow Information

<table>
<thead>
<tr>
<th>Status</th>
<th>User(s)</th>
<th>Date/Time</th>
<th>Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submitted</td>
<td>Brosnan,Patricia A</td>
<td>04/14/2012 09:46 PM</td>
<td>Submitted for Approval</td>
</tr>
<tr>
<td>Approved</td>
<td>Mercerhill,Jessica Leigh</td>
<td>04/15/2012 11:34 AM</td>
<td>Unit Approval</td>
</tr>
<tr>
<td>Pending Approval</td>
<td>Achterberg,Cheryl L Blount,Jackie Marie Zircher,Andrew Paul</td>
<td>04/15/2012 11:34 AM</td>
<td>College Approval</td>
</tr>
</tbody>
</table>
A. **One-time Request Information** (This section is required for all one-time offering requests)

1. Requested Room Capacity (if university pool classroom is being requested) __off campus
2. Enrollment Capacity 25
3. Waitlist Capacity 5
4. Final Exam:  
   - Yes  
   - No  
   - Last Class (Note: per faculty rules, this option is **NOT** available for the Undergraduate career)
   a. Exam Seat Spacing none
5. Special Instructions or Additional Information
   
   This is an outreach course that will be taught in the CCS.

6. Class Search Title (18 character limit) Lrn, Cog, & Tch
7. Display in Class Search:  
   - Yes  
   - No
8. Credit Hours 02
9. Course Components (check all that apply):
   
   [ ] Clinical  [ ] Field Experience  [ ] Independent Study
   [ ] Laboratory  [ * ] Lecture  [ ] Recitation
10. Graded Component (check one):
    
    [ ] Clinical  [ ] Field Experience  [ ] Independent Study
    [ ] Laboratory  [ * ] Lecture  [ ] Recitation
11. Campus of Offering (check all that apply):
    
    [ ] Columbus  [ ] Marion  [ ] Newark
    [ ] Lima  [ ] Mansfield  [ ] Wooster (ATI)
12. Prerequisites and Exclusions teacher in CCS
13. Permission to Enroll in this course:  
   - No Consent needed  
   - Department Consent
14. General Education Details (if applicable): Attach GE model curriculum compliance statement and GE course assessment plan.

B. Group Studies Request Information (This section is required for group studies requests only)

1. Previous quarters of offering and enrollment (Regular course numbers should be sought for group studies courses taught three times with success).

2. This course has been discussed with and has the concurrence of the following academic units needing this course or with academic units having directly related interests (list units here and attach letters indicating concurrence or objection from academic units that might have jurisdictional interests).

3. Attach the course syllabus that includes the topical outline of the course, student learning outcomes and/or course objectives and methods of evaluation.

C. Flexibly Scheduled/Off Campus/Workshop Request Information (This section is required for flexibly scheduled / off-campus / workshop requests only)

1. Start Date and End Date  July 1, 2012 – July 15, 2012

2. Previous quarter(s) of offering and enrollment  Summer 2011 - 40

3. Expected enrollment for proposed quarter of offering 25

4. Attach the course syllabus that includes the topic outline of the course, student learning outcomes and/or course objectives, methods of evaluation and off-campus field experience.

5. Off-Campus Site  CCS

6. Will course be taught in distance learning format:  □ Yes  □ No

7. Complete the following for courses offered for less than term length or for Workshops:

<table>
<thead>
<tr>
<th>Level and Credit Hours:</th>
<th>Present Offering</th>
<th>Proposed Offering</th>
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<tbody>
<tr>
<td>GRD 02</td>
<td>GRD 02</td>
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</tbody>
</table>

| Class/Lab Contact Time: | 25 hours | 25 hours |
Prerequisites: none

Exclusion or Limiting
MEd student

Grade Options (Check)
* Letter  S/U  Progress

Number of Hours of out-of-class preparation required: 505

Total hours of class meetings: 25

Length of each class: 

8. Complete this section for Off-Campus courses only:

Distribution of contact time (explain differences from on-campus offerings):
Will be across two weeks rather than full term

Instructor  Dr. Kim Kembitzky
Rank  Lecturer

Qualifications (explain any difference in rank/qualification from on-campus instructors
No differences

Explain differences in teaching arrangements from on-campus offerings
No differences

Student Services (explain how they will be provided to off-campus students):

Registration  on-site

Office Hours  before and after class or by appointment

Academic Advising  on site

D. Study Tour Request Information (This section is required for study tour requests only)

1. Previous quarters of offering and enrollment:

2. Expected enrollment for proposed quarter of offering:

3. This request has been discussed with and has the concurrence of the following academic units needing this study tour or with academic units having directly related interests (list units and this course has been discussed with and has the concurrence of the following academic units needing this course or with academic units having directly related interests (list units here and attach letters indicating concurrence or objection from academic units that might have jurisdictional interests):
4. Attach the academic plan that includes student learning outcomes and/or course objectives, topical outline and percent of time spent on each topic, methods of instruction, course requirements, methods of examination and percent of the final grade each method constitutes, textbooks and/or reading lists, admission procedure, orientation and debriefing plans and method of dealing with any expected language barriers.

5. Attach the administrative plan for the study tour that includes an itinerary, arrangements for travel, housing, meals, classrooms, excursions, and budget.

ATTACHMENT TYPES that may be needed for this form:

Cover Letter  
Syllabus  
Study Tour Academic Plan  
Study Tour Administrative Plan  
Concurrence Letters / Forms  
GE model curriculum compliance statement  
GE course assessment plan  
Memo of Understanding  
Appeal statement  
Other supporting documentation
1. Component (Section) Type (Choose 1):
   - [ ] Clinical
   - [ ] Field Experience
   - [ ] Independent Study
   - [ ] Lab
   - [* ] Lecture
   - [ ] Recitation
   - [ ] Seminar
   - [ ] Workshop

2. Instruction Mode. (Choose only ONE):
   - [ ] Clinic Field Experience
   - [ ] Computer taught
   - [ ] Distance Learning
   - [* ] Flexibly Scheduled
   - [ ] In Person
   - [ ] Video Taught

3. Meeting Pattern
   - [* ] MON
   - [* ] TUE
   - [* ] WED
   - [* ] THR
   - [* ] FRI
   - [ ] SAT
   - [ ] SUN

4. Meeting start time: _9AM__________
5. Meeting end time: _11:30AM___________

6. Instructors. Provide at least 1 primary instructor.

<table>
<thead>
<tr>
<th>Instructor Name.n</th>
<th>Role</th>
<th>Access</th>
<th>Print name in schedule?</th>
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</thead>
<tbody>
<tr>
<td>Kimberle Kembitzky</td>
<td>Primary</td>
<td>Kimberle</td>
<td>Yes</td>
</tr>
<tr>
<td><a href="mailto:kkembitzky@gmail.com">kkembitzky@gmail.com</a></td>
<td><a href="mailto:kkembitzky@gmail.com">kkembitzky@gmail.com</a></td>
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</table>

7. Central classroom pool facility or department room: [ ] Pool [ ] Dept

8. Room Characteristics. Specify up to 5 in priority order.

<table>
<thead>
<tr>
<th>Priority</th>
<th>Characteristic</th>
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<tbody>
<tr>
<td>1</td>
<td>Off campus</td>
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9. Notes: ___________ in CCS___________________________________________________
_____________________________________________________________________
_____________________________________________________________________
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9a. Notes print location relative to class listing: [ ] Do not Print [ ] Before [ ] After
Begin Component 2

1. Component (Section) Type (Choose 1):
   [ ] Clinical
   [ ] Field Experience
   [ ] Independent Study
   [ ] Lab
   [ ] Lecture
   [ ] Recitation
   [ ] Seminar
   [ ] Workshop

2. Instruction Mode (Choose only ONE):
   [ ] Clinic Field Experience
   [ ] Computer taught
   [ ] Distance Learning
   [ ] Flexibly Scheduled
   [ ] In Person
   [ ] Video Taught

3. Meeting Pattern
   [ ] MON [ ] TUE [ ] WED [ ] THR [ ] FRI [ ] SAT [ ] SUN

4. Meeting start time: ___________  5. Meeting end time: ___________

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9a. Notes print location relative to class listing: [ ] Do not Print [ ] Before [ ] After

End Component 2
1. Component (Section) Type (Choose 1):
   [ ] Clinical
   [ ] Field Experience
   [ ] Independent Study
   [ ] Lab
   [ ] Lecture
   [ ] Recitation
   [ ] Seminar
   [ ] Workshop

2. Instruction Mode. (Choose only ONE):
   [ ] Clinic Field Experience
   [ ] Computer taught
   [ ] Distance Learning
   [ ] Flexibly Scheduled
   [ ] In Person
   [ ] Video Taught

3. Meeting Pattern
   [ ] MON    [ ] TUE    [ ] WED    [ ] THR     [ ] FRI    [ ] SAT    [ ] SUN

4. Meeting start time: ___________  5. Meeting end time: ___________

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9. Notes: ______________________________________________________________
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_____________________________________________________________________
_____________________________________________________________________  

9a. Notes print location relative to class listing: [ ] Do not Print [ ] Before [ ] After
ED T&L 5741: Learning and Cognition in STEM Education
Semester

Course description
This course explores theories, which seek to explain the development of students’ knowledge and practices in science and mathematics. Policy, teaching, and research in mathematics and science education are often informed by tacit assumptions about the nature of learning. We will seek to make those assumptions explicit and explore the theoretical underpinnings, which inform work in mathematics and science education.

Course rationale
Theories about how people learn underlie virtually all work undertaken in education – including policies which impact instructional activities in schools; everyday practices of classroom teachers; assessments used to monitor student learning; and research undertaken to explore more effective approaches to teaching and learning. While these theories are sometimes explicated, they are often tacit. By virtue of our own experiences as teachers and learners, we possess strongly-held beliefs about the way in which learning occurs. These “personal theories” influence the way in which we approach educational work but are rarely explicit – and may not even be recognized by those who hold them. However, truly understanding instructional policies, practices, and research – and our own reactions to them - requires unpacking underlying theoretical commitments. As a foundation for doing so, this course has been designed to explore ideas about learning, which have been codified in formal theories.

In addition, through a focus on both mathematics and science education, this course has a secondary aim of increased interactions between those engaged in study of mathematics and science education. Despite numerous parallels between these two fields, we often operate in separate silos and, thus, fail to build upon work being done by our colleagues. Thus, this course has been designed to expose participants to ideas and work outside of their own areas of expertise and to encourage further discussion and collaboration among those in science and mathematics education.

Finally, as a graduate-level course, an underlying goal and commitment is to students’ ongoing professional development as educators. In particular, this course aims to support graduate students in continuing to strengthen their abilities to read critically and to engage others in consideration of theoretical and empirical work.

Course goals
The course structure and requirements have been designed to support the following learning goals:

1) Familiarity with the history of research in the psychology of mathematics and science, and particularly with important results from earlier decades
2) Familiarity with current issues of interest to the mathematics education community and science education community
3) Development of a theoretical foundation to critically analyze work on learning in the fields of mathematics and science education

Course requirements
During this course, participants are expected to:

1) Read assigned readings before each class session;
2) Attend class regularly and actively contribute to scholarly discussions of the readings;
3) Respond (in writing) to reflective questions for selected readings;
4) Conduct a group project, using learning theories to develop a lesson;
5) Write a final paper, which analyzes the theoretical foundation of an artifact, and present that in class.

- Contributions to class discussions (including completion of assigned readings)
  See #1-2 above. If you must miss one of our class sessions, please inform the instructor in advance.
- Responses to reflective questions
  See #3 above. You will be asked to complete a one-page written response to reflective questions addressing issues in the readings. These are designed to help you to engage with particular readings and will be used as the basis for our class discussions. Therefore, please submit your responses to Carmen no later than 8:00 am on the day we will be discussing the reading.
- Group Project
  See #4 above. You will conduct a group project: design and implement a lesson (about 20 min) using one or more learning theories addressed in the course readings. You will also need to use the lesson plan template to design the lesson. The template can be downloaded from Carmen. In class, the group will: 1) introduce the major ideas of your lesson plan (5 min), 2) teach the lesson to the class (20 min), 3) collect and summarize feedbacks from peers (5 min). Note that each member of the group should play a role in implementation of the lesson. For example, you can co-teach the lesson. Please submit your lesson plan to Carmen 24 hours before your teaching.
- Final Paper
  See #5 above. My goal is for the paper written for this class to be as useful as possible for your ongoing progress in your graduate program as well as your teaching practice. The purpose of final paper is to unpack the theoretical underpinnings of an instructional practice. You should select an artifact related to teaching practice.
  1. An artifact should be one of the following:
     - A video clip of classroom teaching
     - A video clip of interview with a student
     - Students’ test papers (e.g., you can analyze 20 responses to one question.)
     You can either download artifacts from Carmen or find your own artifact.
  2. We will use the approach of O-P-M to analyze the artifact. O (Observation) is the data you have. For example, the teaching video clip, interview transcript, and students’ written responses are all observations. P refers to Patterns. You will need to use basic qualitative data analysis methods to identify patterns of learning from your data. M refers to Models. In this course, models are the different learning theories. In your paper, you should describe the observations—introduce the source of data, participants (the teacher or the students), background, etc., report how you use qualitative methods to identify patterns, and discuss which learning theories explain the patterns and how.
  4. You will share ideas of your final paper in groups. You can use poster, PPT, or handouts. Your peers will give you feedbacks. You can use the feedbacks to revise your final paper.

Course grading

Grades will be determined based upon the following weighting of course requirements:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Contributions to class discussions</td>
<td>15%</td>
</tr>
<tr>
<td>Responses to reflective questions</td>
<td>20%</td>
</tr>
<tr>
<td>Group Project</td>
<td>30%</td>
</tr>
</tbody>
</table>


Policies, procedures, & information

I intend that students from diverse backgrounds and perspectives be well-served by this course; that students’ learning needs be addressed both in and out of class; and that the diversity that students bring to this course be viewed as a resource, strength, and benefit. Your suggestions about how to improve the value of diversity in this course are encouraged and appreciated.

In addition, I wish to fully include persons with disabilities in this course. If you have a disability-related need for modifications in this course, please let me know and follow appropriate procedures with the Resource Center for Persons with Disabilities.

Writing is a crucial component of any graduate-level course. If you need assistance beyond that available from the instructor and other class participants, please consider contacting http://cstw.osu.edu/writingcenter

I assume that all assignments turned in as part of this course are honest representations of your own work. Violations of the academic integrity policy, such as plagiarism or academic fraud are grounds for academic action and/or disciplinary sanction as described in Ohio State University’s student conduct code. Incidents of plagiarism will be taken very seriously; therefore, you are cautioned not to copy any text without using appropriate quotations and source citations. If you have any questions about what constitutes plagiarism, please ask! (University regulations on plagiarism, as well as links to additional resources on this topic, are available at http://studentaffairs.osu.edu/resource_csc.asp)
Course schedule
The course readings represent a combination of classical and contemporary literature of learning theories. The purpose is to present an overview of the historical development of learning theories and at the same time familiarize you with current issues of interest to the mathematics education community and science education community.

Week 1
Discussion: What is a learning theory? What do our own “personal learning theories” entail?
Presentation: A brief introduction to learning theories; Basic methods of data analysis

Week 2
Overview of learning theories

Supplemental Readings (Not Required)

Week 3
Behaviorist learning theories

Supplemental Readings (Not Required)

Week 4
Introduction to Cognitive Learning Theories & Piaget
Introduction to Cognitive Learning Theories

Piaget

**Week 5**

**Vygotsky and Situated Cognition**

*Vygotsky*


*Situated Cognition*


**Supplemental Readings (Not Required)**


**Week 6**

**Conceptual Change Tradition (1)**


**Week 7**

**Conceptual Change Tradition (2)**


**Supplemental Readings (Not Required)**


**Week 8**

**Socio-cultural Tradition and Diversity (1)**
  Helping At-Risk Students Meet Standards: A Synthesis of Evidence-Based Classroom Practices 
  In N. Minich, E. Forman, & A. Stone (Eds.), Contexts for learning: Socio-cultural dynamics in 
  children’s development (pp. 91-119). Oxford England: Oxford University Press.
• Lee, O., & Luykx, A. (2007). Science education and student diversity: Race/ethnicity, language, 
  culture, and socioeconomic status. In S. K. Abell & N. G. Lederman (Eds.), Handbook of research in 

Week 9
Socio-cultural Tradition and Diversity (2)
  University Press.
  and the discourse of the other (pp. 3-11). New York: Bergin & Garvey.

Week 10
Problem-solving
  Cambridge handbook of thinking and reasoning, pp. 321-349. Cambridge University Press, 
  Cambridge.
  Instructional Science, 26(1-2), 49–63.
  for Science Mathematics and Environmental Education.
• Sage, J.M. (1996). A Qualitative Examination of Problem-Based Learning at the K-8 level: 
  Association.

Week 11
Assessment Strategies Based on Learning Theories
• Jin, H., & Anderson, C. W. (2012). Development of assessments for a learning progression on 
  carbon cycling in socio-ecological systems. In A. Alonzo & A. W. Gotwals (Eds.), Learning 
• National Research Council (2001). Knowing what students know: The science and design of 
• Wood, T. & Sellers, P. (1997). Deepening the Analysis: Longitudinal Assessment of a Problem-

Week 12
Implications on Teaching (1)
  Instruction: A Research-Based Teacher Professional Development Program for Elementary School 
  Mathematics (Report No. RR-003). Madison, WI: National Center for Imporving Student Learning 
  and Achievement in Mathematics and Science.

Week 13
Implications on Teaching (2)

Week 14
Presentation