Cognition and Technology
ED TEC 6444/ED PSY 6444

Winter 2004: Thursdays, 5:30-8:10pm
South Campus Classroom (SCC) 103 (and the E. Desmond Lee Technology & Learning Center for selected meetings)

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Office Hours: Mondays 3:30-5pm, Thursdays 4-5pm, or by appointment
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Course syllabus and links at:
Mygateway course web site at: http://mygateway.umsl.edu

Course Purpose
Through exploration, discussion and analysis of cognitive theories and computer-based "cognitive tools", students will gain a critical understanding of the relationship between the design of technological tools, the use of those tools in educational settings, and the implications of that use for learning.

Objectives
• Understand relevant cognitive theories and their implications for and relevance to the use of technologies in education. Perspectives include:
- Cognitive modeling rooted in artificial intelligence
- Conceptual change models and causal models
- Cognitive apprenticeship
- Sociocultural theory and mediated action

• Critically evaluate the design of technology-based "cognitive tools" and their use. Specific tools include: computer tutors, simulations, hypermedia systems, multimedia exploratory environments, and knowledge building databases.

Required Activities
There are five main activities associated with the course:
1) Attending class weekly and actively participating. These sessions will be devoted to presentation and discussion of readings and other assignments, led by the professor and students, as well as "laboratory" exploration of software. You should notify me before class if you know you will not be able to attend, and as soon as possible if something unexpected arises. Missing more than two class meetings will require makeup work.

2) Doing the required reading and discussing it in our online discussion board
You are expected to post at least one message per week to discussions of readings on the class discussion board on the class Mygateway site (accessed at http://mygateway.umsl.edu). You must make at least one post *before* 6pm Wednesday evening, the day before class. Please read other students' responses to the discussion before you post, and make an effort to build on their

ideas (we want a discussion, not a set of isolated comments). Before class, make sure and read any comments that are posted after yours, because we are likely to use the online discussion as a jumping off point for face-to-face discussion.

3) Together with another student, making a presentation of key points and leading the class in discussion of two readings during the semester. You will sign up for time slots the second week of the semester. In one case, you will act as the presenter, and in the other, you should act as the questioner/facilitator.

4) Completing a report on a cognitive evaluation of an educational technology. A proposal will be reviewed and approved by Week , and the printed paper will be due at the time of the final exam. The paper should be in APA format (4th Edition) and refer to concepts from class readings (with citations where appropriate) and discussion. This project may be done individually or in a pair.

5) Completing an "open final exam". At the beginning of the session, you will be given a set of questions and the opportunity to discuss them with the group. You will then individually write up answers to the questions, but have the opportunity to discuss them further as you wish, and refer to any resources you bring with you.

Grading

Grades for the course will be based on class-related work as follows:

- Class participation,
  including weekly participation during class/short written assignments (20%)
  and presenting/leading discussion (10%)
- Weekly participation in online discussion group (20%)
- Research paper—(length 8 or more printed pages, using APA format) (30%)
- Final exam (20%)

Final grades will be given based on the sum of these parts. Pluses and minuses may be given, with the exception of an A+.

Class Readings

Books (available at the university bookstore)

Bruer, J. T. (1993). *Schools for thought: A science of learning in the classroom*. Cambridge, MA: MIT Press.

McGilly, K. (1994). *Classroom lessons: Integrating cognitive theory and classroom practice*. Cambridge, MA: MIT Press.

Other articles and chapters (cited below in the class schedule) are available on the Mygateway course web site in the "Course Documents" area.

Note

If anyone has a health condition or disability, which may require accommodations in order to effectively participate in this class, please contact the **Disability Access Services Office in 144 Millennium Student Center at 516-6554.** Information about your disability will be regarded as confidential.

Class and Assignment Schedule

Week 1: Introduction

Class Activity on Thursday, Jan 15:

- Personal introductions, background, and purposes
- Orientation to the class, syllabus, and policies
- Introduction to technology and its relation to cognitive science and cognitively-based classroom practice
- Hands-on introduction to the Mygateway CourseInfo system
- Hands-on exploration of interactive systems

Week 2: Cognitive Science and Education

*Assignments to be completed **before** class this week*

- Send me an email with your thoughts on "What makes a technology effective or not for learning?"
- Participate in Mygateway online discussion by introducing yourself. If you are unable to post, email me (polman@umsl.edu) and I will try to help you solve any problem by class.
- Read Bruer Chapters 1 & 2, and McGilly Chapter 1

Class Activity on Thursday, Jan 22:

- Discussion of readings

Week 3: Cognitive Modelling and Intelligent Tutoring

*Assignments to be completed **before** class this week*

- Participate in Mygateway online discussion
- Read Bruer Ch. 3 (pp. 51-79) and
  Anderson, J. R., Boyle, C. Farrell, R., & Reiser, B. J. (1987). Cognitive principles in the design of computer tutors. In P. Morris (Ed.), *Modelling cognition*, (pp. 93-133). New York: John Wiley.

Class Activity on Thursday, Jan 29:

- Discussion of readings
- Demo/exploration of a Geometry or Algebra computer tutor from Carnegie Learning (http://www.carnegielearning.com/). A Flash-based online tour of Quantitative Literacy Through Algebra is accessible at http://www.carnegielearning.com/postsecondary/mathematics/products/ (click on "Guided Overview after the intro)

Week 4: Problem-solving and Math

*Assignments to be completed **before** class this week*

- Participate in Mygateway online discussion
- Read Bruer Ch. 4 (pp. 81-126) and
  Schofield, J. W., Evans-Rhodes, D., & Huber, B. R. (1990). Artificial intelligence in the classroom: The impact of a computer-based tutor on teachers and students. *Social Science Computer Review, 8*(1), 24-40.

Class Activity on Thursday, Feb 5:

- Discussion of readings
- Further exploration of a Geometry or Algebra computer tutor from Carnegie Learning

Week 5: Conceptual Change and Causal Models in Science and Social Studies: Microworlds and Simulations

*Assignments to be completed **before** class this week*

- Participate in Mygateway online discussion
- Read beginning of Bruer Ch. 5 (pp. 162-171) and
  White, B. Y. (1993). *Intermediate abstractions and causal models: A microworld-based approach to science education.* Paper presented at the AI-ED 93: World Conference on Artificial Intelligence and Education, Charlottesville, VA.
- Read *one* of the following two:
    - Schauble, L., Raghavan, K. & Glaser, R. (1993). The discovery and reflection notation: A graphical trace for supporting self-regulation in computer-based laboratories. In S. P. Lajoie & S. J. Derry (Eds.), *Computers as cognitive tools* (pp. 319-337). Hillsdale, NJ: Erlbaum.
    - Shute, V. J., & Glaser, R. (1990). A large-scale evaluation of an intelligent discovery world: Smithtown. *Interactive Learning Environments, 1*, 51-77.

Class Activity on Thursday, Feb 12:

- Discussion of readings
- Exploration of ThinkerTools physics simulation and/or SmithTown economic simulation

Week 6: Assessment in Cognitive Context of Science Instruction

*Assignments to be completed **before** class this week*

- Participate in Mygateway online discussion
- Read Bruer Ch. 5 (pp. 162-171) and McGilly Ch. 3 (pp. 51-74)

Class Activity on Thursday, Feb 19:

- Discussion of Week 5 and Week 6 readings
- Demo/Exploration of DIAGNOSER on the Mac or on the Web

Week 7: Learning from Hypermedia in History and Literature

*Assignments to be completed **before** class this week*

- Participate in Mygateway online discussion
- Read McGilly Ch. 4 (pp. 75-101)
- Write a paragraph-long proposal of what cognitive tool you would like to evaluate for your semester project and why

Class Activity on Thursday, Feb 26:

- Discussion of readings
- Exploration of a history or literature hypermedia resource on the web

Week 8: Cognitive Apprenticeship and Reciprocal Teaching

*Assignments to be completed **before** class this week*

- Participate in Mygateway online discussion
- Read Bruer Ch. 6 (pp. 173-213) & McGilly Ch. 9 (pp. 229-270)

Class Activity on Thursday, Mar 4:

- Discussion of readings
- Demo/Exploration of Web-based Inquiry Science Environment (WISE), Model-It or Scientific Inquiry Assessment Environment

Week 9: Anchored Instruction and Goal-based scenarios

*Assignments to be completed **before** class this week*

- Participate in Mygateway online discussion
- Read McGilly Ch. 7 (pp. 157-200)
- Schank, R. C. (1992). Goal-based scenarios. Technical Report No. 36. Evanston, IL: Northwestern University Institute for the Learning Sciences.

Class Activity on Thursday, Mar 11:

- Discussion of readings
- Demo/Exploration of Jasper and/or other Vanderbilt products

Week 10: Learning Math through Video Analysis

*Assignments to be completed **before** class this week*

- Participate in Mygateway online discussion
- Read Bresnahan, S., Ducas., T., & Rubin, A. (1994). Cartwheeling in CamMotion. *Hands On!, 17*, 2. Available: http://www.terc.edu/handson/f94/cartcam.html
- Read the Video Analysis Activity at the Slam Dunk Science Site (http://www.scire.com/sds/vidact/Pages/vidact.html)

Class Activity on Thursday, Mar 18:

- Discussion of readings
- Demo/Exploration of CamMotion

Spring Break March 22-March 26

Week 11: Learning through Writing

*Assignments to be completed **before** class this week*

- Participate in Mygateway online discussion
- Read Bruer Ch. 7 (pp. 215-256) and McGilly Ch. 8 (pp. 201-228)

Class Activity on Thursday, Apr 1:

- Discussion of readings
- Hands-on use of a writing tool

Week 12: Computer Tools as Cultural Tools

*Assignments to be completed **before** class this week*

- Participate in Mygateway online discussion
- Read Pinkard, N. (1999). Learning to read in culturally responsive computer environments. CIERA Report #1-004. Ann Arbor, MI: Center for the Improvement of Early Reading Achievement. (available at http://www-personal.umich.edu/~pinkard/homepage/pinkard-CIERA.pdf)
  Lee, C. D. (2001). Is October Brown Chinese? A cultural modeling activity system for underachieving students. *American Educational Research Journal, 38*(1), 97-142.

Class Activity on Thursday, Apr 8:

- Discussion of readings
- Demo/Exploration of Say Say Oh Playmate

Week 13: Distributed Cognition

*Assignments to be completed **before** class this week*

- Participate in Mygateway online discussion
- Read Salomon, G., Perkins, D. N., & Globerson, T. (1991). Partners in cognition: Extending human intelligence with intelligent technologies. *Educational Researcher, 20* (1), 2-9.

Class Activity on Thursday, Apr 15: Class will not meet as a group this week, because I am attending a conference (American Educational Research Association). You may use the class time to work independently on your final project.

Week 14: Technology as Scaffolding Science Inquiry

*Assignments to be completed **before** class this week*

- Participate in Mygateway online discussion
- Read Reiser, B. J., Tabak, I., Sandoval, W. A., Smith, B., Steinmuller, F., Leone, T. J., (in press). BGuILE: Stategic and conceptual scaffolds for scientific inquiry in biology classrooms. In S.M. Carver & D. Klahr (Eds.) Cognition and Instruction: Twenty five years of progress. Mahwah, NJ: Erlbaum (available at http://www.letus.org/bguile/Papers/bguile_chapter.pdf)

Class Activity on Thursday, Apr 22:

- Discussion of reading
- Demo/Exploration of BGuILE (Biology Guided Inquiry Learning Environment)

Week 15: Summary and Review

*Assignments to be completed **before** class this week*

- Participate in Mygateway online discussion
- If you plan on turning in the recommended draft of your cognitive evaluation paper for feedback, it is due by class on April 29 (feedback will be returned by Monday, May 3).

Class Activity on Thursday, Apr 29:

- Course evaluations
- Review and discussion of course concepts and "big ideas", using Inspiration

Final version of paper due at time of final exam: Thursday, May 6, 5:30-7:30pm.