

Cognition and Instruction I

Psy 625

Spring 2013

Course Description

625. *Cognition and Instruction I*. Three semester hours.

This course will examine the psychological principles and scientific knowledge base underlying the major instructional theories. Content will include an evaluation of how current theories and knowledge of human cognition relate to the principles and practices of instructional design and development.

The amount of material on cognition and instruction is absolutely staggering. Some of it is “pop psychology” junk and some of it is way too “education oriented” for me to stomach. Still, much of it is written by very credible cognitive scientists. Indeed, the classic articles and books listed below are easily less than 10% of the “good stuff.” As such, my aims in this course are to 1) expose you to the scope of available resources, 2) use Norman and Tufte to show you that the topic can be both fun and rigorous at the same time, 3) have you delve into some area(s) of the literature in more detail.

As the two texts should make clear, instructional design is not just about schools and classrooms. Likewise, we will look at topics such as web design and game design as other domains of cognition and instruction. Our goal then will be to look for “general principles” of **cognition** that will obtain across various **instructional** applications.

Texts

Norman, D.A. (2002). *The Design of Everyday Things*. New York: Basic Books.

Tufte, E.R. (2003). *The Cognitive Style of PowerPoint*. Cheshire, CT: Graphics Press.

The Basics

Keep in mind that a syllabus sometimes shifts as the course unfolds. I say that by way of noting the importance of class attendance, as you will be held responsible for any change in plans announced in class. Another basic admonition every syllabus should include is that cheating (broadly defined) is not allowed. Or, as the University likes me to say: “All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment. (See Student's Guide Handbook, Policies and Procedures, Conduct).” Also, note that “Students requesting accommodations for disabilities must go through the Academic Support Committee. For more information, please contact the Director of Disability Resources & Services.”

Course Format

The course format will vary from class to class, so I have been as specific as possible on the schedule of events. However – much of the class will involve you making presentations.

Grades

Currently you have an A. To keep the A, just do what I ask you with an appropriate sense of professionalism and punctuality. Specifically: I expect you to “do the homework,” and to actively participate in the discussions over the Norman and Tufte readings. Your real chance to shine will come in your three individual presentations, our critiques, and your “glorified book report.” Should you feel a need to do “extra credit,” then you should do two “glorified book reports.”

Presentations and Reports

You will do three presentations over journal articles/book chapters that you have read for the course. Some “classic” options are found below in the list of Suggested Readings.

Based on the number of folks in the class, we’ll determine an appropriate length for each presentation. Your task will be to provide a summary of the material, and then to lead/stimulate a discussion of that topic. You can use handouts/overheads/the chalk board/powerpoint/French mimes as pleases you, but none of that is required. These will begin after Spring Break.

And yes, this is class that leads to the widely spread rumor that “Henley hates powerpoint.” But, if you actually read the Tufte book (as assigned) then you’ll see that is a gross over-simplification...

Additionally, I want to see you apply what you have learned. As such, everyone will do a “critique” on an instructional material. We’ll cover the specifics of this assignment in class.

The “glorified book report” is just what it says. Write a 10 page-ish summary/review of the book with the class in mind as your audience. Along with your taxes, these will be due April 15th (so don’t procrastinate). Books for this assignment are found at the end of the syllabus, and you will present these in the last few weeks of the course.

The Instructor

Dr. Tracy B. Henley

You are welcome to drop by and speak with me any time that you find me in my office. Beyond that, just see me before (or after) class to schedule a meeting.

Schedule of Events

Date **Topic**

1/14 **Pointless Pontification**

Course Overview

1/21 **Holiday – No Class**

1/28 Lecture

An Idiosyncratic Summary of Cognitive Science in less than 3 hours...

What is Cognitive Science? The computer as an Interdisciplinary model

The foundations of cognitive science: "a cognitive revolution"

George Miller and Jerome Bruner

Ulric Neisser

The philosophy of science (as it relates here)

From Logical Positivism to Kuhn and beyond

Neuroscience : Perception, Learning, Memory, & Cognitive Development

Anthropology and Linguistics

Cultural universals (Whorf)

Language, thought, and reality (Vygotsky)

Describing language: phonology, syntax, semantics, etc

Language acquisition (Chomsky)

Linguistic Flexibility (Lakoff)

Philosophy

Philosophy of psychology (Ryle and Wittgenstein)

Philosophy of mind (Fodor and Dennett)

Consciousness, free will, AI (Searle and Dreyfus)

Philosophy of language (Grice)

Cognitive Psychology

Schema and Mental representations

Perception and Memory = Mind (James)

Concepts and categories (Rosch)

Reasoning, planning, and problem solving

Computer Science

Artificial Intelligence

Connectionism and Machine Learning

Natural Language Processing

The "sociology" of computing and cognitive science

Homework

Go to the library and look for **textbooks** on topics such as cognition and instruction, instructional design, and related areas. What are the core and common features?

While at the library also look for **materials** (such as journals, like *Cognition and Instruction*) on topics such as cognition and instruction, instructional design, and related areas. What are the classical and current topics that folks write about?

Go to the web and look for other materials on cognition and instruction, instructional design, web design and game design. What are the common features in this literature? What are the current "hot topics?"

While on the web also look for **syllabi** from courses on cognition and instruction, instructional design, and such. What are the core and common features?

Be prepared to present and discuss all your findings at the next class.

2/4 Seminar

We will discuss the previous homework in Seminar fashion (i.e., you do the talking).

Homework

Review the list of suggested readings and pick the three articles you want to read and present (rank order 10 or 12, as folks may not get all their top picks). Finding the papers and skimming the abstracts would be optimal as time allows. Many of them are available online. Make sure you can obtain the articles you select.

By next Monday, have read Norman's book (at least chapters 1-3).

2/11 Schedule Presentations

Discussion: Norman Chapter 1-3

Homework

Have finished the Norman book

2/18 Discussion: Norman Chapter 4-5

2/25 Discussion: Norman Chapter 6-7

Homework

Have read Tufte's booklet. Have your first presentation about ready.

3/4 Discussion: Tufte

3/11 Spring Break – No Class

3/18 Seminar: Student presentations from selected readings

Homework

Make sure you have your next presentation ready for next week (that will be my birthday – so wow me).

Find an “instructional material,” which can be an educational material, a training material, a game manual/tutorial, or even an appropriate web site, and then provide a critique of it based on the principles of cognition and instruction that you have learned thusfar. These are due in about a month.

3/25 Seminar: Student presentations from selected readings

Homework

Make sure you have your last presentation ready for next week.

4/1 Seminar: Student presentations from selected readings

4/8 Seminar: Discuss design critiques

Homework

Have your “glorified book reports” and final presentations ready

4/15 Seminar: Final Presentations of glorified book reports
Homework
Think about what else we need to do/discuss (comps?)

4/22 (Final Class Meeting unless something comes up)
Discussion
Final discussion, course evaluation, etc

The suggested readings list represents a very eclectic collection of things. Some I personally like, many are by authors that I respect, and others are works that are considered “classics” in the field. This list should be large enough that all of you can find three articles of interest. As noted previously, several of these are available online.

Thirty-Four Selected Readings for Student Presentations

Anderson, J. Douglass, S., & Qin, Y. (2005). How should a theory of learning and cognition inform instruction? In A. Healy (Ed.), *Experimental cognitive psychology and its applications* (pp. 47-58). Washington, DC: APA.

Anderson, J. R., Reder, L. M., & Simon, H. A. (1996). Situated learning and education. *Educational Researcher*, 25, 5-11.

Butler, A. C. (2010). Repeated testing produces superior transfer of learning relative to repeated studying. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, 36, 1118-1133.

Carey, S. (1986). Cognitive science and science education. *American Psychologist*, 41, 1123-1130.

Carey, S., Evans, R., Honda, M., Jay, E., & Unger, C.M. (1989). 'An experiment is when you try it and see if it works': A study of grade 7 students' understanding of the construction of scientific knowledge. *International Journal of Science Education*, 11, 514-529.

Chinn, C. A., & Brewer, W. F. (1993). The role of anomalous data in knowledge acquisition: A theoretical framework and implications for science instruction. *Review of Educational Research*, 63, 1-49.

Cognition and Technology Group at Vanderbilt. (1990). Anchored instruction and its relationship to situated cognition. *Educational Research*, 19, 2-10.

Cognition and Technology Group at Vanderbilt. (1993). Toward integrated curricula: Possibilities from anchored instruction. In M. Rabinowitz (Ed.), *Cognitive Science: Foundations of Instruction* (pp. 33-55). Hillsdale, NJ: Erlbaum.

Cognition and Technology Group at Vanderbilt. (1994). From visual word problems to learning communities: Changing conceptions of cognitive research. In K. McGilly (Ed.), *Classroom lessons: Integrating cognitive theory and classroom practice* (pp. 157-200). Cambridge, MA: MIT Press.

Cooper, P.A. (1993). Paradigm shifts in designed instruction: From behaviorism to cognitivism to constructivism. *Educational Technology, 33*, 12-19.

Fuson, K.C., & Willis, G.B. (1989). Second graders' use of schematic drawings in solving addition and subtraction problems. *Journal of Educational Psychology, 81*, 514-520.

Gaskins, I. (1994). Classroom applications of cognitive science: Teaching poor readers how to learn, think, and problem solve. In K. McGilly (Ed.), *Classroom lessons: Integrating cognitive theory and classroom practice* (pp. 129-156). Cambridge, MIT Press.

Glaser, R. (1984). Education and thinking: The role of knowledge. *American Psychologist, 39*, 93-104.

Graesser, A. C., Person, N. K., & Huber, J. D. (1993). Question asking during tutoring and in the design of educational software. In M. Rabinowitz (Ed.), *Cognitive Science: Foundations of Instruction* (pp. 149-172). Hillsdale, NJ: Lawrence Erlbaum Associates.

Halpern, D. F. (1998). Teaching critical thinking for transfer across domains. *American Psychologist, 53*, 449-455.

Hunt, E., & Minstrell, J. (1994). A cognitive approach to teaching physics. In Kate McGilly (Ed.), *Classroom lessons: Integrating cognitive theory and classroom practice* (pp 51-73). Cambridge, MIT Press.

Karpicke, J. D., & Roediger, H. L. III (2008). The critical importance of retrieval for learning. *Science, 319*, 966-968.

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist, 41*, 75-86.

Lehman, D. R., Lempert, R. O., & Nisbett, R. W. (1998). The effects of graduate training on reasoning: Formal discipline and thinking and about everyday-life events. *American Psychologist, 43*, 431-442.

Mayer, R. E. (2005). Cognitive theory of multimedia learning. In R. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (pp. 31-48). Cambridge, MA: Cambridge University Press.

Mayer, R. E., Griffith, E., Jurkowitz, I. T. N., & Rothman, D. (2008). Increased interestingness of extraneous details in a multimedia science presentation leads to decreased learning. *Journal of Experimental Psychology: Applied*, *14*, 329-339.

Moreno, R., & Mayer, R.E. (2000). Engaging students in active learning: The case for personalized multimedia messages. *Journal of Educational Psychology*, *92*, 724-733.

Nickerson, R. S. (1986). Reasoning. In R. F. Dillon & R. J. Sternberg (Eds.), *Cognition and Instruction* (pp. 343-373). San Diego, CA: Academic Press.

Noble, D. D. (1989). Cockpit cognition: Education, the military, and cognitive engineering. *AI & Society*, *3*, 227-296.

Norman, D., Gentner, D., & Stevens, A. (1976). Comments on learning schemata and memory representation. In D. Klahr (Ed.), *Cognition and instruction*. Hillsdale, NJ: Erlbaum.

Pirolli, P.L., & Greeno, J.G. (1988). The problem space of instructional design. In J. Pstka, L.D. Massey, S.A. Mutter, & J.S. Brown (Eds.), *Intelligent tutoring systems: Lessons learned* (pp. 181-201). Hillsdale, NJ: Lawrence Erlbaum Associates.

Pyc, M. A., & Rawson, K. A. (2010). Why testing improves memory: Mediator effectiveness hypothesis. *Science*, *330*, 335.

Schank, R.C. (1990). Case-based teaching: Four experiences in educational software design. *Interactive Learning Environments*, *1*, 231-253.

Scardamalia, M. & Bereiter, C. (1986). Writing. In R. F. Dillon & R. J. Sternberg (Eds.), *Cognition and instruction* (pp. 59-81). San Diego, CA: Academic Press.

Simon, H.A. (2000). Observations on the sciences of learning. *Journal of Applied Developmental Psychology*, *21*, 115-121.

Stanovich, K. E. & Cunningham, A. E. (1993). Where does knowledge come from? Specific associations between print exposure and information acquisition. *Journal of Educational Psychology*, *85*, 211-229.

Sternberg, R. J. (1987). Teaching intelligence: The application of cognitive psychology to the improvement of intellectual skills. In J. B. Baron & R. J. Sternberg (Eds.), *Teaching thinking skills: Theory and practice* (pp. 182-218). New York: W. H. Freeman.

Tobias, S. (1994). Interest, prior knowledge, and learning. *Review of Educational Research*, *64*, 37-54.

Tripp, S.D., & Bichelmeyer, B. (1990). Rapid prototyping: An alternative instructional design strategy. *Educational Technology Research & Development*, 38, 31-44.

Seventeen Suggested Books for Final Paper(s)

Bransford, J.D., Brown, A.L., & Cocking, R.R. (1999). *How People Learn: Brain, Mind, Experience, and School*. Washington, DC: National Academy Press.

Bruer, J. (1993). *Schools for Thought: A Science of Learning in the Classroom*. Cambridge, MA: The MIT Press.

Clark, R.C. and Mayer, R.E. (2003). *e-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning*. San Francisco, CA: Pfeiffer.

Dewey, J. (1933). *How we think*. Lexington, MA: D. C. Heath and Company.

From *The Collected Works of John Dewey, 1882-1953* (37 volumes published between 1967-1987). Carbondale: Southern Illinois University Press. See Volume 7: 1912-1914, Essays, *Interest and Effort in Education*. (1979).

James, W. (1899). *Talks to Teachers on Psychology: And to Students on Some of Life's Ideals*. Note: Both Harvard and Dover have reprinted this recently.

Johnson, J. (2000) *GUI Bloopers: Don'ts and Do's for Software Developers and Web Designers*. San Francisco: Morgan Kaufmann.

Kahneman, D. (2011). *Thinking fast and slow*. Farrar, Straus and Giroux.

Krug, S. (2000) *Don't Make Me Think! A Common Sense Approach to Web Usability*. Berkeley, CA: New Rider Press.

Krug, S. (2005). *Rocket Surgery Made Easy*. Berkeley, CA: New Rider Press.

Norman, D. A. (1993). *Things that make us smart*. Reading, MA: Addison-Wesley.

Rosson, M.B. & Carroll, J.M. (2001). *Usability Engineering: Scenario-Based Development of Human Computer Interaction*. San Francisco: Morgan Kaufmann

Schank, R.C. (2001). *Designing World-Class E-Learning: How IBM, GE, Harvard Business School, and Columbia University Are Succeeding at e-Learning*. New York: McGraw Hill.

Schraagen, J.M., Chipman, S.F., & Shalin, V.L. (Eds.) (2000). *Cognitive Task Analysis*. Mahwah, NJ: Lawrence Erlbaum and Associates.

Simon, H.A. (1996). *The Sciences of the Artificial* (3rd Ed). Cambridge, MA: MIT Press.

Tufte, E.R. (1997). *Visual Explanations: Images and Quantities, Evidence and Narrative*. Graphics Press: Cheshire, CT.

Winograd, T. (1996). *Bringing Design to Software*. Addison-Wesley: Wokingham.