

Foundations of Educational Neuroscience (BEP-570) – Fall 2015

College of Education, The University of Alabama

Instructor: Firat Soylu

Email: fsoylu@ua.edu

Room: Graves Hall 326

Meeting Time: Thursdays, 3:00pm – 5:50pm

Office hours: By appointment

Office: Carmichael Hall 307B

Course Description

This is an introductory course on Educational Neuroscience, an emerging area of research grounded in multiple disciplines including (but not limited to) educational psychology, neuroscience, cognitive science, and learning sciences. The purpose of this course is to provide an introduction to major issues and topics in these domains and discuss implications for educational research and practice.

Educational Neuroscience started as a conversation between brain sciences and education. However educational neuroscience is now becoming a field in itself. A field is defined by the grand questions that guide investigations, methodologies, a body of literature and a community of scientists. These are yet to be realized for educational neuroscience. Discussions in this class and the work students pursue after taking it will hopefully contribute to the efforts in defining this new area of research.

Course Objectives

- Students will explore major themes and paradigms in cognition and brain research.
- Students will discuss the implications of primary research in brain science for educational research and learning design practice.
- Students will synthesize, criticize and interpret empirical work and theoretical perspectives in a specific domain of their choice that relate to their research interests and future research agenda.
- Students will formulate ideas for future empirical research in their field of study that incorporate perspectives and methodology from brain science.
- Students will compare and contrast various research methodologies in learning sciences, educational psychology and cognitive neuroscience.

Prerequisites

Graduate students from any program can take this course. This course does not require any specific background in neuroscience, cognitive science or education.

Overview of Weekly Themes

1. An introduction to educational neuroscience
2. Research methods in educational neuroscience and educational psychology
3. Memory & learning
4. Executive mechanisms & self regulation
5. Emotion and cognition
6. Embodied Cognition
7. Intelligence
8. Evolution of Cognition
9. Influence of culture on brain and cognition
10. Social development
11. Language development
12. Literacy development & dyslexia
13. Mathematical development and numerical cognition
14. Science learning and scientific reasoning
15. Poster Sessions

Course Activities

Weekly Readings & Reflections

You are expected to read all weekly readings. There are also some optional recommended readings. Most weeks we will have one chapter from the textbook (see below) and one review or primary research article. You will be able to download the articles from the Blackboard site.

You will write a reflection about each week's readings that will synthesize ideas from at least two of the readings for the week and post these on the forum for that week in Blackboard. You are expected to submit your reflections by 12:00 pm on the day of the class (Thursday). The title of your reflection should be concise and should summarize the main theme of your reflection (e.g., Language evolution parallels changes in brain structure). At the end of your reflection you will pose one discussion question to be covered in class. The discussion question should be in a separate paragraph and in bold-text, so that viewers of your post can quickly spot your big question for the week.

Project

The project is an opportunity to focus on a topic that is of interest to you, and to practice sharing your findings and insights with other people, in a format similar to academic conferences. You will (1) synthesize the literature about a specific cognitive phenomenon, disorder, or area of research of your choice, (2) provide a reflection on the implications of the research covered for educational theory and learning design practice, and (3) formulate ideas for future educational research. The final paper for the project can be structured as a literature synthesis, opinion paper, theoretical paper, or a research grant proposal.

There are four deliverables for the course project:

(a) Proposal: By the fourth week of the class you will submit a proposal for your project that explains the topic you will focus on, why this topic is important for you and the

format you would like to use (e.g., grant proposal). We will have a one-to-one meeting to discuss your project ideas. The proposal will also have a bibliography showing the body of work you will cover in your paper.

(b) Proposal presentation: You will give a 10-min presentation to introduce your project and to get feedback from the class.

(c) Poster session: We will have a poster session at the end of the semester where students present their projects.

(d) Final paper: You will submit a 5000 to 8000 words paper based on your proposal.

Grading	
Readings, reflections and class participation 3 pts each week (1 pt for the reflection, 1 pt for the discussion question & 1 pt for class participation)	3 x 14 = 42 pts
Proposal	15 pts
Proposal presentation	5 pts
Poster Presentation	8 pts
Final paper	30 pts
Total	100 pts

Grading scale: A: 90 - 100, B: 80 - 89, C: 70 - 79, D: 60 - 69, F: 0 - 59

Textbook (TB)

Mareschal, D., Butterworth, B., & Tolmie, A. (Eds.). (2014). *Educational Neuroscience*. John Wiley & Sons.

Weekly Readings

1. An introduction to educational neuroscience

[TB Chp1] Butterworth, B & Tolmie, A. (2014) Introduction

Fischer, K. W., Goswami, U., & Geake, J. (2010). The Future of Educational Neuroscience. *Mind, Brain, and Education*, 4(2), 68–80

2. Research methods in educational neuroscience and educational psychology

[TB Chp 2] Dick, F., Lloyd-Fox, S., Blasi, A., Elwell, C., Mills, Debbie. (2014). Neuroimaging methods.

[TB Chp 5] Tolmie, A. (2014). Research methods in educational psychology.

3. Memory & learning

Klingberg, T. (2010). Training and plasticity of working memory. *Trends in Cognitive Sciences*.

Squire, L. R., & Wixted, J. T. (2011). The cognitive neuroscience of human memory since H.M. Annual review of neuroscience

4. Executive mechanisms & self regulation

[TB Chp 12] De Haan, M. (2014). Attention and Executive Control.

Diamond, A. (2013). Executive functions. *Annual Review of Psychology*

Blair, C., & Raver, C. C. (2014). School Readiness and Self-Regulation: A Developmental Psychobiological Approach. *Annual Review of Psychology*, (August 2014), 1–21.

5. Emotion and cognition

Immordino-Yang, M. H., & Damasio, A. (2007). We Feel, Therefore We Learn: The Relevance of Affective and Social Neuroscience to Education. *Mind, Brain, and Education*

[TB Chp 11] Jones (2014). Emotional Development

6. Embodied cognition

Smith, L., & Gasser, M. (2005). The Development of Embodied Cognition: Six Lessons from Babies. *Artificial Life*, 11(1-2), 13–29. <http://doi.org/10.1162/1064546053278973>

Wilson, M. (2002). Six views of embodied cognition. *Psychonomic Bulletin & Review*, 9(4), 625–636. <http://doi.org/10.3758/BF03196322>

Barsalou, L. W. (2008). Grounded Cognition. *Annual Review of Psychology*, 59, 617–645.

7. Intelligence

Deary, I. J. (2012). Intelligence. *Annual Review of Psychology*

Newman, S. D. & Just, M. A. (2005). The neural bases of intelligence: A perspective based on functional neuroimaging. In Robert J. Sternberg & Jean Pretz (Eds.). *Cognition and intelligence: Identifying the mechanisms of the mind*. New York: Cambridge University Press.

Cole, M. W., Yarkoni, T., Repovs, G., Anticevic, a., & Braver, T. S. (2012). Global Connectivity of Prefrontal Cortex Predicts Cognitive Control and Intelligence. *Journal of Neuroscience*

8. Evolution of brain and cognition

Schoenemann, P. T. (2006). Evolution of the Size and Functional Areas of the Human Brain. *Annual Review of Anthropology*, 35(1), 379–406.

Anderson, M. L. (2007). Evolution of cognitive function via redeployment of brain areas. *The Neuroscientist*, 13(1), 13–21.

9. Influence of culture on brain and cognition

Kitayama, S., & Uskul, A. K. (2011). Culture, mind, and the brain: current evidence and future directions. *Annual Review of Psychology*

Tcheang, L. (2014). Culture and math. *Cognitive Neuroscience*

10. Social development

Burnett, S., Sebastian, C., Cohen Kadosh, K., & Blakemore, S. J. (2011). The social brain in adolescence: Evidence from functional magnetic resonance imaging and behavioural studies. *Neuroscience and Biobehavioral Reviews*

[TB Chp 10] Blakemore, S.J., Cohen Kadosh, K., Sebastian, C., Grossman T., Johnson, M. (2014). Social development.

11. Language development

[TB Chp 6] Knowland, V., Donlan, C. (2014). Language development.

Sakai, K. L. (2005). Language acquisition and brain development. *Science*

12. Literacy development & dyslexia

[TB Chp 7] Fern-Pollak, L., Masterson, J. (2014). Literacy development.

Schlaggar, B. L., & McCandliss, B. D. (2007). Development of neural systems for reading. *Annual Review of Neuroscience*

13. Mathematical development and numerical cognition

[TB Chp 8] Butterworth, B., Varma, S. (2014). Mathematical development.

Arsalidou, M., & Taylor, M. J. (2011). Does $2+2=4$? Meta-analyses of brain areas needed for numbers and calculations. *Neuroimage*

14. Science learning and scientific reasoning

[TB Chp 9] Fugelsang, J., Mareschal, D. (2014). The development and application of scientific reasoning.

Dunbar, K. N., & Klahr, D. (2012). Scientific Thinking and Reasoning. *The Oxford Handbook of Thinking and Reasoning*

Goldstone, R. L., Landy, D. H., & Son, J. Y. (2010). The education of perception. *Topics in Cognitive Science*

Disability Statement

If you are registered with the Office of Disability Services, please make an appointment with me as soon as possible to discuss any course accommodations that may be necessary.

If you have a disability, but have not contacted the Office of Disability Services, please call (205) 348-4285 (Voice) or (205) 348-3081 (TTY) or visit 133-B Martha Parham Hall East to register for services. Students who may need course adaptations because of a disability are welcome to make an appointment to see me during office hours. Students with disabilities must be registered with the Office of Disability Services, 133-B Martha Parham Hall East, before receiving academic adjustments.

The Code of Academic Conduct

All students in attendance at the University of Alabama are expected to be honorable and to observe standards of conduct appropriate to a community of scholars. The University expects from its students a higher standard of conduct than the minimum required to avoid discipline. Academic misconduct includes all acts of dishonesty in any academically related matter and any knowing or intentional help or attempt to help, or conspiracy to help, another student. The Academic Misconduct Disciplinary Policy will be followed in the event of academic misconduct.