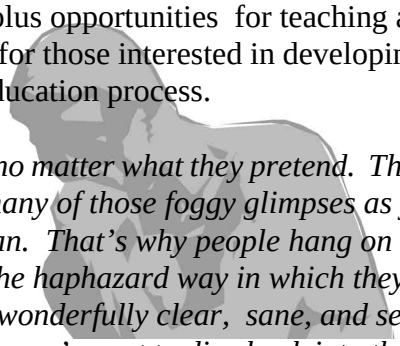
ECE 198

Teaching and Learning Engineering

Winter 2002, Thursdays 9:35-11:00, McGill 2334

A course on how people learn and understand key concepts in engineering. Readings in engineering and cognitive science, plus opportunities for teaching and evaluating K-12 students. Useful for all students, especially for those interested in developing leadership skills and an understanding of education and the education process.



> *Nobody thinks clearly, no matter what they pretend. Thinking's a dizzy business, a matter of catching as many of those foggy glimpses as you can and fitting them together the best you can. That's why people hang on so tight to their opinions; because, compared to the haphazard way in which they're arrived at, even the goofiest opinion seems wonderfully clear, sane, and self-evident. And if you let get away from you, then you've got to dive back into that foggy muddle to wrangle yourself out another to take its place.* --- Dashiell Hammett

As we muddle along, this class is designed to be engaging, provocative, and enjoyable. The class will largely depend upon your input. You will help create and direct the class.

Student responsibilities:

- active participation
- weekly readings (notes and occasional presentation of readings)
- homework (occasional assignments to teach others)
- final project (project of your own design)

My role, as instructor will be to facilitate your engagement with the material, provide resources for you, and give you feedback and direction. Please make use of my office hours,

Noah Finkelstein
275 EBU 2
858 822 5909
nfinkels@ucsd.edu

Official Office Hours
:Thursdays 11a-Noon
I'm usually in the office
Call or drop an email to make an appt

Class Schedule:

Week 1: 1/10 Introduction
Week 2: 1/17 For those simultaneously enrolled in TEP 139, identify fieldsite(s)
Week 4: 1/31 Identify area of interest for project - Turn in 1 paragraph description
Week 7: 2/21 Outline of project due
Week 9: 3/7 Rough draft due
Finals week: project due.

ECE 198: Teaching and Learning Engineering

(preliminary reading list)

Week 1: Introduction: The state of affairs: where are we at in pre-college education.

Third International Mathematics and Science Study (TIMSS) Summary
Third International Mathematics and Science Study Revisited (TIMSS-R) Summary
National Center for Education Statistics: Science Highlights: The Nation's Report Card 2000

Week 2: Introduction II: survey of some approaches to pre-college instruction in sciences

Mestre, Jose, "Learning and instruction in pre-college physical science", Phys. Today 44:9 (1991) 56-62.
McDermott, "How We Teach and How Students Learn - A mismatch?," AJP 61(4), (1993), p295,
Lopez and Tuomi, "Student-Centered Inquiry," Educational Leadership, May 1995, p 78.

Week 3: So what about an engineering approach in pre-college?

NY Times "Push To Reorder Science Puts Physics First" NYT 1/28/99.
Driver, Guesne, and Tiberghien, "Children's Ideas and the Learning of Science," in Children's Ideas in Science, Open University Press, (1985) pg 1.
Shipstone, "Electricity in Simple Circuits," in Children's Ideas in Science, Open University Press, (1985) pg 33
Lopez, R.E., and Schultz, T. "Two revolutions in k-8 Science Education,"Physics Today, Sept 2001, pg. 44.

Week 4: Intro to Theories of learning: surveys

Redish, "Implications of Cognitive Studies for Teaching Physics," AJP 62(6), (1994), 796
Felder, R.M, " Reaching the Second Tier: Learning and Teaching Styles in College Science Education," J College Science Teaching 23(5) 286-90, (1993).

Week 5: theories of student learning II: pre conception vs. misconception

DiSessa, A.A., "Knowledge in Pieces," in Forman and Puffall Constructivism in the Computer Age, Hillsdale NJ: Lawernce Erlbaum (1988). [part I]
Posner, G.J,Strike, Hewson and Gertzog, "Accommodation of a Scientific Conception: Toward a Theory of Conceptual Change," Science Education 66(2), 211-227 (1982)

Week 6: Constructionism

Papert, S, "Situating Contructionism," in Harel and Papert, Constructionism, Ablex, (1991), 1
Felder, R. and Brent, R., "Effective strategies for Cooperative Learning," Journal of Cooperation and Collaboration in College Teaching 10(2) 69-75 (2001).

Week 7: Cog - Science approach

Bruer, J.T., "Science inside the Black Box" in J.T. Bruer Schools for Thought, Bradford Books
Brow, Collins, Duguid, "Situated Cognition and the Culture of Learning," Educational Researcher, Jan - Feb 1989, 32-42.
Bruer, J.T. "Education and the Brain: a Bridge Too Far," Educational Researcher, to appear.

Week 8: Context and Culture:

Dewey, J., Experience and Education, Ch's 1, 2 & 7 Science Chapter
Finkelstein, N. Context in the Context of Physics Education

Week 9: Gender, Physics and Math:

Schiebinger, Londa, Has Feminism Changed Science, Harvard University Press, 1999.
Introduction and Chapeter 9: Physics and Math

Week 10: Student projects discussion / presentation.

Fieldwork Opportunities
ECE 198 / TEP 130

Informal Environments: Junior High/ High School		
UCSD Science and Tech Club (after school)	afternoons ~3-5pm	Solana Beach
Tutoring - Nat'l City Middle School	afternoon / flex	UCSD
High School		
Active Physics	flex	UC High / SD High
Engineering	flex	Crawford High

Programs of your design.

If you select to enroll in TEP 139 (for an additional 2 units), you will be required to spend approximately 40 hours in the field. Each time you work in the field you would write-up notes about your experience (details about these notes are forthcoming).

ECE198: Final Project Overview

Purpose: to have you explore in depth a topic of your choosing, relating to teaching and learning in engineering. The projects should be challenging, fun, and allow you to explore an area of your interest.

Topic: I encourage you to be creative. There is no set form to these final projects There are no set topics. Examples of reasonable final projects are: a traditional research paper, the design and write-up of some activities for pre-college students, or a research study where you collect data on some area of engineering education that interests you.

Some basic guidelines are below. However, as necessary, these too are flexible. Just be certain to check with me about your project.

Length: 8-10 pages (double spaced). Your work must be **typed**. This may be the only inflexible rule. Don't forget a **spell checker** please.

Due date: No later than Noon, March 14, 2002 In my office.

Structure: Your projects will vary, but below I give some general guides for a research study, where you might collect data from the field:

Introduction:- states the problem or area of exploration
- list your research questions and hypothesis **
**(PURPOSE OF DATA COLLECTION)
- gives a summary of your paper

Background: - locates your topic in relevant literature
- gives a history of your field-site / working environment

Body: Data: - how was your data collected
- what difficulties were there in your data collection (why / when was is possible to collect data and why/when not) - were you able to prove your hypothesis?
- presentation of collected data -- e.g. fieldnote excerpts, taped conversation pre-post test data, etc. Make sure this is an orderly presentation. For bulk data, include an appendix, rather than inserting volumes of data into the body. (e.g. if you developed sample homework problems it is okay to put one or two into the paper, but include the 50 or so used in an appendix)

Analysis/Results/Discussion:
- what results do your data suggest
- how does this prove/ disprove your hypothesis
- how does this support or refute alternative theories

Conclusion/ Summary:
- summarize your paper / work
- what future directions does this research point to --- if you were to continue the the project what would you do next / recommend to others

As I mentioned in class there are many ways to approach the final project. If you have any questions feel free to contact me, I'm always eager to discuss your projects.