Cognition, Cognitive Development, Learning Theories

Monsoon 2016

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Tutors: Deborah Dutta, Durgaprasad Karnam

Credits: 4
Duration: *16 weeks; class starts 16 August, ends November 29; final paper and project due Dec 15*
Time and Location: Tuesday 2-4 PM, Friday, 2-4 PM; Room 102, Main Building, HBCSE

This is a survey course, seeking to provide a brief overview of three topics. First, it outlines the major problem domains in cognitive science that are relevant to education, and the experimental methods used. Some theoretical issues will be discussed, but in the context of the problem domains. Secondly, it will provide a summary outline of experimental and theoretical work in cognitive development, but focusing on topics related to education. Finally, a historical overview of the main theories of learning is provided.

Learning Objectives: The course seeks to establish basic concepts that will help the student in navigating the rich and complex literature in cognitive science, developmental psychology and learning. A second objective is developing the skills to ask critical questions about this research, particularly its application/relevance to education. A final objective will be gaining familiarity with the empirical methods, data analysis approaches, and argument structures used in the study of cognition, development and learning. The class discussion will seek to connect the course topics with issues in education.

Reading Material

The course requires extensive reading (40-50 pages a week). The readings are mostly based on the three textbooks below.

1. **Cognition Section**: Smith, E. E. & Kosslyn, S. M. (2007). *Cognitive Psychology- Mind and Brain*. Pearson Education Inc., New Jersey.
2. **Cognitive Development Section**: Flavell, J.H., Miller, P.H. & Miller, S.A. *Cognitive Development*. Prentice Hall, New Jersey.
3. **Learning Theories Section**: Hergenhahn, B.R. & Olson, M.H. *An introduction to theories of learning*. Prentice Hall India.

Indian editions of 1 and 3 are available on Flipkart, and some copies are available in the library. The Flavell and Miller book is available in the library, and the three chapters can be photocopied. Readings for the last two weeks will be provided later. The title for each week in the course plan below indicates the topic covered in that week.

Class Structure

The class will be participant-driven and discussion-based. Each week's readings would be presented by a team of two participants, possibly in two sections, and they will lead the discussion. This cycle will continue throughout the course. All participants are requested to read the text beforehand, so that there is a common base to discuss and critically analyse the issues raised by the papers.

All participants have to turn in a “Comments and Queries” (C&Q) document every Monday to the TA, focusing on the week's readings and focus questions. See Note 1 below for guidelines on what is

expected in this document. The Comments and Queries could also be used to frame the discussion in the class. Participants who are presenting the material in a given week need not submit this document for that week, but generating these would be useful in guiding the discussion. The TA will provide feedback on your C&Q documents and the presentations. See Note 2 for guidelines on the structure of presentations.

You will work with the TAs to develop a concept map of the reading, integrating the various concepts covered in the reading, to generate a big picture. This activity will be done in class, for the modules where it is possible. The map will be built on the blackboard by teams, and this activity will contribute to your class participation grades.

Apart from class-based work, students need to form 2-member teams, and replicate one of the experiments discussed in class. This requires reading the research paper reporting the experiment, discussing the protocol and feasibility of replication with the instructor/TAs, recruiting participants, running the experiment, and writing a report on the results and the problems/issues encountered in the replication. The experiment can be from any of the sections in the course. The replication work can be done at any point during the course, but it would be better if it is done during the break in October.

Assessment

Students taking the course for credit will be graded on the basis of three submissions. A final term paper (40%), the Comments and Queries document, Class Presentations and Class Participation (40%), and a report on the Replication Experiment (20%). Each C&Q/Class-Presentation carries 4 marks. Your C&Qs and Class Presentations together should total a minimum of 10 submissions.

The final term paper should preferably connect the student's interest in education with one of the topics covered in the course. A rough outline of the term paper should be submitted by November 15, and a clear outline (argument structure) of the paper developed in discussion with the instructor. See Note 3 on what is expected for the term paper.

Course Plan

Session	**Date**	**Topic**	**Reference Chapter/ Paper**
0	Aug 16	Introduction	
1,2	Aug 19, 23	What is Learning? Approaches to Study of Learning . Early Notions of Learning	H&O Chapter 1, 2 and 3
3	Aug 26	Brain and Mind	S&K Chapter 1
4,5	Aug 30, Sept 2	Perception	S&K Chapter 2
6,7	Sept 6, 9	Attention	S&K Chapter 3
8,9	Sept 13, 16	Knowledge Representations, Memory	S&K Chapter 4
10,11	Sept 20, 23	Representation and concepts	F, M & M, chapter 4,
12,13	Sept 27, 30	Encoding and Retrieval in LTM	S&K Chapter 5
14,15	Oct 4,7	Working memory	S&K Chapter 6
BREAK	**Oct 11,14**	**Dussehra & Muharram**	
16, 17,18,19	Oct 18,21,25,28	Reasoning and Problem Solving	S&K Chapter 10, F, M & M, chapter 5,
20,21,22,23	Nov 1,4,8,11		H&O Chapter 10-11, 12,13
21,22	Nov 15, 18	Vygotsky	Mind and Society Chapter 1,2,3,

			6,7
23,24	Nov 22, 25	Bruner	Folk Pedagogy Models of Learning, History of Learning Theories, Growth of Mind
25	Nov 29	Connections with Science Education	Scientific and Pragmatic Challenges for Bridging Education and Neuroscience by Verma, McCandliss and Schwartz

Note 1: Comments & Queries

1) A summary of the papers is not expected. If summarising helps you in understanding the material, you should still do it. But don't submit this summary, keep that part as a separate file, and refer to the summaries when you run into problems or get stuck while conceptualizing/writing your final paper/proposal/thesis.

2) Queries with the following structure are not useful: "how can we use (say) mental imagery for education/design"? There is no clear answer to this question, because it is too general. It would be better if you turn such questions into something like: "in math/science education, there is this problem of XYZ, and the author's ideas seem to imply that strategy ABC would be useful/would not work, is this right?" or something along these lines. To do this, you will have to do some focused thinking about the author's ideas, and apply it to a problem you are familiar with. If you have a question like this, other people can contribute to the discussion, and maybe even help you solve a problem.

3) Comments along the lines of "this view is interesting", "the author has done a good job" etc. are not useful. Comments should show close engagement with the ideas in the papers. So something like "the author's position seems to contradict/support the position of (another) author X in the following way" or "the data seems to be showing X, but it does not seem to support the author's claims" or "the author argues for X, but it has the following implication, which is undesirable" etc.

4) Before writing your C&Q, try to think a little more deeply about the implications of the ideas presented by the authors, and also try to connect their ideas with other things you have read, in the class or outside. This would help you come up with C&Qs that are closer to the description above.

Note 2: Presentations

All presentations should follow the structure below:

1) What are the major findings reported in the section?
2) What designs/data/arguments support these findings?
3) How well does the design/data/argument support the findings? What are the main problems?
4) What would be other better ways to support the findings?
5) What implications/connections could follow from the findings, particularly for education?
6) Any details you would like to highlight.

Using 1 slide for each of these questions would be the ideal format. Aim for a 15 minute presentation for each paper. Presentations for each day can be up to 30 minutes in total.

Note 3: Term Papers

The following points should be kept in mind while picking your topic for the term paper, and during writing of the paper.

*1) The paper should be around 15-25 pages, single space. Why is this an important point? Because you should choose a topic that *requires* that much space for discussion. If you choose a very broad topic, you will not be able to do justice to it in this amount of space. If you choose a very narrow topic, you will not have enough things to say to fill that amount of space. The size of the paper is a good way to "scope" your topic.*

2) The paper should have an argument. That is, it should have some clearly articulated premises, and a conclusion that follow from these, preferably with some discussion of data/results that support the conclusion. For instance, you can argue that neuroscience research is irrelevant for science education. Or you can argue that imagery research can inform physics learning. But you should give reasons for why you think this is the case. The requirement for an argument means the paper cannot be a literature review, a discussion of a new approach to science education, or an evaluation of a new technology. The argument structure makes the term paper similar to a miniature thesis, or a journal paper. If you write a few of these during your course work, you will be able to deal better with your research proposal and thesis.

*3) **The process of writing** the paper should make you think. This is sort of implicit in the previous point, as you cannot develop an argument without thinking. However, in academic writing, particularly in humanities and social sciences, apart from the thinking you do to develop the argument, you also think *through writing*. This involves being able to see counter examples and counter arguments as you develop your argument in text, and then finding ways of countering them. This process can take a life of its own, and might lead you into many tangents that prevent you from developing your core thesis, so part of the skill here is learning how to do this in a controlled fashion.*

4) Ideally, you should pick a topic that is related to a possible thesis topic you have in mind. This way, you can reuse the thinking you do for the term paper while developing your research proposal.

5) The paper should have an abstract (~150 words) that summarises its key points.

6)The term paper is due on December 15th midnight. This is a hard deadline, as I have to turn in the marks by the date specified by TIFR.

7) Two alternatives to term papers could be: 1)Developing and executing a new experiment, to test a new hypothesis; 2) Reviewing a book. Texts based on these would also need to follow the above structure. Further, you need to discuss ideas for these with the instructor beforehand, to develop a clear structure of what you will be doing.

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