

**HBCSE Graduate Course (Spring 2016)**  
**Cognition, Cognitive Development and Learning**

**Instructors:** Ankush Gupta and Jayashree Ramadas

**Tutor:** Deborah Dutta

**Credits:** 4

**Period:** January to April 2016

**Contact:** 56 hours

**Main Texts:**

1. Smith E. E., and Kosslyn, S. M., (2007). **Cognitive Psychology: Mind and Brain**. PHI Learning, Delhi. [Referred as 'SK' below]
2. Flavell J. H., Miller, P. H., and Miller, S. A. (2002). **Cognitive Development**. (4<sup>th</sup> edn.) Prentice Hall, New Jersey. [Referred as 'FMM' below]
3. Vygotsky, L. S. (1978). **Mind in Society: The Development of Higher Psychological Processes**. Eds.: Cole, M., John-Steiner, V., Scribner, S., and Souberman, E., Harvard University Press, Cambridge, MA. [Referred as 'VC' below]

**Contents:**

**A. Introduction to Cognition and Cognitive Development (Jan 4 and 7):**

Readings: Chapter 1, SK  
Chapter 1, FMM

**B. Brain Mechanisms of Vision (Jan 11):**

Readings: Hubel, D. H. and Wiesel, T. N. (1979). Brain Mechanisms of Vision, Scientific American Inc., September Issue, 40-52.

**C. Perception (Jan 14)**

Readings: Chapter 2, SK  
Chapter 2, FMM

**D. Attention (Jan 21 and 25):**

Readings: Chapter 3, SK

**E. Infant Cognition (Jan 28)**

Readings: Chapter 3, FMM

**F. Representations (Feb 2, 4 and 8):**

Readings: Chapter 4, SK  
Chapter 4, FMM

**G. Child Development from Vygotsky's Perspective (Feb 11, 15 and 18):**

Readings: Chapters 1, 2, 3, 6 & 7, VC

**H. Long Term Memory: (Feb 22, 23 and 29):**

Readings: Chapter 7, FMM

Chapter 5, SK

**I. Working Memory (Mar 3):**

Reading: Chapter 6, SK

**J. Problem Solving and Reasoning (Mar 7, 14 and 17):**

Readings: Chapter 10, SK

Chapter 5, FMM

**K. Models of Learners by Bruner**

Readings: Bruner, J. (1985). Models of the Learner, *Educational Researcher*, 14 (6), pp. 5-8.

Bruner, J. (1996). Folk Pedagogy. in *The Culture Of Education*. Harvard University Press, Cambridge, pp. 44 - 65.

**L. Bridging Education and Neuroscience (Mar 31):**

Reading: Verma, S., McCandliss, B. D., and Schwartz, D. L. (2008). Scientific and Pragmatic Challenges for Bridging Education and Neuroscience, *Educational Researcher*, 37 (3), 140-152.

([http://aaalab.stanford.edu/papers/Challenges\\_for\\_Ed\\_Neuro\[1\].pdf](http://aaalab.stanford.edu/papers/Challenges_for_Ed_Neuro[1].pdf))

**M. Mathematics learning in Childhood (Apr 4):** Special class by K.

Subramaniam

Reading: first 28 pages of Clements, D. H., & Sarama, J. (2007). Early childhood mathematics learning. In Lester, F.K. (Ed.) *Second handbook of research on mathematics teaching and learning*. Information Age Publishing. pp. 461-555.

**N. Discussions on Term papers (April 11-28).**

**Assignments:**

Assessment in the course was based on 3 components

1. **Classroom participation:** Students were expected to have read the study materials before the class, to summarize them orally and to participate actively in class discussions.
2. **Written assignments:** Each student created a workbook on google drive that was shared with the instructors. These workbooks were regularly discussed in the class. They included:

a. Responses to the guiding or comprehension-check questions as specified in textbook or suggested by the instructors. These questions were mostly limited to the content of the textbook or other readings required for the class: see pp.4-10 of this document.

For parts b.-d. below students had to go beyond the given reading materials.

b. Student's comments and reflections on the material (brief or extended) (Students should try to counter their own criticisms, and finally give their own conclusion / opinion on which view(s) seem more plausible.)

c. Student's questions on the topics:

- general / conceptual / theoretical
- specific / empirical / phenomenological

d. Student's own examples or counter - examples related to the topic

· from experience

· from received knowledge

e. Learning resources related to the topic identified by the student

· articles, books, videos

· from library, internet or other

**3. Term paper and presentation:** A term paper based on literature review on a topic chosen by the student.

### **Guiding or comprehension-check questions**

(Note: The sequence of chapters as it was done in the course is maintained here, since often the questions were often based on comparative understanding of the present chapter with previous readings.)

#### **SK Chapter 1**

The following questions may serve as advance organisers.

1. What is cognition? See how SK & FMM define it differently.
2. Why do I want to study cognition and cognitive development? Any present curiosities? or future interests which could be served by my learning about cognition?
3. The history section - how has the development of this field been shaped by the work of philosophers, psychologists and computer scientists?
4. What is your view of the computer analogy for mind? How might it help, or limit, our study of cognition?
5. Conjecture different forms that 'mental representations' may take. Imagine and recount some specific instances of behavioural input and output, and the representations and processes that may connect them.

6. What do you understand by 'structure-process trade-off'?
7. The biology section - structure and function of neurons, the nervous system and the brain - describe the highlights as you see them.
8. pp.46-48 - critical thinking - read and reflect on the questions.

### **FMM Chapter 1**

Q1. Identify two questions central to all of the approaches to studying to cognitive development.

Q2. What have been Piaget's central contributions to cognitive development; what have been some criticisms of the Piagetian approach and the subsequent modifications made to his observations and his theory?

Q3. What are some of the alternative approaches to Piaget?

### **Hubel and Wiesel 'Brain Mechanisms of Vision'**

#### **SK Chapter 2 (beginning sections)**

1. Summary / comprehension

Based on information in the Hubel and Wiesel article - make as many correspondences as possible between structural and functional features of the cerebral cortex. Classify these features according to appropriate levels of size or space scales (eg. single neuron, small or large groups of neurons, extended cortical areas, etc).

2. Historical context

Find out from Google search - the first recorded instances in history that the brain was related with cognitive functions; with sensory and motor functions; with vision.

#### **SK Chapter 2 (Sections 1- 4.2.2, 5.2.1)**

When is perception more or less demanding in everyday life? How might actions such as driving a car in traffic or reading in a noisy environment rely more or less on top-down processing? (Response to this question can be drafted by monday morning, and we shall discuss on Jan 18)

### **FMM Chapter 2 - Pages 29-43, 58-62**

With the help of the examples cited in Chapter 2 of FMM illustrate how nature and nurture work together in the development of infant perception.

### **SK Chapter 3**

Please anticipate and write draft responses to the comprehension check questions. You may refine your responses after the class.

### **FMM Chapter 3**

Describe the different ways in which post-Piagetian research on infant cognition has modified the Piagetian view of the sensorimotor stage of development.

### **SK Chapter 4 (Representations and knowledge in LTM)**

Please anticipate and write draft responses to the comprehension check questions. You may refine your responses after the class.

### **FMM Chapter 4 (Representations and Concepts)**

Q1: Chapter 4 (FMM) describes experiments in which certain categories of animals (such as birds and fishes) are given to young children and asking them to categorize some more examples such as shark into these categories. What are differences between these experiment and their results from similar experiments (diggers and builders) described in Chapter 4 in S&K?

Q2: Based on Chapter 4 (FMM), list the representational competencies that babies less than 3 year old exhibit.

Q3: In Fig 4.1, the sketches of lollipop and balloon look similar, and that of pig and chicken look similar, but the children who made these insist that these are different. What does this behavior tell about the nature of pictorial representations in these children's minds?

### **VC Chapter 1 (Tool and Symbol in Child Development)**

Q1: Vygotsky is critical of the Botanical and Zoological models of Child development. What are these models and why he considers them inappropriate models for child development?

Q2: What evidences are presented in the chapter to support the argument that language assists a child in effective use of tools?

### **VC Chapter 2 (The Development of Perception and Attention)**

Q1: Vygotsky states that ignoring the role of language in cognitive development has led to wrong conclusions about development of perception in children? What are these wrong conclusions according to Vygotsky?

Q2: According to chapter, younger children name their drawing only after making it, while adults can decide before what they are going to draw. What does this tell about the evolution of perception and its relation to language from child to adult? Does this observation seem consistent with your experiences?

### **VC Chapter 3 (Mastery of Memory and Thinking)**

Q1: How does Vygotsky define natural memory and what are its differences from other kinds of memories?

Q2: According to this chapter, are external signs tools useful in development of memory or in development of thinking?

### **VC Chapter 6 (Interaction between Learning and Development)**

Q1: State in brief the three prior theoretical positions (as described by Vygotsky) on the relation between learning and development. Specify whether these positions posit any 'interaction' between learning and development.

Q2: Summarise Vygotsky's own position on the relation between learning and development. Think of your own examples to illustrate this relationship. (The latter part relates to part d. of this assignment.)

Q3: Can you think of a society where a distinction between learning and development is irrelevant? Can you think of a theory which does not make this distinction?

### **VC Chapter 7 (The Role of Play in Development)**

Q1. Vygotsky states that for children, play is not merely or necessarily a source of pleasure but a developmental need. What needs of children does play satisfy?

Q2. In this chapter, Vygotsky claims that in play, a child learns to unconsciously follow the rules and hence internalizes the rules. Recently there is a significant amount of work in science education focussing at developing games in which the concepts in science are stated as rules of the games and children play it with given constraints. Can we thus conclude that such games always help a child in learning scientific concepts with much less effort or resistance?

### **FMM Chapter 7 (Memory)**

Q1. What evidences are presented in Chapter to support recent claims that infants also possess memory?

Q2. Are the testimonies given by children in criminal cases true representation of their autobiographic memories? Give reasons for your answer.

Q3. What strategies are used for memorization tasks by children as described the the chapter?

Q4. Constructivists claim that memorization is not merely an storage process of information received, but a lot more is added internally in memory than the information that is memorized. Similarly, recall is an active reconstruction process than just copying out the stored information. How do these construction/reconstruction tendencies differ for different age groups and for children from different cultures?

Q5. State examples to support the idea in the chapter that different socio-cultural experiences lead to learning of different kind of memory strategies.

### **SK Chapter 5 (Encoding and Retrieval from Long-Term Memory)**

### **SK Chapter 6 (Working Memory )**

### **FMM Chapter 5**

Q1. It is obvious from many experiments that children as young as 2 year old have reasoning and problem solving abilities. Cite two examples from the chapter that support this claim. What then is it in these abilities that changes during the course of development of children?

Q2. Theory building seems to be a basic cognitive process in children from an early age. What similarities and differences do we observe in theory building of children and what is desired in an ideal scientific process.

Q3. The chapter lists 10 metacognition aspects of reading a text that are of significant importance in education process. Which of these aspects are we able to successfully develop in our CCDL course? What can we do to develop these 10 aspects further?

## **SK Problem Solving and Reasoning (Chapter 10)**

### **Models of a Learner by Jerome Bruner**

Q1. Before presenting the models of learner, Bruner first argues that it is impossible to have a true model of a learner, as it is task specific. But then he argues that actual learning processes do not differ across tasks and hence there is a possibility of arriving at a general model of learner. What advantage does he have in presenting these arguments before presenting the models, rather than if he would have presented them after the models?

Q2. What kind of pedagogical approaches are necessary for successful learning in the four models of learner presented by Bruner?

### **Folk Pedagogy by Jerome Bruner**

Q1. Folk psychology is about beliefs one has about others' minds. What is folk pedagogy and what is its relevance to education? Support your answers with examples.

Q2. If group discussions are to be seen as a means of creating knowledge, what beliefs are needed on part of participants?

Q3. Draw parallels and differences between models of learner presented in this paper and the previous paper on "Models of a Learner".

### **Reading: Scientific and Pragmatic Challenges for Bridging Education and Neuroscience by Verma, McCandliss and Schwartz.**

Give two examples of situations that may be of relevance to both science education and neuroscience research.