Sample questions from which the advisor chose 6 (3 pairs of two questions each)

1. One major issue in many learning domains is specificity of learning (i.e., failure of learning transfer). Are there clear common principles that underlie experiences that seem to produce transfer versus specificity (if so, make sure to discuss these in the context of at least three separate learning domains)? Are there differences across domains in terms of the relationship between learning task characteristics and specificity/transfer of learning?

2. Do learners ever successfully demonstrate far transfer? If so, when and why? If not, please explain why you don't think far transfer exists.

3. A fundamental challenge in conceptualizing and measuring cognitive skills is *context specificity*. Learners frequently display a skill in one context, but fail to display it another, relevant context. How do data about the context specificity of learners' skills inform theories of skill acquisition? And how are data about context specificity incorporated into measurement practices? Draw on at least two research areas in considering these questions.

4. The extent to which attention is needed for learning has been a topic of heated debate in psychology and neuroscience. Some of the disagreements may stem from different conceptualizations of what attention entails. How would you define the different aspects of attention? Given those definitions, then discuss when and how learning may or may not depend upon attentional processes.

5. Attention is a multi-faceted construct, yet it rests at its lowest level on a basic pull-push mechanism, between attentional enhancement and distractor suppression. First explain that basic push-pull mechanism and what it entails at the level of receptive fields of neurons. Second, discuss the brain networks that mediate various forms of attention. Finally, discuss how these two previous levels combine (or not) to elicit the varieties of attention described in the literature.

6. Many researchers seek to identify mechanisms of learning and to specify their functioning. However, this approach has been criticized as being reductionist, in the sense that it seeks to account for the complexity and richness of learning using only a small set of simple mechanisms. Consider the tension between acknowledging complexity and specifying simple mechanisms in one or two research areas, and suggest some ways in which this tension has been or could be resolved.

7. Rosch thought that mental categories "carve the world at its joints," but theory-theorists challenged that idea. Do you think Rosch was right? In your response indicate what Rosch meant by this idea, citing some of her supporting evidence, and also indicate the nature of the objections from theory-theorists. Then explain your own perspective and rationale or evidence supporting that view.

8. Bayesian and neural-network-based approaches are sometimes viewed as offering qualitatively different frameworks for thinking about cognition. Do you agree, or do you think the two approaches can be reconciled? In your answer, make note of strengths and limitations of each approach, then provide evidence from readings supporting your own view.

9. Historically there has been significant interest in whether the acquisition of mathematical knowledge (or academic knowledge more generally) is undergirded by more basic cognitive capacities. Discuss the evidence in favor/against this proposal as well as the evidence in favor/against the idea that one might be able to improve learning in mathematics (or academic domains more generally) by improving basic cognitive capacities.

10. Cognitive/developmental researchers can't seem to settle on what they mean by "working memory"—there's storage vs. processing ideas, and many subdivisions like visual working memory, spatial working memory etc. Which of the many conceptions of working memory seem most useful for studying math development, and why?

11. Review and critique the literature on **young children's learning from media, emphasizing evidence-based principles for designing educational media**. Describe how basic cognitive and learning science can be applied in the context of educational media to improve learning outcomes for young children. In the process of this critique, synthesize what is known and convey how well it is known theoretically and empirically, identify gaps in knowledge, evaluate the methods used, and provide conclusions regarding next steps for research or to advance the field.

12. What does it mean for knowledge to be implicit? By what mechanisms does knowledge shift from implicit to explicit with development and/or learning? Can it go the other way?

An example of a reading list given to a single student

Cognitive development, learning, and transfer

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