Mathematics Education Qualifying Exam Name:
Part II, Spring 09

Instructions: *You must respond to Questions 1, 2, and 3. In addition, respond to one other question of your choosing from the remaining list. Provide responses to entire questions, not parts of multiple ones. All responses should be in essay form; aim for clarity and explicitness, as well as thoroughness, concision, and coherence in your writing. The recommended length limit for each response is roughly 1000 words. If you use diagrams in your responses, draw them by hand, label each with a title (e.g., "Figure x"), and insert a clear reference to each one in the appropriate place in your narrative. Turn in any diagrams with your responses. Your responses may cite literature that is not explicitly mentioned in a question.*
Good luck and good writing!
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Question 1

At the core of von Glasersfeld's (1995) Radical Constructivism (RC) are 3 central constructs that are interrelated and organized in a particular way to form a basis for his mechanistic model of learning:

- Action scheme
- Assimilation
- Accommodation

a) Explain the meaning of each of these constructs (including any significant components of them).
b) Characterize von G's mechanistic model of learning; that is, describe how these 3 constructs are interrelated and organized to form a framework that posits how an act of learning might come about?

Illustrate your response with an example involving the learning of mathematics.

Question 2

a) Describe Thompson's (1994) theory of quantitative reasoning (QRT): explain its key components and their organization into a framework for thinking about what it means to understand and reason about quantity. Situate your description within a concrete illustrative example.

b) What aspect(s) of Thompson's QRT make it arguably deeply coherent with von Glasersfeld's RC ?

c) Position QRT within Cobb's discussion of general and domain-specific theories of mathematical thinking/learning. Which of these two types, would you argue, is QRT more or less like?

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Question 3

Oehrtman (2008) articulates an approach to the design of instruction for the concept of limit that is partially grounded in Piaget's theory of abstraction. Discuss the role of abstraction in Oehrtman's approach. In particular, describe Oehrtman's overarching design principles and the associated 5-step instructional design method, and explain how Piaget's ideas about abstraction shape and influence the development of this method.

Question 4

Cobb (2008) discusses cognitive theoretical frameworks that have been developed and used in mathematics education research: "theoretical frameworks that seek to account for teachers' and students' inferred interpretations and understandings in terms of internal cognitive structures and processes" (p. 19). He distinguishes between two types of frameworks developed within this tradition: *general* and *domain-specific* theories of mathematical thinking/learning.

a) Characterize each of these two types of theoretical frameworks, discussing key distinctions among them, and common element, as viewed by Cobb.

b) Provide an illustrative example of each type of theoretical framework; briefly describe each one and explain what makes it an example of that type.

Question 5

Throughout his expose on radical constructivism (RC), von Glasersfeld (1995) periodically refers back to an empiricist-based model of knowing that he characterizes as paradoxical and that motivated the development of his *radical* brand of psychological constructivism.

a) Characterize this model of knowing and the paradox it entails (in von G's view).

b) Explain how RC is offered as a "solution" to this paradox (in von G's view). That is, what change in perspective/assumptions does RC entail that removes the paradox to which the empiricist model leads?