

Mathematics Education Qualifying Exam
August 2020

The following constitutes the Mathematics Education Qualifying Exam for August of 2020. The questions are separated into two sections; the first section is based on MTH 761 and the second section is based on MTH 762. **You must answer all four questions on the exam.** You have four hours to complete this exam. Remember to save your work frequently.

Section I:

For both of the following questions, we expect your response to be detailed and for you to use evidence from the literature to support your claims.

1. In their seminal piece titled "Concept Image and Concept Definition in Mathematics with Particular Reference to Limits and Continuity," Tall and Vinner (1981) coin the phrases "concept image" and "concept definition".
 - a. Define both of these phrases, making sure to explain how one's "concept definition" may differ from the "formal definition" of a concept.
 - b. Pick a specific mathematical topic that you have taught (for example, in MTH 105 or MTH 107) and provide examples of a "formal definition", "concept definition", and "concept image" for this topic.
 - c. When teaching mathematics, we often use multiple representations (graphs, formulas, tables, and words) to represent concepts. Discuss how the use of multiple representations affect the formation of a "concept definition" and "concept image" for students.
2. *Active Learning* is a blanket term used to reference "classroom practices that engage students in activities ... that promote higher-order thinking" (Braun, Bremser, Duval, Lockwood, & White, 2017, p. 124). There are many different teaching styles that fit under the term of *active learning*. Two of these styles that we discussed in depth in MTH 761 are: 1) guided discovery, and 2) The (Modified) Moore Method. Discuss in detail both of these two teaching methods and provide examples (either from your own teaching and/or from the literature) of how each of these two methods have been used successfully in the teaching of mathematics.

Section II:

For both of the following questions, we expect your response to be detailed and for you to use evidence from the literature to support your claims. An attachment is provided for you as a separate document for the second question in this section.

1. For your answers to this question, please cite articles we read in 762 (or that you read for one of your projects) as examples.
 - a. What is reliability in quantitative work? How can it be achieved? Cite and discuss at least one example from an article we read.
 - b. What is validity in quantitative work? How can it be achieved? Cite and discuss at least one example from an article we read.
 - c. What is reliability in qualitative work? How can it be achieved? Cite and discuss at least one example from an article we read.
 - d. What is validity in qualitative work? How can it be achieved? Cite and discuss at least one example from an article we read.

2. In the attachment, you will find the methods section of Lockwood and Purdy (2019), which we read and discussed in MTH 762. This was a study to examine undergraduate students' understanding of the multiplication principle. For this study:
 - a. Describe the design of the study, in your own words. What were the main methods of data collection?
 - b. What are the strengths of this study's methods? Be sure to draw on what we learned about mathematics education research in class.
 - c. What are the limitations of this study's methods? Be sure to draw on what we learned about mathematics education research in class.
 - d. What is one way the study's methods could be improved, without creating a new study? Be sure to draw on what we learned about mathematics education research in class.