MED Comprehensive Examination
2017

Nature of the MED Comprehensive Examination

The purpose of the Mathematics Education (MED) Written Comprehensive Exam is to determine whether doctoral students have made sufficient progress in the program, demonstrating the necessary knowledge of theory and research methods in mathematics education and writing skills that form a foundation for successfully engaging in a dissertation study.

The questions for the take-home examination draw from content related to MED 610, MED 700, MED 701, and MED 702. The questions primarily focus on the MED Comp Reading List 2017 (see appendix), but exam prompt and response expectations include a broader familiarity of literature involving educational research, theory, and practice.

There are two parts to the MED Comprehensive Examination 2017.

Part I. Provide responses to **both** prompts related to research methods. These items primarily focus on coursework in MED 701 and MED 702, although drawing on educational theory and practice might be appropriate.

Part II. Provide responses to **one** of two prompts related to theory and practice. These items primarily focus on coursework in MED 700 and MED 610, although drawing on research methods might be appropriate.

Scheduling and Evaluation of the MED Written Exam:

MED Comp Exam takers will receive this exam at 12 p.m. on Monday, August 7, 2017. Responses are due to Dr. Robert Powers (robert.powers@unco.edu), Chair of the 2017 MED Comp Exam Committee, within 72 hours (by 12 p.m. on Thursday, August 10, 2017). MED Comp Exam takers may submit responses via email, access to shared files (e.g., documents on Dropbox or Google Docs), or flash drive delivered to the UNC mailbox.

Guidelines for MED Comp Exam Responses

Below are guidelines for doctoral students as they craft their responses.

1. Your goal is to write high quality essays, both in terms of substance and writing style. The essays should demonstrate your understanding of a variety of theoretical perspectives on learning and cognition, as well as central issues in mathematics education research. It is expected that your responses will consist of more than a literature review and should entail synthesizing the literature.
2. While you should focus on the reading list, it is appropriate and important to draw upon additional resources, such as reading from your other MED courses, statistics courses, scholarly papers, and your teaching and learning experiences.
3. The essay questions are designed to align with the reading list. However, this does not mean that you have to mention every paper on the reading list that might have bearing on the question. Support your argument by citing papers appropriately.
4. You may contact the chair of the MED Comprehensive Exam to clarify questions. This question and response will be shared with everyone taking the written exam. On the other hand, you may NOT consult with anyone else during the written examination. All university plagiarism policies will be enforced.

5. It is important that your essay has a thesis. In other words, your essay should have a stance and "your voice" by integrating existing literature, logical arguments, supporting evidence, and so forth. Your response will be evaluated on the strength of your argument, not on whether the evaluators agree with you.
6. Each response should be no longer than 5-7 pages (not including references, tables and figures). It is important to pace yourself and decide in advance which subset of ideas you think you can tackle well in the time and page-space available.
7. *Formatting instructions:* Type your response on a computer using Microsoft Word and following these guidelines:
   - Use APA style on all responses.
   - Each response is contained within a unique file, named as LastName.QuestionNumber (e.g., Hernandez.Q1)
   - Each file has a header with your name on the left margin, and question number and page number on the right margin (so that this information appears on every page).
   - Each file begins with a statement of the question to which the response is given.
   - Responses will be in 12 point Times New Roman, double spaced, with 1-inch margins all around.
   - Use clear headings (in bold font) to label each section of your essay.

Part I

Items 1 and 2: Respond to **BOTH** of the following prompts.

1. The primary goal of Lewis and Perry (2017) was to investigate the impact of the participation in lesson study using a resource kit on fractions. The authors admit that the study conditions deviate "from a more conventional experimental design" (p. 268) and provide an explanation and justification for their decision.

    a. Critique the actual study conditions of Lewis and Perry (2017).
        i. Summarize the study conditions employed by the researchers.
        ii. Explain their rationale for the decisions they made regarding the study conditions.
        iii. Evaluate the implications of their decisions on the internal and external validity (Gall, Gall, and Borg, 2007) of their study, including any ways they attempted to mitigate those threats.
    b. Recommend a more conventional experimental design that addresses the primary research goal of Lewis and Perry (2017).
        i. Summarize the study conditions of your proposed investigation assuming ideal conditions.
        ii. Compare and contrast your proposed ideal study conditions with the researchers' actual study conditions.

Reference

Gall, M. D., Gall, J. P., & Borg, W. R. (2007). *Educational research: An introduction* (8th ed.). Boston: Pearson.

2. Gaete, Gómez, and Benavides (2017) present a critique of the overuse of self-report data in mathematics education research, usually collected by means of surveys. Lockwood, Ellis, and Lynch (2016) present results from surveys and interviews with mathematicians that targets the role of examples in mathematicians' proof-related activity.
   a. Explain Gaete et al.'s (2017) critique of the overuse of self-report data in mathematics education research.
      i. Summarize Gaete et al.'s (2017) discussion of the validity threats to mathematics education research based on self-report data.
      ii. Describe their four "failure conditions" and provide an example of each condition based on the literature or experience.
   b. Evaluate Lockwood, Ellis, and Lynch (2016) using criteria established by Gaete, Gómez, and Benavides (2017)
      i. Explain how Gaete and colleagues would assess the research methodology used by Lockwood, Ellis, and Lynch (2016), including their survey methods and their triangulation of their survey with interview data.
      ii. Discuss the validity of the findings in Lockwood et al. (2016) using validity criteria presented by Gaete et al. (2017) or other validity criteria in the literature.

Part II

Item 3: Respond to **ONE** of the following prompts.

A. Gabriel et al. (2012) and Lewis et al. (2017) both provide positive results related to the concept of fractions. Based on their philosophies, how would Ernest (1991) and Vygotsky (1930) explain these results and how might they critique the studies?

B. Larsen (2013) presents a local instructional theory for the guided reinvention of the concepts of group and isomorphism in abstract algebra. In the context of guided reinvention:
   a. What does it mean to *know* mathematics? What does it mean to *do* mathematics? (Are the answers to these questions different for the student and the teacher?) What does it mean to *teach* mathematics? What are the roles of the student and the teacher, and how do they differ from those in a more typical classroom context? Illustrate your response with examples from Larsen (2013) or other guided reinvention studies.
   b. Which learning theories are well-equipped to provide a sensible account of the learning that takes place throughout the guided reinvention process? Which learning theories are *not* so well-equipped? Explain your answers.

MED Comp Reading List
2017

Ernest, P. (2002). Chapter 3. Social constructivism as a philosophy of mathematics. In *The philosophy of mathematics education* (pp. 42-67). London: Routledge.

Ernest, P. (2002). Chapter 4. Social constructivism and subjective knowledge. In *The philosophy of mathematics education* (pp. 68-85). London: Routledge.

Ernest, P. (2002). Chapter 5. The parallels of social constructivism. In *The philosophy of mathematics education* (pp. 89-108). London: Routledge.

Gabriel, F. et al. (2012). Developing children's understanding of fractions: An intervention study. *Mind, Brain, and Education, 6*(3), 137-146.

Gaete, A., Gómez, V., & Benavides, P. (2017). The overuse of self-report in the study of beliefs in education: epistemological considerations. *International Journal of Research & Method in Education*, 1-16. https://dx.doi.org/10.1080/1743727X.2017.1288205

Goos, M. (2004). Learning Mathematics in a Classroom Community of Inquiry. *Journal for research in mathematics education*, 35(4), 258-291.

Larsen, S. (2013). A local instructional theory for the guided reinvention of the group and isomorphism concepts. *Journal of Mathematical Behavior*, *32*(4), 712–725. https://dx.doi.org/10.1016/j.jmathb.2013.04.006

Lester, F. K. (2005). On the theoretical, conceptual, and philosophical foundations for research in mathematics education. *ZDM*, *37*(6), 457-467.

Lewis, C., & Perry, R. (2017). Lesson study to scale up research-based knowledge: A randomized, controlled trial of fractions learning. *Journal of Research in Mathematics Education, 48*(3), 261-299.

Lockwood, E., Ellis, A. B., & Lynch, A. G. (2016). Mathematicians' example-related activity when exploring and proving conjectures. *International Journal of Research in Undergraduate Mathematics Education*, *2*(2), 165-196. https://dx.doi.org/10.1007/s40753-016-0025-2

Newton, K. J. (2009). Instructional practices related to prospective elementary school teachers' motivation for fractions. *Journal of Mathematics Teacher Education, 12,* 89-109.

Phillips, D. C. (1995). The good, the bad, and the ugly: The many faces of constructivism. *Educational Researcher, 24*(7), 5-12.

Schoenfeld, A. H. (2000). Purposes and methods of research in mathematics education. *Notices of the AMS, 47*(6), 641-649.

Silver, E., & Herbst, P. (2007). The role of theory in mathematics education scholarship. In F. Lester (Ed.), *Second Handbook of Research in Mathematics Teaching and Learning* (pp. 39-67). New York: Information Age.

Strauss, A., & Corbin, J. (1994). Grounded theory methodology: An overview. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 273 – 285). Thousand Oaks: Sage Publications.

Vygotsky, L. (1987). The Development of Scientific Concepts in Childhood. In R. W. Rieber and A. S. Carton (Eds.) *The Collected Works of L.S. Vygotsky*. Vol. 1, 167-241. (Original work published in 1934).