MED Comps
Summer 2014
PART I

Respond to **TWO** of the following three numbered questions. You have 3 hours. This part of the exam focuses on general knowledge, mainly from coursework and readings in MED 610, 700, 701 and 702.

Provide responses to entire questions. All responses should be in essay form; aim for clarity and explicitness, as well as thoroughness, concision, and coherence in your writing. Define all technical terminology that you use in your responses and be explicit about how you are applying the ideas.

Adhere to the following formatting guidelines:

- Write your name on the first page of each response.
- Start each answer on a new sheet of paper and double space the final version.
- If you use diagrams in your responses, label each with a title (e.g., "Figure x") and insert a clear reference to each one in the appropriate place in your narrative. Figures may be hand-drawn and submitted with the electronic copy of the exam.
- In all cases, support assertions with citations from the literature, as appropriate, using APA format: (Author(s), Year).
- **SAVE** your work **OFTEN** on USB drive provided by the proctor. You will submit your final work on this USB drive and will also email the final work to Dr. Karakok at the end of the exam, in case we have issues with the USB drives.

---

1. Choose an area of mathematics education research and synthesize the findings of at least three different published research articles related to this area. Describe an important theoretical perspective (specifying its basic assumptions and mechanism) that has been employed to conduct research in this area and describe its role and impact in the research that you discussed.

2. You are interested in investigating factors that influence the successful mentoring of teaching assistants using quantitative methods. With supporting evidence design a quantitative study that will address this investigation. Be sure to include:

a. a research question(s) written in a question format as well as null and alternative hypothesis format,
b. a description of the population from which the participants will be selected and other relevant issues in sampling procedures used in the study
c. an identification of the research variables (independent and dependent) and a brief rationale for each,
d. the data gathering process – including a description of any instruments used,
e. a discussion of how you will address reliability and validity issues, and
f. the methods and justification for the analysis of the data, including the unit of analysis and the descriptive and inferential statistical methods and tests that would be appropriate.

3. *Quantitative Literacy (QL)* also known as *numeracy* is referred as the third R in education, accompanying the other two- reading and writing. Steen (2001) states that *QL* is "more a habit of mind, an approach to problems" (p.5), and it is about "capacity to deal effectively with the quantitative aspects of life" (p.6). There are many operational definitions of *QL*, all of which describe it is the ability to identify quantities, understand the relationships among

quantities and use quantitative reasoning in given contexts and everyday life situations. Even though many underlying ideas of *QL* could easily be observed in middle school mathematics curriculum (e.g., ratios, proportional reasoning, percentage), Steen (2004) points out that "numeracy can only be developed by a continued, coordinated effort throughout" (p.19) all grade levels. A group of researchers at Michigan State University developed *QL* assessment instrument to investigate the *QL* of the entering undergraduate students. They describe their results in the abstract below:

> *Development, psychometric testing, and the results of the administration of a quantitative literacy (QL) assessment to undergraduate students are described. Three forms were developed covering a wide range of skills, contexts, and quantitative information presentation formats. Following item generation and revision based on preliminary testing and cognitive interviewing, a total of 3,701 consented undergraduate students at Michigan State University completed one of the three forms. Two of the forms contained 14 multiple-choice items, and one form contained 17 multiple-choice items. All forms were completed by students in less than 30 minutes. Evidence of validity and reliability were obtained for the three forms. Unidimensionality of the underlying construct was established using confirmatory factor analysis. Correlations with ACT and university mathematics placement test ranged from .41 to .67, and correlations with the Lipkus numeracy scale ranged from .40 to .45. Cronbach's alphas for the three forms were near or exceeded .70. Comparison of student QL performance according to demographic characteristics revealed gender differences, with males scoring higher than females. These gender differences persisted even after controlling for ACT composite scores. Race/ethnicity differences were significant in unadjusted analysis, but did not persist over and above ACT composite scores in the adjusted analyses. The three newly developed forms of QL assessment will need to be further tested in the future to determine if they capture the effects of interventions that aim to improve QL.*

These researchers would like to extend this study through mixed methods in order to further understand the initial study's results and to develop interventions and additional instruments assessing *QL* of their undergraduates. Provide an overview of a proposal for a mixed method study. As part of this overview address major issues of educational research, including

a. the research question(s),
b. relevant literature,
c. a description of the setting and participants,
d. the proposed method(s) of data collection and analysis methods, including ways to ensure valid and reliable results, and
e. the limitations of your proposed study.

References

Sikorskii, A., Melfi, V., Gilliland, D., Kaplan, J., & Ahn, S. (2011). Quantitative Literacy at Michigan State University, 1: Development and Initial Evaluation of the Assessment. *Numeracy*, 4(2).

Steen, L. A. (2001). *Mathematics and democracy: The case for quantitative literacy.* Princeton, NJ: National Council on Education and Disciplines, Woodrow Wilson National Foundation.

Steen, L. (2004). *Achieving quantitative literacy: An urgent challenge for higher education.* Washington, DC: The Mathematical Association of America.

MED COMPS
Summer 2014
Part II

Respond to **TWO** of the following three numbered questions. You have 3 hours. This part of the exam focuses on the short reading list of articles and book chapters specified at the beginning of the summer and loaded onto your USB drive. You may also access ***unmarked*** copies (provided by the proctor) of the items on the short reading list during the exam. Your responses should be framed by a comprehensive treatment of the relevant ideas contained in the specified articles and book chapters. You **should also** draw on additional literature to develop broader support for your answers. Any student who uses only the reading list items in their comparisons and discussions will not pass the exam.

Provide responses to entire questions. All responses should be in essay form; aim for clarity and explicitness, as well as thoroughness, concision, and coherence in your writing. Define all technical terminology that you use in your responses and be explicit about how you are applying the ideas.

Adhere to the following formatting guidelines:

- Write your name on the first page of each response.
- Start each answer on a new sheet of paper and double space the final version.
- If you use diagrams in your responses, label each with a title (e.g., "Figure x") and insert a clear reference to each one in the appropriate place in your narrative. Figures may be hand-drawn and submitted with the electronic copy of the exam.
- In all cases, support assertions with citations from the literature, as appropriate, using APA format: (Author(s), Year).
- **SAVE** your work **OFTEN** on USB drive provided by the proctor. You will submit your final work on this USB drive and will also email the final work to Dr. Karakok at the end of the exam, in case we have issues with the USB drives.

---

1. In their study, Sfard and Lavie (2005) use the *participationist* perspective instead of the *acquisitionist* one. They claim that the *acquisitionist* perspective starts with seminal work of Piaget, which is implemented and extended by Dubinsky (1991). Provide a summary of these two strands (acquisitionist and participationist) by describing and comparing their epistemological and ontological foundations with examples from Dubinksy (1991), Simon, Tzur, Heinz, and Kinzel (2004), and Sfard and Lavie (2005) articles.

2. Simon, Tzur, Heinz, and Kinzel (2004) state, "[m]any researchers and theorists have recognized reflective abstraction as an essential focus for educators" (p.312). Both Simon et. al., (2004) and Dubinsky (1991) provide suggestions on teaching mathematics in the light of the seminal work of Piaget, focusing on reflective abstraction. Describe how each teaching suggestion implements the reflective abstraction ideas and compare these teaching suggestions. In addition, describe how these teaching suggestions might contribute to content knowledge, curriculum knowledge, and pedagogical content knowledge (Shulman, 1986) required by high school teachers.

3. You are interested in testing Sfard and Lavie's (2005) conjecture that: "children's numerical discourse lacks the *objectification* that is typical of the numerical talk of the adults" (p. 243) using quantitative methods. Explain how you could adopt the statistical methods and findings of Clark et al. (2014) and Post et al. (2010) to design a study. In your description discuss how theory would play a role by referring to the ideas outlined in Silver and Herbst (2007).

References

Clark, L. M., DePiper, J. N., Frank, T. J., Nishio, M., Campbell, P. F., Smith, T. M., Griffin, M., Rust, A.H, Conant, D.L., & Choi, Y. (2014). Teacher Characteristics Associated With Mathematics Teachers' Beliefs and Awareness of Their Students' Mathematical Dispositions. *Journal for Research in Mathematics Education*, *45*(2), 246-284.

Dubinsky, E. (1991). Reflective Abstraction in Advanced Mathematical Thinking. In D. Tall (Ed.), *Advanced mathematical Thinking*. (pp. 95-126). Boston: Kluwer.

Post, Medhanie, et al (2010). The Impact of Prior Mathematics Achievement on the Relationship Between High School Mathematics Curricula and Postsecondary Mathematics Performance, Course-Taking, and Persistence, *Journal for Research in Mathematics Education*, 41(3) 274–308.

Sfard, A., & Lavie, I. (2005). Why cannot children see as the same what grown-ups cannot see as different?—Early numerical thinking revisited. *Cognition and Instruction*, *23*(2), 237-309.

Silver, E. and 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.

Simon, M., Tzur, R., Heinz, K., & Kinzel, M. (2004). Explicating a mechanism for conceptual learning: Elaborating the construct of reflective abstraction. *Journal for Research in Mathematics Education*, 35(5), 305-329.

Shulman, L.S. (1986). Those who understand: knowledge growth in teaching. *Educational Researcher*, 15(2), 4-14.