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Faculty Improvement Leave -- Narrative

(a) Precise and specific description of the activities planned while on leave: indicating the procedures and time-table that will be followed and the prior arrangements that have been made

I am requesting a yearlong faculty improvement leave (2019-2020) wherein I will continue to develop my research in the quality of math instruction in undergraduate learning environments. Specifically, I will (1) establish a new research project titled Understanding Measures of Improvement in Undergraduate Mathematics Instruction (UMI)² as Principal Investigator (PI) and (2) author manuscripts and a book.

**New Research Project**

(UMI)² is an NSF proposal ($2.5million collaborative project with BGSU and University of Nebraska—Lincoln [UNL]) that aims to provide clear guidelines and metrics to robustly evaluate and improve collegiate mathematics instruction (presently under review; anticipated funding start date of September 2019). Observation protocols are commonly used to assess K-12 teaching, but these protocols have not been applied frequently in collegiate settings, and their effectiveness in capturing the mathematics presented therein has not yet been examined. (UMI)² addresses this need by completing a qualitative cross-comparative analysis of affordances, drawbacks, and features of observation protocols and examining their utility in collegiate mathematics classrooms (Figure, Timeline).

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**Early 2019, I expect to hear an NSF funding decision. If funded, the timeline during 2019-2020AY is:**

**Part I: Literature searches and cross-comparative analyses (Fall) and interviews (Spring).** For this work, I will collaborate with co-PI, Dr. Jonathan Bostic (BGSU), who has previously completed similar analyses of non-collegiate protocols. He and I will meet twice a month while working with graduate assistants. Then, while attending national conferences (e.g., Joint Math Meetings and Conference on Research in Undergraduate Mathematics Education), I will conduct interviews about mathematics education researchers’ experiences designing/using protocols in collegiate mathematics settings and arrange follow-up virtual interviews.

**Part II: Conduct small-scale classroom observations at BGSU and UNL (Spring).** Results from these observations will inform logistics and approaches used during subsequent years of (UMI)² and involve traveling to UNL to initiate these aspects. I will collaborate with Co-PI, Dr. Wendy Smith (UNL Center for Science, Math, and Computer Education).

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**Figure, Timeline:**

- **2019-2020** (Year 1)
  - Conduct Small-Scale Classroom Observations
  - Identify Baseline Instrument
  - Conduct Literature Search
  - Cross-Comparative Analysis

- **2020-2021** (Year 2)
  - Phase 1: Establish Contacts at Additional Institutions
  - Training on Observation Protocols
  - Write Handbook

- **2021-2022** (Year 3)
  - Phase 2: Video Data from NE, OH, & MI
  - Cross-Comparative Analysis
  - Write Manuscripts & Submit Papers

- **2022-2023** (Year 4)
  - Cross-Comparative Analysis
  - Analyze, Write Manuscripts, & Submit Papers

- **2023-2024** (Year 5)
  - Cross-Comparative Analysis
  - Collaborate, Publish Workshop
  - Conduct Workshops

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**KEY: Color indicates which institution will lead efforts**

- **UNL**
- **BGSU**
- **BGSU & UNL**
If (UMI)² is not funded, I will focus on Part I—feasible without external funding because it involves a literature review and travel to conferences I already plan to attend.

**Book and Manuscripts**

I will also submit manuscripts for publication using previously collected data and co-author a book to support novice mathematics instructors’ learning to teach. These products align with my long-term research goal of improving undergraduate teaching and learning, especially in STEM disciplines, by focusing on undergraduate mathematics classrooms and instructors. Much of this work focuses on what novice mathematics instructors are currently doing in the classroom or their beliefs and knowledge about teaching and ways to efficiently support them becoming effective teachers. Specifically, I will analyze data from recent/current projects and submit manuscripts to researcher and practitioner journals.

Moreover, my co-author, Dr. David Meel (BGSU) and I will finish our book manuscript. Currently, we have seven chapters written consisting of case stories relevant to mathematics graduate students’ needs and experiences, along with commentary, references, and guiding questions. I have piloted the use of many of these cases when teaching professional development courses (e.g., MATH 5900/5910/5920) over the past six years. Therefore, data from students using these cases will inform and modify the book to help newer instructors determine ways to prevent or navigate challenging situations in teaching. Although a similar type of resource already exists (Friedberg et al., 2001), it does not include the emporium setting nor some important issues for international graduate students and fraternization scenarios that Dr. Meel and I have found crucial for this population to consider. For instance, I have reflections from instructors working in the emporium that we will use to create realistic case stories for an emporium-focused chapter.

Dr. Meel and I will meet at least once a month to discuss progress on refining existing chapters and integrate new scenarios, commentary, and references. We intend to have a refined draft ready to pilot for Fall 2020 and will dialogue with potential publishers (e.g., MAA and Routledge) in 2020. During FIL, I will submit at least two manuscripts: one submitted before the end of each semester. After FIL, I will share about these findings with other STEM departments to integrate substantial support systems for their graduate students.

(b) *Detailed explanation of how these activities will either enhance the faculty member’s professional capabilities in teaching, research, creative activity, or service or strengthen the academic program of the University*

These activities will increase my visibility in the mathematics education community as a leading expert on professional development for collegiate mathematics instructors. First, (UMI)² will strengthen BGSU’s visibility as a powerhouse for validity-related research. Co-PI Bostic is well known as a leading researcher for validity/validation, evidenced by two books he will produce by the end of his year-long FIL (ending summer 2019). His work focuses on K-12 (not collegiate) mathematics. Pairing his expertise with mine in (UMI)², examining and providing validation evidence for observation protocols for collegiate mathematics instruction, sets the stage for BGSU faculty to be seen as forerunners regarding validation for K-16 mathematics. Second, the book Dr. Meel and I will produce is an enhanced product building on the book Friedberg and colleagues produced in 2001. This needed resource will enhance the teaching of courses like MATH 5900/5910/5920 and be utilized by departments throughout the country who are working to address the professional development needs of STEM graduate student instructors. In turn, by providing professional development for novice mathematics instructors these activities will have a positive impact on undergraduate mathematics students’ learning. Third, writing manuscripts and traveling to conferences and invited talks during FIL will cultivate old and new research collaborations that will enhance my research career.
(c) A specific plan for the format and content of a report to be submitted to the President upon completion of the leave

The entire impact of FIL will be apparent over the course of a few years that I will also emphasize in reports beyond Fall 2020. Following FIL, however, I will submit a report (before July 2020) including a summary of my activities: (a) detailed descriptions of progress/results from (UMI)² cross-comparative analyses and book preparations, (b) list of conferences/meetings attended and how they impacted my career or research, (c) list of talks given or other relevant research activities and how they relate to my current/upcoming work, and (d) citation information for manuscripts submitted or papers accepted, with abstracts/preprints attached.

References