

CROSSING COMMUNITY BOUNDARIES: COLLABORATION BETWEEN MATHEMATICIANS AND MATHEMATICS EDUCATORS

Sarah K. Bleiler
Middle Tennessee State University

Effective mathematics teachers are able to make connections between mathematical content and pedagogy in their professional practice. One of the most readily prescribed approaches for facilitating teachers' ability to make such connections is through the development of collaborations between mathematicians and mathematics educators in venues related to teacher professional development. Most prior research related to collaborative endeavors between these two groups has focused on the products, rather than the process, of collaboration. In this preliminary research report, I present the results of an interpretative phenomenological case study that investigated the team-teaching experiences of a mathematician and a mathematics educator within the context of an undergraduate mathematics teacher preparation program. I present extracts from interviews that highlight the instructors' perceptions related to crossing the boundaries of their professional communities of practice, and engage participants in discussion about relevant "boundary crossing" in their own institutional contexts.

Key words: Teacher Education, Team-Teaching, Communities of Practice, Phenomenology

Introduction.

Research shows the importance of teachers' ability to make connections between mathematics content and mathematics pedagogy as a means of increasing student achievement (Ball & Bass, 2000; CBMS, 2001, 2012; Hill, Rowan, & Ball, 2005). One of the most readily prescribed approaches for facilitating teachers' ability to make such connections is through the development of collaborations between mathematicians and mathematics educators in venues related to teacher professional development (Bass, 2005; CBMS, 2001, 2012; Cheng, 2006; Ferrini-Mundy & Findell, 2001; McCallum, 2003; Millman et al., 2009; Wu, 2006). In its seminal publication, *The Mathematical Education of Teachers*, the Conference Board of Mathematical Sciences (CBMS, 2001) recommended that "the mathematical education of teachers should be seen as a partnership between mathematics faculty and mathematics education faculty," while at the same time acknowledging that "the reality today is that there is considerable distrust between mathematics faculty and mathematics education faculty both within institutions and through public exchange" (p. 9).

Over a decade later, with its release of *The Mathematical Education of Teachers* (part II), CBMS (2012) suggested that considerable strides have been made in relation to collaborative endeavors between mathematicians and mathematics educators. Examples of the products of such collaborations are prevalent throughout mathematics education literature (e.g., Eaton & Carbone, 2008; Koirala, Davis, & Johnson, 2008). However, the researchers who have reported on these collaborations have focused primarily on the products of such collaborative efforts, with little attention to the process of collaboration. In order to build on and learn from collaborative efforts between members of the mathematics and mathematics education communities, it is imperative to investigate the nature and process of existing collaborations.

Research Questions.

In this preliminary research report, I present a selection of results from an interpretative phenomenological case study (see Bleiler, 2012) investigating a team-teaching collaboration between a mathematician (Dejan) and a mathematics educator (Angela) within the context of a university undergraduate teacher preparation program for prospective secondary mathematics teachers (PSMTs). Dejan and Angela worked together to plan, teach, and assess a mathematics content course (Geometry, Fall 2010) and a mathematics methods course (Teaching Senior High School Mathematics, Spring 2011) for PSMTs. The overarching research question guiding this inquiry is the following: In what ways do a mathematician (Dejan) and a mathematics educator (Angela) make sense of their experiences engaging in a team-teaching collaboration within a mathematics content course and a mathematics methods course for PSMTs?

To provide insight into the overarching question above, I used the following sub-questions as a guide to understand particular elements of Dejan and Angela's perceived experiences during their collaboration: (1) In what ways do Dejan and Angela make sense of their similarities or differences in relation to their perceptions of teaching and learning?, (2) In what ways do Dejan and Angela make sense of their roles within the team teaching collaboration?, (3) What do Dejan and Angela perceive as the affordances, if any, of their experiences in the team-teaching collaboration?, and (4) What do Dejan and Angela perceive as the constraints, if any, of their experiences in the team-teaching collaboration?

Methodology.

To answer these questions, I employed interpretative phenomenological analysis (IPA) (Smith, Flowers, & Larkin, 2009) as my methodological framework. In comparison to more traditional approaches to phenomenology (e.g., Husserl, 1970; van Manen, 1990), in which phenomenological research is conceptualized as "the study of the lifeworld—the world as we immediately experience it pre-reflectively rather than as we conceptualize, categorize, or reflect on it" (van Manen, 1990, p. 9), interpretative phenomenological analysis is focused on the lived experiences of individuals within a particular context as those experiences are reflected on and interpreted by the individuals themselves (Smith, Flowers, & Larkin, 2009). Because the main question guiding this research is focused on the ways Dejan and Angela make sense of their experiences while team-teaching, IPA is particularly useful as a methodological framework.

Interviews with each of the instructors served as the primary source of data for this study, as interviews were the most appropriate means of gaining an understanding of instructors' perceived experiences. Individual (one-on-one) interviews were conducted at the beginning and end of each of the two semesters of team-teaching (4 individual interviews per instructor). In addition, two group interviews (researcher and two instructors together) were conducted at the end of each semester of team-teaching. Other data sources (e.g., video-recordings of class sessions, audio-recordings of instructor planning sessions, researcher observation notes) were collected to triangulate the findings and to inform the contextual description of the case.

Theoretical Perspective.

I utilized situated learning theory (Lave and Wenger, 1991; Wenger, 1998) as an interpretive lens to describe and explain Dejan and Angela's meaning-making throughout their collaboration. In particular, I followed Wenger's (1998) perspective that learning and meaning are situated within communities of practice. I aimed to provide insight into the ways Dejan's and Angela's identities and understandings as members of the mathematics and mathematics education communities, respectively, were instrumental in the ways they made sense of their team-teaching experiences. Therefore, I analyzed the interview transcripts from the perspective that the

instructors' words were representative of their personal understanding of "being" in their respective communities (Hemmi, 2006) as opposed to directly representative of the mathematics and mathematics education communities of practice.

Results.

The themes that emerged from this interpretative phenomenological analysis illustrate (a) how crossing community boundaries led to Dejan and Angela's increased awareness of their practice, (b) the roles of coach and student taken on by Angela and Dejan throughout the collaboration in an effort to increase Dejan's awareness of the needs of PSMTs, and (c) the influence of mutuality as a driving force in the instructors' collaborative experiences.

Using the situated learning perspective as an interpretive lens proved useful to describe and gain greater understanding of the instructors' perceived experiences. Some of the major insights derived from this analysis were (a) the importance of the dual processes of participation and reification to facilitate learning and meaning between instructors, (b) the ways in which a lack of shared history can hinder communication between collaborators, (c) the influence of a community's "regime of mutual accountability" on collaborators' decision making and interactions, and (d) the value and complexities of brokering and crossing boundaries.

Conference Presentation and Future Directions.

During this preliminary report session, I will provide a brief overview of the study described above and then engage participants in a reading of several extracts from Dejan's and Angela's interviews that highlight the instructors' perceived experiences of collaboration, focusing specifically on the instructors' perceptions related to crossing boundaries of their professional communities of practice. I will seek feedback from participants related to their own experiences "crossing boundaries" (Wenger, 1998) between the mathematics and mathematics education communities by posing the following questions: Have you been involved in collaborative efforts that "cross boundaries" between the mathematics and mathematics education communities? Does your professional identity lie more so in one of these communities than the other? How does your identity and understanding as a member of the mathematics (mathematics education) community influence your perspective when collaborating with members of other communities of practice? How does your identity and understanding as a member of the mathematics (mathematics education) community influence your perspective when teaching/preparing undergraduates and/or prospective teachers?

I expect the discussion that transpires during this session will provoke members of the audience to think deeply about their own educational experiences and community identities, their assumptions about the teaching and learning of mathematics that stem from those experiences and identities, and how those assumptions might help or hinder progress in the education of prospective teachers at their own institutions. As suggested by Barritt (1986), "By heightening awareness and creating dialogue, it is hoped research can lead to better understanding of the way things appear to someone else and through that insight lead to improvements in practice" (p. 20).

The ultimate goal of this research program is to build a significant library of cases from which a cross-case inductive analysis can be conducted. From such an analysis, I plan to collaborate with other researchers to build a practice-based theoretical framework to guide the implementation of successful collaborations between mathematicians and mathematics educators across different contexts related to mathematics teacher professional development. The discussion that evolves from this proposed conference session has the potential to inform future research with respect to possible considerations for the development of case investigations of collaborative endeavors in different contexts.

References

- Ball, D. L., & Bass, H. (2000). Interweaving content and pedagogy in teaching and learning to teach: Knowing and using mathematics. In J. Boaler (Ed.), *Multiple perspectives on the teaching and learning of mathematics* (pp. 83– 104). Westport, CT: Ablex.
- Barritt, L. (1986). Human sciences and the human image. *Phenomenology and Pedagogy*, 4(3), 14-22.
- Bass, H. (2005). Mathematics, mathematicians, and mathematics education. *Bulletin of the American Mathematical Society*, 42(4), 417-430.
- Bleiler, S. K. (2012). *Team-teaching experiences of a mathematician and a mathematics teacher educator: An interpretative phenomenological case study*. (Doctoral dissertation, University of South Florida). Retrieved from ProQuest Dissertations and Theses database. (3504993)
- Cheng, S. (2006). The role of mathematicians in K-12 education: A personal perspective. In M.S. Sole, J. Soria, J. L. Varona, & J. Verdera (Eds.), *Proceedings of the International Congress of Mathematics, Madrid 2006, Vol. 3* (pp.1688–1690). Zurich, Switzerland: European Mathematical Society.
- Conference Board of the Mathematical Sciences (2001). *The mathematical education of teachers*. Washington, DC: American Mathematical Society.
- Conference Board of the Mathematical Sciences (2012). *The mathematical education of teachers II*. Providence, RI and Washington, DC: American Mathematical Society and Mathematical Association of America.
- Eaton, P. T., & Carbone, R. E. (2008). Asking those who know: A collaborative approach to continuing professional development. *Teacher Development*, 12(3), 261-270.
- Ferrini-Mundy, J., & Findell, B. (2001). The mathematical education of prospective teachers of secondary school mathematics: Old assumptions, new challenges. In *CUPM discussion papers about mathematics and the mathematical sciences in 2010: What should students know?* (pp. 31–41). Washington, DC: Mathematical Association of America.
- Hemmi, K. (2006). *Approaching proof in a community of mathematical practice* (Doctoral dissertation, Stockholm University). Available from WorldCat Dissertations and Theses database.
- Hill, H. C., Rowan, B., & Ball, D. L. (2005). Effects of teachers' mathematical knowledge for teaching on student achievement. *American Educational Research Journal*, 42(2), 371-406.
- Husserl, E. (1970). *The crisis of European sciences and transcendental phenomenology* (D. Carr, Trans.). Evanston: Northwestern University Press.
- Koirala, H. P., Davis, M., & Johnson, P. (2008). Development of a performance assessment task and rubric to measure prospective secondary school mathematics teachers' pedagogical content knowledge and skills. *Journal of Mathematics Teacher Education*, 11(2), 127-138.
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.
- McCallum, W. (2003). Promoting work on education in mathematics departments. *Notices of the American Mathematical Society*, 50(9), 1093-1098.

- Millman, R., Iannone, P., & Johnston-Wilder, P. (2009). Educators and the teacher training context. In R. Even & D. L. Ball (Eds.), *The professional education and development of teachers of mathematics* (pp. 127-133). New York, NY: Springer.
- Smith, J. A., Flowers, P., & Larkin, M. (2009). *Interpretative phenomenological analysis: Theory, method, and research*. London: Sage.
- van Manen, M. (1990). *Researching lived experience: Human science for an action sensitive pedagogy*. Albany: State University of New York Press.
- Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge: Cambridge University Press.
- Wu, H. (2006). How mathematicians can contribute to K–12 mathematics education. In M.S. Sole, J. Soria, J. L. Varona, & J. Verdera (Eds.), *Proceedings of the International Congress of Mathematics, Madrid 2006, Vol. 3* (pp.1676–1688). Zurich, Switzerland: European Mathematical Society.