"Vulnerability in Action":

Noticing and Wondering in Building a Professional Learning Communities

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Introduction

This study focused on mathematics teachers' online and face-to-face interactions in order to advance theories on how PLCs can "create participatory spaces for the sharing [and production] of knowledge" (hooks, 1994, p. 15). Through an exploration of teachers' negotiated and "shared" situated learning (Lave & Wenger, 1991) of what it means to teach and learn mathematics, the questions guiding this research include:

1. **How are collaborative work cultures for mathematics teachers of different professional and experiential backgrounds constructed and sustained?**
2. **To what extent do PLCs affect individual teachers' conception and approach to teaching and learning mathematics?**

Background: The EnCoMPASS Program

EnCoMPASS (Emerging Communities for Mathematical Practices and Assessment) began as a partnership with the **Math Forum** (mathform.org), an online educational community with a long history of being dedicated to supporting students and teachers to engage in meaningful mathematics. **A primary goal of the project is to create and support a hybrid community of mathematics educators; various social media and technological tools are evoked in order to help foster the sense of community and support communication online. T**he Math Forum and the Drexel University team held two summer institutes in 2013 and 2014. Between the summer institutes were a series of online short courses running 3-4 weeks at a time with active discussion boards, a running newsfeed on the Math Forum website that included individual participant blogs, and a cultivated Twitter list (**Fig. 1**).

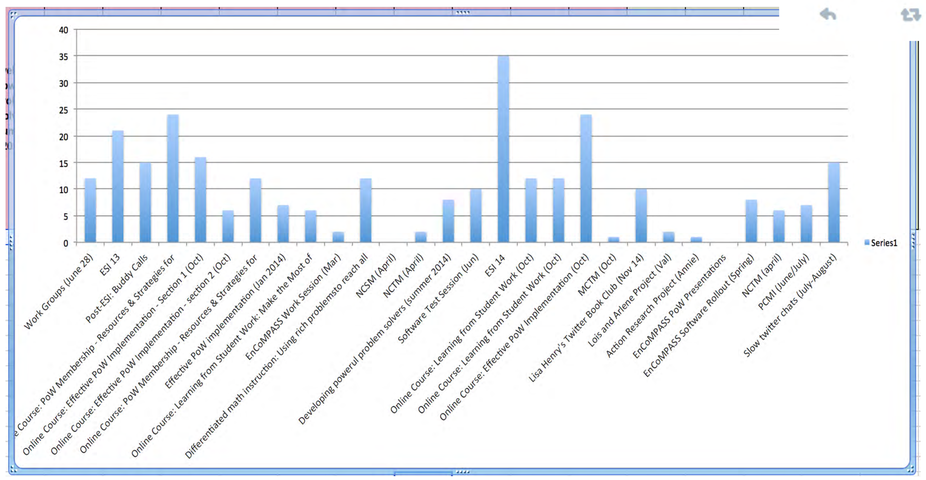

Figure 1: PLC activities and participants involvement Summer 2013-Summer 2015.

Methods

Using qualitative methods, this research follows 33 mathematics teachers for 2 years (2013-2014) as they formed a blended PLC around the use of an online tool to examine students' problem-solving strategies. Teachers worked together while engaged with the **Problem of the Week** through the Math Forum (http://mathforum.org), an online resource for mathematics teachers at all grade levels. Teachers were mostly white women and men whose years of experience teaching in public schools varied widely. Included were those teaching basic mathematics in elementary schools to high school teachers of geometry and calculus.

Data from virtual activities includes discussion boards from online courses, teacher blogs, email, Twitter chats, online surveys, and online reflections. Interviews and 10 hours of video from two face-to-face summer institutes were also transcribed and analyzed. All data were analyzed using a constant comparative analysis (Patton, 2015) using open and axial coding using the qualitative software program Dedoose™ which were then aggregated into categories that resulted in identifying key themes.

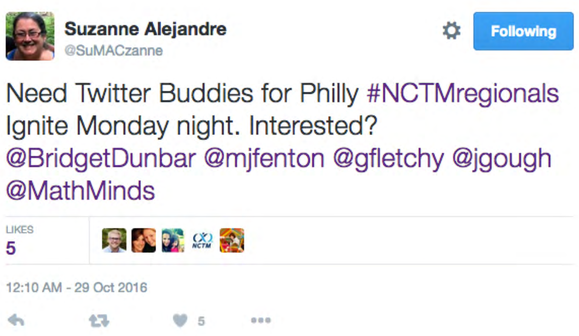

Figure 2. Example of tweets, illustrating mutual support.

Results & Discussion

Noticing and wondering, an instructional method based on observations, explorations and discussions (Hogan & Alejandre, 2010), structured and shaped most of the interactions documented and analyzed for this study. This systematized approach to organize, document and share individual experiences created a space for deep and inhibited evaluations. The iterative process of sharing, receiving feedback and thinking collectively helped some participants to wonder aloud about the potential challenges of implementing noticing and wondering in their own classrooms.

This problem intrigued me, because in my geometry class, we have been studying lines, rays, and angles, and I had already assigned Points, Lines, and Planes...I noticed that the minute hand and the hour hand move at different rates...I noticed that the time is somewhere between 3:00 and 4:00 for all the questions. I noticed that the smallest angle between the two hands starts at 90° and then decreases until somewhere around 3:17, and then it begins increasing again until it reaches 180° somewhere around 3:50...I wonder what relationship the hands have. I wonder what [the] function will look like when graphed **(Post by Teacher S., PoW "What time is it?", 09/17/2013).**

We also noticed interactions that we called "**mutual vulnerability,**" which allows members of a learning community to view and relate to each other differently than the simplistic and one-dimensional "producer-receiver" of knowledge paradigm. We especially saw this in the Tweets (**Fig 2**) and Blogs.

I have been at that point in my teaching journey…I'm not doing a horrible job, however, I am not where I would like to be. In fact, I have noticed that as my weight crept up, I took fewer pictures in general and specifically of myself. I have been that way with blogging over the last year. As I tended to drift back into what I knew how to do (instructing by telling students how to do something, using the few structures I was familiar with and comfortable with for practice such as Around the World), I blogged much less this past year. In both cases, I was not comfortable with where I was. **(Teacher T, Personal Blog)**

Using the discourse of noticing and wondering as a central approach to sharing curricular ideas and problem-solving strategies, participants often took time to Tweet during their teaching day particular pieces of student work, a new idea for a problem of the week, or a visual image that supported students learning. Members of the PLC also used social media and blogging as reflective spaces where they could express their sense of vulnerability, both as a learner of new content and pedagogical skills, but also as a teacher whose work is continually changing in relation to increasing accountability measures.

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