DESIGNING AND RESEARCHING ONLINE PROFESSIONAL DEVELOPMENT

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In this working group, we continue with previous efforts to consider design and research methodologies related to teacher learning in online professional development contexts. We describe the extant literature on online professional development, including a review of digital technologies and the applicability of this practice to teacher learning in education. We then describe an innovative project designed to support the development of middle school mathematics teachers in rural contexts, with a focus on three distinct forms of online learning: digitally communicated teaching lab lessons, an online course, and online video coaching. Given recent technological advances and demands to support teachers in various contexts, we contend that researching and understanding these online models, as well as other online models is important for the broader field of mathematics education. As a result, Year Two of this proposed discussion group will combine whole-group and subgroup time to converse about: (a) the challenges of online professional learning experiences, (b) research tools, methods, and analyses, (c) the connections among different projects and studies, and (d) future collaborations and research.

Keywords: Teacher Education-Inservice/Professional, Research Methods, Learning Theory

All teachers need access to high quality professional development in order to meet the needs of students and to teach rigorous mathematics as outlined in college and career-ready standards (Marrongelle, Sztajn, & Smith, 2013). In order to accommodate the limited resources in some areas, including rural and urban school districts, online professional development has the potential to provide access to a wider range of teachers than what is possible face to face. Furthermore, given the propensity of millennials to seek online learning experiences, we feel that more attention needs to be given to the design, dissemination, and research of online professional development. Given the emerging importance and availability of online professional development, we propose the continuation of a working group that met at PMENA 2017 to continue focus on the design, dissemination, and research on online professional development. The working group participants will analyze current practices in online professional development, including the technology affordances and limitations. Major themes that will be addressed are:

- affordances of online platforms,
- affordances and constraints of synchronous vs. asynchronous experiences,
- challenges related to scaling up high-quality online professional development,
- methodologies used to research professional learning in online contexts.

As schools turn to digital learning contexts, it is inevitable that professional development will follow a similar trend. It is imperative to have research-based models that demonstrate how the features of high quality face-to-face professional development can be matched or augmented in online contexts. As an example of necessity, teachers in rural areas face constraints in terms of accessing the expertise and resources required for high-quality professional learning experiences, often because of lack of proximity to such resources as institutions of higher education and critical masses of teachers required to collectively reflect on problems of practice (Howley & Howley, 2005). Rural contexts are thus ideal sites for online professional development, which can be offered at a distance and can involve geographically dispersed participants (Francis & Jacobsen, 2013). At the same time, teachers in urban and suburban areas may have more regular access to professional development, but online formats afford conveniences and customized learning opportunities that may not be available in face-to-face settings. Digital learning contexts provide opportunities for connections and visual supports that may otherwise not be accessible in face to face professional development. As a result, we consider it necessary to research online professional development and to engage with other mathematics educators and researchers about online professional learning. This working group is intended to advance the practices of designing and researching online professional learning experiences by investigating the challenges of balancing high quality learning experiences and accessibility for teachers. The focus is also on reconnecting with those in attendance during the 2017 conference for updates on discussions about current happenings and experiences with online learning.

Below we provide an overview of the literature related to professional learning in online contexts. Then we revisit the NSF-funded model of online professional development discussed last year, describing what we have learned in the last year in terms of the learning environment and our efforts to research its impact. We will devote part of the first session providing updates on the project as a means of introducing possible models and methodologies to study online professional development, leaving opportunities over the next working sessions to incorporate discussion of other models and methodologies. We then conclude with aims for the 2019 working group.

Literature Related to Online Professional Learning

Digital Technologies

Online professional learning experiences combine longstanding and emerging digital technologies to provide high-quality, interactive, content-focused professional development. Longstanding digital technologies (e.g., electronic learning management systems) have been used to implement online courses to design and implement professional development for the past couple of decades. Emerging digital technologies involve an internet-based platform to implement online video coaching, or other online communications, in ways that augment the interactivity of face-to-face coaching. Online video coaching emerges from the content-focused face-to-face coaching that the project personnel have engaged in over the last ten years.

Research shows that while online communication lacks some of the modalities (e.g., gestures, facial expressions) and spontaneity of face-to-face communication (Tiene, 2000), there are also affordances unique to its asynchronous and text-based nature. In online discussions, communication tends to be more exact and organized (Garrison, Anderson, & Archer, 2001; McCreary, 1990), involve more formal and complex sentences (Sotillo, 2000; Warschauer, 1995) and incorporate critical thinking, reflection, and complex ideas (Davidson-Shivers, Muilenburg, & Tanner, 2001; Marra, Moore, & Klimczak, 2004). Research on synchronous online communication – which can include text chat windows and shared space in learning management

systems – shows that it is experienced as more social than asynchronous spaces (Chou, 2002). Synchronous sessions induce *personal participation*, which Hrastinski (2008) compared to *cognitive participation* in that personal communication in synchronous spaces "involves more intense interaction … while cognitive participation is a more reflective type of participation supported by asynchronous communication" (p. 499). Furthermore, synchronous communication fosters multiple communication channels based on emerging networks within the larger group, including the use of chat boxes and personal email during synchronous sessions (Haythornthwaite, 2000, 2001). Researchers have reported positive outcomes from professional development involving synchronous exchanges via typing (e.g. Chen, Chen, & Tsai, 2009). However, synchronous verbal online discussions and group activities have not been a focus of research.

Online Professional Development in Education

Despite the growing popularity of online professional development, there is a continued need for empirical research regarding its quality and effectiveness (Dede, Ketelhut, Whitehouse, Breit, & McCloskey, 2009). Prior research has not demonstrated advantages for online professional development in terms of teacher outcomes (cf. Fishman et al., 2013), in part due to the lack of online professional development contexts that involve teachers in sustained, intensive reflection on their practices. Furthermore, teacher learning in online spaces can be challenging, especially related to complex forms of learning. Sing and Khine (2006) found that a number of factors make it difficult for teachers to engage in complex or difficult forms of learning in an online context, such as teachers' roles as implementers rather than producers, cultural norms where disagreement is seen as confrontational, and the cognitive demands relative to the available teacher time. Teacher learning in online contexts is discussed in more detail below.

In order to illustrate professional learning in an online context, we present a model that the authors are currently using in a project situated in rural contexts. We present the model in order to continue the discussion of this model and other potential models, as well as the learning platforms and other features, such as the synchronous or asynchronous nature of learning in online environments.

A Model of Online Professional Development

The innovative online professional learning experiences in the author's project focus on the development of teacher capacity to enact ambitious, responsive instruction aligned with the rigorous content and practice elements of the Common Core State Standards for Mathematics (CCSSM). We use the term *professional learning experiences* to denote that the professional development we employ differs from traditional workshop or other models that are too short or fragmented to be effective (Garet, Porter, Desimone, Birman, & Yoon, 2001).

In the project, we identified three primary research goals. To study and understand: (a) the ways online-based professional development can help teachers improve their instructional practices and their ability to notice and respond to student thinking; (b) the characteristics of the feedback cycles in the online coaching, the role of video feedback, and the asynchronous components of feedback cycle; and (c) the features of the professional development model that would inform efforts to scale up the model, including the resource commitments, the requisite capacity of the course instructors and coaches, and the logistical requirements of the courses and coaching. We are currently in year two of four years of the project. The following describes the three online components of our project. In the working group, we envision these and other components used by other researchers serving as the catalysts for dialogue around online

professional learning and will engage particpatns with conversation around our learning in the past year while encouraging them to share their recent experiences.

Teaching Labs

In order to address the challenges of engaging teachers in learning complex practices in an online context, we include a component aimed at initiating and reinforcing relationships between participants and project personnel and at helping participants to understand the types of learning experiences and design and feedback cycles that will be the core of the project. Research on lesson study (e.g., Amador & Weiland, 2016; Stigler & Hiebert, 1999) has led to an emphasis on demonstration lessons where teams of teachers collectively plan, enact, and reflect on lessons in ways that make public the features of the lessons and teachers' instructional practices (Saphier & West, 2009). Consequently, one component of our project is a collaborative classroom activity, a Teaching Lab, that builds from the *studio classroom* model developed by the Teachers Development Group (2010), with features consistent with content-focused coaching (West & Staub, 2003). For each lesson, a group led by project personnel plans a lesson around a cognitively demanding task. On the day of the lesson, project participants review the lesson plan and explore the task, the mathematics embedded in the task and anticipated student approaches to solving the task, and the related CCSSM practice and content standards, making necessary revisions to facilitate the lesson. The project personnel then enact the lesson while the rest of the group observes and collects evidence of student thinking and learning. The group then collectively reflects on the experience, with a focus on describing evidence for student understanding using the data gathered by the teachers and observers. This process is repeated regularly with participants.

In the beginning of the project all demonstration lesson activities were face-to-face. However, at this point in our project, this component has moved to an online format of synchronous and asynchronous activities. The planning and debriefing portions are held via a video conferencing platform, Zoom, allowing for synchronous engagement in both whole group and small group discussions of the lessons. Asynchronous activities include watching and reflecting on the video recording of the demonstration lesson between the planning and debriefing sessions. Discussion in the working group will center on the affordances and constraints of the online model and possible modifications to ensure the intended professional development goals are met.

Online course - Orchestrating Mathematical Discussions

The second component of our project is the two online course modules, *Orchestrating Mathematical Discussions Parts One and Two*, aimed at orienting the participants toward high-leverage discourse practices that facilitate mathematically productive classroom discussions (Smith & Stein, 2011). In this course, the participants solve and discuss a series of high cognitive demand tasks, activities that will be accompanied by synchronous and asynchronous discussions around the *5 Practices for Orchestrating Productive Mathematics Discussions* (i.e. anticipating, monitoring, selecting, sequencing, connecting; Smith & Stein, 2011). The courses are designed to develop awareness of specific teacher and student discourse moves that facilitate productive mathematical discussions, to understand the role of high cognitive demand tasks in eliciting a variety of approaches worthy of group discussions, and to further develop participants' mathematical knowledge, particularly the rich connections around big mathematical ideas that are helpful to teach with understanding (Ball, 1991; Boaler & Staples, 2008; Chapin, O'Connor, & Anderson, 2003; Choppin, 2007a; 2007b; 2014; Herbel-Eisenmann, Steele, & Cirillo, 2013; Ma, 1999; O'Connor & Michaels, 1993).

In order to take advantage of the affordances of both asynchronous and synchronous characteristics of online communication, the course is embedded in a learning management system (LMS) that: allows for synchronous whole class and small group interaction; the sharing of artifacts, including those collectively developed in the LMS; and asynchronous discussion threads. In the online course modules in the LMS, the facilitator verbally presents a challenging task to the participants, which is viewed in the shared work space. The course instructor then assigns participants to virtual breakout rooms, in which the participants work synchronously in a common workspace, creating virtual white boards to share with the other groups. They can talk to each other, work simultaneously in the virtual space, and use the chat window to communicate. The course instructor can listen to and participate in these group discussions to determine when the groups are ready to present their solutions. The course instructor then closes the virtual breakout rooms, which automatically returns all participants to the main room to conduct a summary discussion of the different strategies, in effect modeling the practices in the *5 Practices* book. Asynchronously, the group can continue to go back and reflect and comment on the task and related solutions, as well as on the readings from the *5 Practices* book using discussions threads in the LMS. Participants are also encouraged to share resources, lesson plans, and student work as appropriate. The working group will discuss this format for online professional learning as well as other formats and tools that have proven beneficial for users.

Online Video Coaching

The third – and most innovative – component of our project's professional development program is the online video coaching that builds from models of content-focused coaching (West & Staub, 2003). More recently, thanks to the advent of improved internet-based software aimed at increasing collaboration around video data, the project personnel have begun conducting online video coaching with teachers. The coaching cycles are focused on identifying and unpacking the mathematics with the teacher, while anticipating likely student strategies, conceptions, and misconceptions. The coach helps the teacher identify evidence for demonstrating how students are thinking (from the video as well as from student artifacts) and make connections between different student approaches in order to help the teacher structure the summary discussion of the lesson.

The online coaching experiences involve synchronous and asynchronous components, with the goal of engaging participants in reflective or deliberative practice. The online coaching has features similar to face-to-face coaching, such as video conferencing conversations via Zoom, in which the coach and participant collaborate to plan lessons and reflect on the qualities of lessons. However, the online coaching includes an innovative component that involves asynchronous collaboration and feedback that structures the post-lesson collaborative reflection, features that augment or surpass the kind of feedback that can be given face-to-face. Teachers video-record themselves using Swivl, which allows them to place a camera (iPhone or other device) on a robot that tracks them around the room, allowing for teacher-focused video without the necessity of someone operating the camera. The video is automatically uploaded into a password-protected site and processed, and is immediately accessible to view and notate. The notation feature in Swivl allows the coach and the candidate to separately view and annotate the video. For example, a teacher can stop the video by hitting the pause button and type in a comment or question that is synced with the video, so that when the coach watches the video, she can read the comment during the point in the video referenced by the comment. The coach can do the same. The video can be viewed repeatedly, which allows for more thorough reflection and analysis. The notation provides for more in-depth and substantive feedback, pointing to specific instances

of practice. The discussion group will focus on this model for professional coaching as well as other models or avenues for supporting individual teachers in online professional learning.

Researching Online Professional Learning Experiences

There is a dearth of research on online professional development, especially online professional development that is sustained and intensive. Similarly, while there have been 16 years of intensive efforts to implement coaching in schools, much of the research have revolved around the role and impact of coaches (Coburn & Russell, 2008; Penuel, Riel, Krause, & Frank, 2009), and less around the impact on reflective or deliberative practice. Although coaching has now been around for over ten years, there is limited research on the effectiveness of coaching in terms of improving teacher quality (Matsumura, Garnier & Spybrook, 2012). The greatest dearth of research involves online video coaching in education, as opposed to face-to-face video coaching, which has no peer-reviewed research yet associated with it.

Structure of the Working Group Sessions

Within this working group we propose to explore the following questions related to researching online professional learning experiences:

1. What are various platforms and models for online professional development?
2. What theoretical framework and methodologies are salient for researching online digital technologies and online professional learning experiences?
3. What data analysis methods are suited to the data captured in online environments?
4. In what ways can online professional learning experiences help teachers improve their instructional practices and their ability to notice and respond to student thinking?
5. In what ways can the characteristics of the feedback cycles in online coaching, the role of video feedback, and the asynchronous components of feedback cycle inform the design on online professional learning experiences to maximize teacher learning?
6. What features of the professional development model would inform efforts to scale up the model, including the resource commitments, the requisite capacity of the course instructors and coaches, and the logistical requirements of the courses and coaching?

Plan for Working Group:

In Session 1, the organizers will present brief update reports on the Author's project and research design, as well as a recap of the 2017 working group discussions. Subgroups will be formed to continue conversations around design and implementation efforts with online professional learning experiences from their own research and current efforts in the field; attendees from this working group at PMENA 2017 will provide updates on their respective projects in the small-group setting.

During Sessions 2 and 3 we will provide the subgroups time to continue collaborating on themes identified in the PMENA 2017 working group: a) identifying the challenges of online professional learning experiences that are the most challenging and why—this will include a specific look across the projects presented and with a focus on activities on the last year, b) refining research tools, methods, and analyses, c) exploring connections among different projects and studies for former and new attendees, and d) discussing future collaborations and research. We will close Session 3 with time to review group progress and discuss next steps for our work as shown in Table 1. Meeting notes, work, and documents will continue to be shared and distributed via our Google Folder (set up for this Working Group). The use of Google documents allows members to create an institutional memory of activities during the working group that we

will continue to use and add to following the 2017 and 2018 working groups. This shared folder will also provide a shared space for future collaborations and writing projects related to online professional learning experiences within the 2017 and 2018 working group members.

	Overview of Proposed Working Subgroup Sessions	
Session 1	**Activities:** 1. Introductions and Agenda 2. Brief Presentations of Authors' Project and Research Questions 3. Brief Presentations of former Attendees' and New Attendees' Projects and Research Questions 4. Subgroup formation and initial work time - designing Online PD experiences	**Guiding Questions:** 1. What are the different forms of online professional development? 2. What research is being done related to online professional development? 3. Which aspects of online professional learning experiences are the most challenging to implement or research? 4. What are new questions that have arisen within the last year?
Session 2	1. Overview of subgroup's work from previous day 2. Subgroup work time - engagement in online professional learning experiences 3. Brief sharing of work in subgroups	1. How can online learning support teacher learning? 2. What are the affordances and constraints of various platforms? 3. What are the affordances and constraints of synchronous and asynchronous experiences?
Session 3	1. Overview of subgroup's work from previous day 2. Subgroup work time - researching online professional learning experiences 3. Brief sharing of work in subgroups 4. Final reflections – future collaborations and research	1. What theories and theoretical frameworks have informed the design of your research project(s)? 2. How might your work inform theory in researching online professional learning experiences? 3. What issues and challenges have you faced in designing studies in this area? 4. What challenges may exist for scaling up high-quality online professional development?

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