UNPACKING THE FIVE PRACTICES USING AN ONLINE PROFESSIONAL DEVELOPMENT

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Understanding and utilizing the Five Practices for Orchestrating Productive Mathematics Discussions (Smith et al., 2009; Stein et al., 2008) has grown in importance as teachers continue to be challenged to engage their students in student-centered, discourse-based instruction. We argue that by engaging in rehearsals of the five practices and decomposing practice, the teachers are not only able to advance their understandings of each of the five practices, but also gain knowledge of its value in their classroom practice and its role in the supporting student development. Preliminary results from analysis of our online professional development suggest that participants learned more about utilizing the five practices within their classrooms and are able to share the role they believe it has in their classroom practice.

Keywords: Instructional Activities and Practices, Professional Development, Teacher Knowledge

Objectives and Purposes

Our work focuses on the design and implementation of a three-part online professional development devised to support teachers as they (1) work collaboratively to develop mathematical and pedagogical knowledge and (2) seek to integrate this knowledge and experience into their classroom. Specifically, the professional development activities feature a continual interplay between activities focused on the development of mathematics knowledge for teaching (Renninger et al., 2011; Shumar, 2017) and classroom practice, increasing the likelihood that teachers' online experiences will connect to and support changes in their instructional practices. In this paper, we report on one component of this work which seeks to help teachers unpack the Five Practices for Supporting Productive Mathematical Discourse (Smith et al., 2009; Stein et al., 2008) using rehearsals (Anthony et al., 2015, Kazemi et al., 2016), which provide "a space where teachers can deliberately experiment with practices in less complex settings" (Webb & Wilson, 2022, p. 129). The current paper documents teachers' participation and experiences in rehearsals and explores their use of the five practices within their classroom practice.

Theoretical Framework

According to Smith et al. (2009), the five practices for mathematical thinking and discussion are:

> (1) anticipating student responses to challenging mathematical tasks, (2) monitoring students' work on and engagement with the tasks, (3) selecting particular students to present their mathematical work, (4) sequencing the student responses that will be displayed in a specific

order, and (5) connecting different students' responses and connecting the responses to key mathematical ideas. (p. 550)

These practices help teachers to think about and utilize their students thinking to advance mathematical understandings of the entire class. The practices encourage teachers to spend more time in the planning phase to be better able to facilitate productive discussions among the students (Smith & Sherin, 2019). Stein et al. (2008) encourage teachers to utilize the five practices as a "method for slowly improving the quality of discussions over time" (p. 26).

In this project, teachers' engagement with the five practices within the professional development was situated in a rehearsal (Anthony et al., 2015, Kazemi et al., 2016) of the five practices during the course of the workshop. The design of the professional development workshop was built on allowing the teachers time to practice and experiment with the five practices in a non-threating way (Webb & Wilson, 2022) and allowed the teachers to analyze and reflect on each of the Five Practices without the constraints or pressure of time or "live" students. Each module in the workshop was designed to allow teachers to engage with a different practice:

Module 1 – Talking Notice/Wonder and Doing the Math represents the work of anticipating student thinking;
Module 2 – Looking at Student Work represents monitoring students' work;
Module 3 – Reacting to Student Work represents selecting and sequencing; and
Module 4 – Connecting to the Classroom represents connecting responses to others and mathematical ideas.

This design essentially decomposes each of the Five Practices into 1–2-week online modules. Therefore, we argue that by engaging in these structured rehearsals and with the support of both colleagues and facilitators, teachers can learn about the practice, use it to analyze a set of student work, and develop conjectures for potential instructional moves. Thus, the teachers are better positioned to do this work in their own classrooms.

Methods

We investigated teachers thinking about and unpacking of the five practices in two iterations (C1 & C2) of an online professional development workshop. The workshop included four modules designed to scaffold the rehearsal process as well as utilize the five practices. Teachers engaged in solving and discussing solutions to a problem (anticipating), noticing and wondering about a set of student work (monitoring), organizing their notices and wonders in meaningful ways (selecting and sequencing), and making decisions about what to do next for individual students and whole class discussions (connecting). The two iterations of the workshop differed in length and methods of engagement. C1 (n=13) participated in a two-week workshop consisting of six discussion boards, three synchronous sessions, and four journal entries. C2 (n=9) participated in a six-week workshop consisting of five discussion boards, six synchronous sessions, and four journal entries. In this research, we explore the research question: *In what ways do teachers see the role of the five practices for mathematical thinking as a means to providing feedback to students?* In particular, we seek to understand teachers thinking about and use of the five practices in their classrooms.

Data for this paper consisted of participating teachers' posts to one discussion board, one journal entry and transcripts from two synchronous sessions (see Table 1 for prompts provided to the teachers for each data set). Data analysis included a three-phase process, beginning with pre-coding, where the entire project team reviewed the entire data corpus multiple times to become

familiar (Ravitch & Carl, 2015). The second phase featured open coding of the data by at least two members of the research team. In this phase, every effort was made to capture the theoretically significant ideas (such as terms from the Five Practices and student-centered, research-based classroom practices). In the final phase, the research team resolved any inconsistencies in the coding and developed and tested conjectures regarding themes in the coded data. They met to generate a theoretical memo that was be based on both the field notes and the patterns and themes from the coded data (Miles et al., 2014).

Table 1: Analyzed Prompts

	C1 (summer 2021)	C2 (winter 2022)
Discussion Board #5	Share something from the article (Smith et al., 2009) that connects to what we have been working on. How might you implement a version of it in your classroom?	Imagine that you are using EnCoMPASS to help you implement the 5 practices in your classroom. Brainstorm ways in which you think this might be accomplished. (You might share examples using the work you have done with the Driving to Work student responses.)
Journal #4	What do you see as the role of the 5 practices for mathematical thinking in providing feedback to students?	What do you see as the role of the 5 practices for mathematical thinking in providing feedback to students?

Results

While we continue to code additional data and revise and refine our conjectures regarding emergent themes, preliminary findings reveal a connection to the five practices, a desire to utilize them more within their classrooms, and challenges they have faced. Four themes are discussed.

The first theme that emerged was teachers beginning to see the how and why they might use the five practices in their classrooms. Examples of excerpts in this category included, (1) GA noted, "I have also learned that structuring class discussions around solutions (incorrect and correct) should work towards the larger learning goal. The five practices serve the role of structuring discussions around challenging tasks and providing a framework for building complex mathematic ideas." (2) MJ noted, "I think their [the five practices] role is to keep us teachers focused on the 'mathematical ideas at the heart of the lesson.' It's a sturdy, efficient, organized framework on which to build our feedback and plan our lessons and direct the course of mathematical discourse during class." These excerpts indicate that while math teachers are aware of the five practices, they need more support to build their foundation for success and professional development is the space for this work to be conducted.

The second theme was that while five practices are hard to do, it was even harder to learn, especially in real time. As an example, KL stated, "I like that we are getting this practice in this scenario as selecting is one step of the 5 practices that I find difficult to do in real-time in the classroom. Practicing in isolation is helpful." Teachers appeared to recognize the benefit of engaging in practice or rehearsal of the five practices so that they can gain understanding of their use in low-stakes environments. By participanting in professional development that encourages and supports this practice, teachers can feel more confident utilizing the five practices in their classrooms.

The third theme indicated an awareness that in addition to learning more about the five practices, teachers needed support with how to get access to student thinking (and not just student answers). As an example, MD noted:

> If I were to implement a version of this [marble problem] in my classroom… I'd do this initial notice/wonder activity at the end of a lesson on Friday. I'd collect the students' notices/wonders, and then use those over the weekend to build my anticipated answers/approaches and prepare for the actual lesson on the problem for the following week. Out of all the five practices, anticipating the responses is probably the trickiest, and I think it really gets better with experience or as they mentioned, using work produced by prior classes, publishes responses, etc. No one has the actual time in school to have several teachers work the problem and get feedback (what a pipedream), so I think this prelude with notice/wonder would be very useful for this purpose.

This category highlights the importance of students engaging in the tasks assigned before the five practices can be thought about and that utilizing noticing and wondering as an engagement practice is useful for planning and implemenation.

The fourth theme was the need for expanding the five practices to support equity in the classroom. As an example, SS stated:

> I work with students with disabilities so explaining their thinking can be challenging. Sometimes I see students struggle to find the right words to explain their work/answers. I am going to try to highlight what they did correctly to alleviate some of the anxiety they may be feeling. In our group discussion the other night it came up that written feedback should be both specific and doable. I am thinking these same guidelines apply to classroom conversations with students. I am going to try to ask more specific questions about their work.

While the five practices provide a structure of guiding productive and supportive classroom discussions, there are still students who may be left behind depending on the implementation utilized by the teacher. It is important for teachers to realize that while monitoring, selecting, and sequencing, they also need to be aware of students who may not be in a place to be chosen and how to they keep those students engaged in the discussion.

Discussion

Based on the preliminary findings, the teachers not only enjoyed learning more about the five practices and their implementation, but also felt as if it provided thoughtful ways to continue the engagement within their classrooms. They felt that by participating in the rehearsals or "practice in isolation" they were able to build their skills before working with their students. They demonstrated the need to engage all students by allowing them entry into the problem utilizing notice and wonder processes. Finally, they noted that to be implemented equitably teachers need to be aware of the students and how they are engaging in the discussions.

These findings demonstrate the potential for online professional development to provide experiences that allow teachers to think deeply about common frameworks for student-centered instruction, such as the Five Practices, and for them to reflect on the details of implementation. Current work includes further analysis of these online workshops as well as analysis of teachers' reflections on their post-workshop goals for instruction. We expect to see additional support of these themes within the teachers' reflections as well as the possibility for new themes to emerge.

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References

Anthony, G., Hunter, J., & Hunter, R. (2015). Supporting prospective teachers to notice students' mathematical thinking through rehearsal activities. Mathematics Teacher Education and Development, 17(2), 7-24.

Kazemi, E., Ghousseini, H., Cunard, A., & Turrou, A. C. (2016). Getting inside rehearsals insights from teacher educators to support work on complex practice. Journal of Teacher Education, 67(1), 18-31.

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative Data Analysis: A Methods Sourcebook* (3rd edition). SAGE Publications, Inc.

Ravitch, S. M. & Carl, N. M. (2015). *Qualitative Research: Bridging the Conceptual, Theoretical, and Methodological* (1st edition). SAGE Publications, Inc.

Shumar, W. (2017). Inside Mathforum.org: analysis of an Internet-based education community (Inside Math Forum). New York, NY: Cambridge University Press.

Renninger, K. A., Cai, M., Lewis, M. C., Adams, M. M., & Ernst K. L. (2011). Motivation and learning in an online, unmoderated, mathematics workshop for teachers. Educational Technology Research and Development, 59(2), 229-247.

Smith, M. S., Hughes, E. K., Engle, R. A., & Stein, M. K. (2009). Orchestrating discussions. Mathematics Teaching in the Middle School, 14(9), 548-556.

Stein, M. K., Engle, R. A., Smith, M. S., & Hughes, E. K. (2008). Orchestrating productive mathematical discussions: Five practices for helping teachers move beyond show and tell. *Mathematical thinking and learning*, *10*(4), 313-340.

Webb, J. & Wilson, P. H. (2022). Designing rehearsals for secondary mathematics teachers to refine practice. Math Teacher Educator, 10(2), 129-142.