ONLINE EDUCATION: TRANSFERRING PERSONAL EXPERIENCES TO PROFESSIONAL DEVELOPMENT

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ABSTRACT
In this paper, we discuss how one candidate's experience as she participated an online mathematics specialist program bolstered her confidence and ability to provide online professional development for her teachers. We include personal accounts by the mathematics specialist program instructors, the mathematics specialist candidate, and an elementary school teacher to illustrate how the experience of completing online graduate courses led to the candidate providing online learning opportunities for teachers. In particular, we highlight the importance of building relationships and using high-quality mathematical tasks in both the online preparation program and the online professional development. This case study provides evidence that exposure to online learning environments as a learner can help lower the barrier of entry for planning and providing online learning experiences as a teacher.

KEYWORDS
online professional development, transfer of learning, relationships, high-quality mathematical tasks

One challenge that mathematics specialists face is finding time to provide professional development during teachers' overscheduled work weeks. In response to this challenge, online and hybrid models of professional development can be accessible and flexible alternatives to in-person professional development. We argue that mathematics specialist candidates who participate in online mathematics specialist courses are uniquely positioned to transfer their online experiences to the task of leading online professional development. Candidates can learn from instructors who are explicit about their pedagogical choices for online learning and who encourage mathematics specialists to incorporate best practices into their own online professional development for teachers.

This paper explores this transfer of practices from an online candidate to an online professional development provider through three perspectives: mathematics specialist instructor, mathematics specialist candidate, and elementary teacher. Erica R. Miller is an instructor at Virginia Commonwealth University (VCU) who has co-taught courses for a fully online mathematics specialist program. In this paper, she discusses the best practices she used in the online format and how they were made explicit to candidates. Tracy Proffitt completed the online VCU mathematics specialist preparation program and now works as a Lead Instructional Coach in an elementary school, focusing on mathematics instruction. She describes her experience as an online candidate, challenges she faces when providing professional development, and online options that she uses to meet those challenges. Elicia Fleshman is a teacher in the school where Tracy coaches. Elicia reflects on her experience as a learner in online professional development experiences facilitated by Tracy. This paper concludes with implications for instructors planning online courses, practicing mathematics specialists, and the next steps for further application of professional development using online tools.

When the terms synchronous and asynchronous are used below to describe modes of instructional delivery, they refer to the definitions provided in the preface of this special issue (Baker et al., 2021). In addition, a hybrid model refers to a combination of in-person and online instruction (Bates et al., 2016). These authors also describe five situations in which online learning is an effective mode of delivery, including two examples that align with the motivation to use online professional development in Tracy and Elicia's school: "teachers' immediate needs prohibit more powerful professional learning experiences" and "particular expertise is not available in a school or district but is available online" (p. 72). When the goal of professional learning is to prepare teachers to facilitate rich tasks for their students, teachers should participate in tasks as a central part of their learning and sensemaking, in both content and pedagogy (Hughes et al., 2015). Tasks are completed collaboratively, and collaboration among teachers has a positive impact on teachers' effectiveness (National Council of Teachers of Mathematics, 2014).

Individual Perspectives

Instructor: Erica R. Miller

Before teaching in the online, synchronous mathematics specialist program at VCU, I had only taught and taken face-to-face classes. However, I have always enjoyed using technology, so I was excited by the invitation to join the instructional team for the online cohort. For both courses that I taught, Jamey Lovin was one of my co-instructors. She had many years of experience teaching and coaching mathematics in the K–12 setting, while I had limited

experience teaching undergraduate mathematics courses during graduate school. Jamey's K–12 experience, in addition to her experience teaching other courses in the online cohort, was an invaluable resource. Together we were able to craft our online course to focus on deepening the mathematical knowledge of the candidates in the cohort while also modeling student-centered, constructivist pedagogy through an online platform.

In designing the courses for the preparation program, our main goal was to model best practices that we wanted our online cohort to adopt and model for the teachers in their own schools. We focused on building relationships with the candidates in our cohort by offering virtual office hours and integrating "getting to know you" activities, like sharing recent personal and professional events. We also asked our candidates to work together virtually in small groups outside of class, which provided them with less-formal spaces to form relationships outside of our normal synchronous class meetings. Building upon the *Developing Mathematical Ideas* [DMI] (see Schifter et al., 2016) case-based curriculum, we integrated collaborative explorations of authentic, high-quality mathematical tasks (Smith & Stein, 1998). In order to engage candidates in asynchronous and synchronous mathematical activities online, we utilized digital mathematics platforms (e.g., Desmos Classroom Activities), cloud-based collaborative applications (e.g., GSuite), and our learning management system (Blackboard) to guide candidates through the activities and provide them with a space to share their work.

By asking our candidates to share their work on mathematical tasks, we were able to select and sequence different solution strategies and approaches in order to help them draw connections to the important mathematical concepts during our synchronous class meetings (Smith & Stein, 2018). For many of the mathematics activities, we provided links to online manipulatives that simulated the physical manipulatives that teachers often use in their own classrooms. Candidates were also responsible for posting responses to discussion questions (based on the DMI case studies) on our class discussion board, which provided us with another opportunity to integrate and build upon candidate ideas. During our synchronous meetings, we again used the familiar tools of digital mathematics activities (e.g., Desmos Classroom Activities) and cloud-based collaborative applications (e.g., Google Slides and Google Sheets) in order to monitor small groups as they worked together in breakout rooms. As an instructional team, we then selected and sequenced different groups to share their work during our whole class debriefs.

As candidates progressed through the program, we gave them more and more opportunities to take on leadership roles in different courses. In our final content course, we wanted to provide them with an opportunity to plan and lead part of our class. They had completed a group presentation project in one of their leadership courses, so we used a similar model in the content course. This project provided the candidates with the unique opportunity to lead a professional development session in an online format. Project groups signed up to develop and lead a 45-minute session on one of the chapters from *Connecting Arithmetic to Algebra* (Russell et al., 2011). To support their planning, we provided them with supplemental materials for the book as well as a facilitation plan template. We also met with individual project groups and provided them with feedback on their facilitation plan.

Each project group was encouraged to consider what high-quality mathematical tasks they wanted to include, what focus questions they would use for small and whole group discussion, why these questions were important, how these questions addressed their goals, what additional questions they might want to ask, and how they would adapt the session to meet the needs of the audience. They also were tasked with providing a clear outline of the presentation,

all prerequisite work that participants needed to complete before attending the session, concurrent work they would complete during the session, materials and online resources that the participants would need, and a detailed breakdown of the schedule and presenter responsibilities. At the end of the course, candidates in the cohort shared the following reflections about what they learned from the group presentation project:

- The presentation gave me the opportunity to practice planning and implementing a professional learning opportunity for other teachers. I was able to collaborate with two others in creating a presentation that focused [on] making the connections with representations and the laws of arithmetic for students in the middle grades (Candidate 1, personal communication).
- I've learned how to really facilitate good mathematical discussions in the classroom, and I would be able to help other teachers incorporate these ideas in their own classrooms (Candidate 2, personal communication).
- I feel far more comfortable with professional developments and teaching functions (Candidate 3, personal communication).

Candidate: Tracy Proffitt

My experience as a candidate in the VCU mathematics specialist preparation program exposed me to multiple best practices for online instruction. Instructors consistently used rich mathematical tasks and case study reflections as a focus in both in-class and out-of-class work. Candidates practiced video conferencing during impromptu meetings between classes to discuss work and also in small groups during synchronous class sessions. Instructors modeled tools and structures for engaging students online, such as collaborative bulletin boards (e.g., Padlet) and interactive graphing platforms (e.g., Desmos). All candidates were given opportunities to lead online instruction within our cohort and were encouraged to implement best practices modeled by instructors. The learning around these online experiences was amplified by relationships built through frequent and required collaboration with other candidates.

Upon completion of these courses, I began my first year as a mathematics specialist eager to share mathematics content and pedagogical knowledge with teachers. Like other members of the cohort, it was a challenge for me to find time during school hours to meet with teachers due to limited common planning time and a lack of substitutes to cover classes for teachers. After-school hours were often not an option due to after-school programs, second jobs, or family responsibilities. Finally, providing access to experts in mathematics education through attending conferences, bringing in speakers, or purchasing books for a group of teachers can be prohibitively expensive.

After reflecting, I realized that I could leverage online instruction as a tool for meeting some of the challenges I was facing, rather than waiting for face-to-face professional development to become convenient. I tried a variety of formats for delivering mathematics professional development for teachers in my first year as a mathematics specialist. These formats and their advantages are described in Table 1.

Table 1
Professional Development Formats and Advantages

Format	Example	Advantages of the Format
Synchronous video course	Presented a "Pajama PD" workshop on the basics of number talks offered through video conference at a late evening hour.	Synchronous formats work well for professional development in which participant interaction is essential.
Asynchronous online video module	Recorded a video about rounding on a number line, prepared accompanying questions, and shared the module with teachers to complete at a time convenient for them.	Asynchronous modules can be created ahead of time and accessed by the teacher when they need to know the new content or skill.
Hybrid course	Facilitated an online course, Empowered Problem Solving (Kaplinksy, 2020), for six teachers. Some of the course work was completed together and some at home on their own time.	An advantage of the hybrid model is that it provides the opportunity for teachers to learn from each other while completing rich mathematical tasks, followed by reflection and further teaching from an expert online.
Video recording of an in-person training or lesson	Recorded trainings, book study meetings, or modeled lessons so that teachers who were unable to attend could watch them at a later time.	This is helpful for professional development that needs to be repeated each year for new teachers.
One-on-one coaching via video conferencing	Met with teachers virtually to discuss upcoming mathematics content or lessons observed.	This format works when traditional face-to-face coaching is needed but not feasible due to scheduling conflicts.
Podcast	Recommended specific episodes of a mathematics education podcast to teachers who wanted to learn more about a certain topic.	This format works well for teachers who have specific questions because their needs can be matched to episodes that they can listen to while driving, exercising, etc.

The online mathematics specialist courses I completed as a candidate impacted my facilitation of online professional development in several ways. First, participating in these courses and being required to lead classes through video conferencing helped to reduce my fear of using various online formats. Throughout my program, I was exposed to multiple tools and formats for collaborative, engaging, online instruction, and this familiarity as a candidate

transferred into a willingness to try the same when planning and leading professional development. Second, as I planned various professional learning experiences, I tried to model my instruction after best practices I observed in my mathematics specialist courses. For example, I avoided the "sit and get" structure by incorporating frequent discussion opportunities and formative checks for understanding. When applicable, professional development included high-quality mathematical tasks, especially in the hybrid Empowered Problem Solving course discussed below by Elicia. Finally, I constantly considered the importance of building and sustaining positive, supportive relationships throughout professional development offerings. Much like I had learned to do as a candidate, I encouraged participants to ask questions, maintained a curious, facilitator disposition while leading activities, and focused on teacher growth in all situations. I also provided teachers with time to have one-on-one follow up meetings with me for reflection and individual goal setting.

Teacher: Elicia Fleshman

I have been an elementary educator for 20 years, and I am of the belief that as an educator it is incumbent upon me to remain a continuous learner. As a continuous learner, I have always had an interest in effective mathematics pedagogy and the potential impacts it has on student achievement. An opportunity arose to work with my school's mathematics specialist and other colleagues through a National Science Foundation Noyce-funded workshop. I welcomed the challenge to enrich my learning of teaching mathematics and to collaborate with other educators.

The Empowered Problem Solving Workshop (EPS) is typically offered as an asynchronous course. The EPS Workshop's mission was to bring to light the ineffective teaching strategies educators have been instituting for years, such as a heavy reliance on algorithmic instruction and rote memorization techniques. These antiquated techniques bypassed essential, rigorous, critical thinking instruction that promotes learner agency and engagement.
My colleagues and I met weekly to engage with the online course modules. During our meetings, we openly processed new learning goals through collaboration. We considered this format to be that of a hybrid model because we began the week's learning objectives together, processed new information, worked through high-quality mathematical tasks, discussed strategies, and then continued individual learning outside of contract hours to ensure we were adhering to program fidelity. Though the course was designed for individual teachers to complete asynchronously, our group's redevelopment of the course to a more hybrid approach met the diverse needs of each participant.

One of the key elements that made this experience successful was that Tracy, our mathematics specialist, was skilled at developing meaningful, trustworthy relationships. Also, she created an environment of shared responsibility, creativity, and varied skill sets in which each member of the team was able to share openly and honestly. Another key element that she brought to the table was her level of expertise. She had a firm grasp of the mathematics and technology fields, and that in and of itself was invaluable. Having a knowledgeable, capable, and approachable facilitator to guide us through the hybrid course helped to provide an element of ease in which each team member could apply the new knowledge to their own classroom.
Moving forward with my experiences regarding the aforementioned learning opportunities and the new norm of teaching and learning during the COVID-19 pandemic, I feel more prepared and confident within the realm of remote learning. Working with and learning from Tracy has

enabled me to pick up new and exciting ideas about online teaching and learning. The technological platforms themselves and how she modeled their use has led me to believe that these strategies are universal. They can be just as effective in online learning environments as in face-to-face environments. I feel more confident in taking risks with my instructional pedagogy than before we embarked on this journey.

Conclusion

Mathematics specialist candidates who complete online course work are exposed to a variety of best practices and tools for online learning. When instructors are explicit about the choices they make for online instruction, conversations may arise between instructors and candidates about the pedagogical and technological choices. This may lead to candidates transferring online experience into practice in effective professional development experiences for the teachers they serve. The anecdotal account described above prompted one mathematics specialist to explore synchronous, asynchronous, and hybrid options to meet the professional development needs of the teachers in her school building. Instructors and mathematics specialists are encouraged to consider ways in which online learning can be paired with collaborative tasks in order to increase learning and engagement (Bates et al., 2016).

The idea for this article originated before the COVID-19 pandemic forced closures of schools across the United States in March of 2020. As school systems faced the challenge of preparing teachers for online instruction, the conversation surrounding online professional development became even more widespread and necessary. Mathematics specialists who already have experience with the online learning format can pave the way in preparing teachers for concept-based, student-focused online and hybrid learning. In addition to group professional development, one-on-one virtual coaching (Matsumura et al., 2016) can also be explored and expanded. Another area that can be explored is the further transfer of best practices from online professional development into online mathematics teaching. Mathematics specialists who make their online professional development choices explicit to teachers may better prepare teachers as they navigate various online teaching platforms.

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