Drawing Taylor Swift, Orcas are Dolphins, & "What if" Questions: Creating a Third Space to Reflect in an Elementary Mathematics Field Experience for Preservice Teachers

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Abstract

In preservice teacher education, there is often a tension between the realities of in-field experience and the theoretical knowledge of higher academia. This article reveals the benefits of an elementary mathematics education mentor-supervised clinical experience and the creation of a third space to bridge these tensions to cohesively traverse between practice to theory. Moreover, we provide this third space by sharing reflections on the challenges faced in our own in-field experience in hopes that others gain insight on a different mathematics field experience, how to support that transition from practice back to theory, and how to pivot when things do not go as planned.

Keywords: Pre-service teachers, clinical experiences, mathematics teacher educator mentors, mathematics education

1 Introduction

Providing spaces for preservice teachers (PSTs) to engage in and develop different pedagogical skills has become standard practice in most U.S. university programs. These practices such as interviewing children, analyzing student work samples, and/or designing tasks and lesson plans are meant to prepare PSTs for their future careers in teaching mathematics to children. Often, these are done in methods courses with peers rather than in field placements with actual children, providing a valuable but less authentic experience. The Association of Mathematics Teacher Educators (2017) states that not only should PSTs engage in these practices within their methods courses but that, "an effective mathematics teacher preparation program supports candidates' engagement in increasingly comprehensive acts of teaching by providing coherent and developmentally appropriate clinical experiences" (Indicator P.4.2. Sequence School-Based Experiences). These clinical or field experiences support PSTs in deepening their understanding and application of mathematics pedagogy because they engage with actual children rather than peers, providing more authenticity (Cooper & Nesmith, 2013). Also, these experiences can allow PSTs to practice theories they learned in their methods courses with immediate and direct support from their Mathematics Teacher Educator (MTE). Having their MTE available during these experiences can have a positive impact on PSTs' comfort level and preparedness for teaching mathematics (Roland, 2010; Wyss et al., 2012).

However, not all field or clinical experiences have an MTE available. Bjerke and Nolan (2023) found that when field experiences lacked guidance from Teacher Educators (TEs), PSTs often placed more value in the practical experiences, which often contradicted what was taught in methods courses and theory. They suggested that TEs provide what they call a "third space" for PSTs to reflect in a post-field experience as a transition from practice back to theory.

The goal of this paper is to provide that third space and share the challenges faced during a mathematics field experience through our lens as the course MTE and a participating PST and how we responded to those challenges. It is our hope that by sharing these challenges and reflections, others will gain insight on a different model of engaging in a mathematics field experience, how to support that transition from practice back to theory, and how to pivot when things do not go as planned.

2 Context

Forty-two PSTs were enrolled in a one-credit, two-hour Elementary Mathematics Lab course during the second semester of their junior year. They completed an integrated English for Speakers of Other Languages (ESOL) and Elementary Mathematics Methods course the previous semester. The Spring 2024 course was redesigned to provide greater access to children by embedding part of it in a local elementary school. The philosophy of the Mathematics Teacher Educator (MTE) for the course was that to become a better elementary mathematics teacher, PSTs needed opportunities to teach mathematics to actual children. Although PSTs spent two days in their school/field placements during the Spring semester, some expressed that they did not have the opportunity to teach mathematics to their students. Thus, the goals for the course were to provide PSTs:

- Opportunities to interact with children solely around mathematics,
- A field experience where the MTE could provide feedback and support in-the-moment,
- Opportunities to practice implementing tasks that focused on conceptual understanding, problem solving, and that elicited student explanations and reasoning.

The MTE originally planned for PSTs to participate in three cycles of observations and teaching. During the first session of each cycle, PSTs observed an elementary teacher (1st or 5th grade) leading a mathematics lesson, debriefed their observations, and planned a small group activity based on the observed lesson and formative assessment results collected from the children. Then, during the second session of each cycle, three PSTs worked with a group of children, where one PST acted as the "teacher," while the two other PSTs observed and wrote field notes using the TEACH Math Video Lenses Tool to organize their observations (Parks & Wager, 2019). Specifically, PSTs focused on the Learning, Teaching, and Power & Participation Lenses. To ensure all PSTs had the opportunity to lead an activity, they rotated positions for each cycle. To engage in the third space, PSTs were asked to reflect in a journal after each session and then write an overall reflection on the entire experience at the end of the semester.

However, as with any experience in the teaching field, the PST cohort that engaged with the fifth-grade students encountered several obstacles that caused the MTE to adjust the planned cycles. Specifically, they only engaged in two sessions of observations and although they did interact with the children during the three teaching sessions, not every PST had the opportunity to lead the activity as absences from both the PSTs and children often required shuffling and reforming of groups. In the end, most teaching sessions were co-taught with multiple PSTs engaging a group of two to four fifth graders.

In what follows, we (both a PST from the course and MTE), as a team, share a few of our

challenges with added context. We then offer our reflections of how we responded to these challenges by sharing specific quotes from conversations and observations with the elementary children who 1) made the experience possible and 2) were the driving force behind the entire field placement. We then conclude our manuscript with suggestions on making the most out of field placements.

3 Results

3.1 Challenge #1: Pressures of Accountability and Testing—How We Responded: "Drawing Taylor Swift"

Reflections from the MTE

During the sessions focused on teacher observations, we often witnessed the emphasis of procedures and rote memorization of vocabulary tied to highly conceptual topics. We recognized the extreme pressures these teachers were under to prepare and help their students succeed in the annual state assessments, and discussed how these pressures can manifest as teaching focused solely on procedures. As an MTE that focuses on engaging children in problem solving to develop conceptual understanding, I saw this as an opportunity to support the children in making meaningful connections between the procedures and the underlying concepts. I also saw this as a valuable learning opportunity for the PSTs to consider how to navigate these pressures. To supplement the procedures and vocabulary, we decided that during our teaching sessions, we would engage the children in problem solving with opportunities to explore with manipulatives and connect to the procedures.

Figure 1: Shapes Created by the Children Using AngLegs manipulatives.

Reflections from the PST

When we initiated hands-on, open-ended activities, students were able to freely engage in mathematics. In turn, we had the opportunity to observe, understand, and extend the complex thinking of young students. For example, when we asked students to explore geometry through experimenting with shape-building, we assumed the children would use the AngLegs we provided. Indeed, many did, creating everything from triangles to transforming, irregular polygons. However, one child picked up a whiteboard and began to draw a humanoid figure (Figure 1, left side of picture). When asked what she was doing (and how it related to the assignment), she explained that she was **"drawing Taylor Swift through shapes."** She then proceeded to point out every shape that composed the drawing, allowing us to see her understanding of how shapes comprise the world around us and connecting to the vocabulary she learned in class.

While this student's drawing may have initially seemed off-task, it was a significant reminder that children understand the world differently than adults and are so often underestimated for it. Mathematics is universal and is all around us—no matter where we go. As citizens living in this world, children are already making sense of mathematics from a very young age. However, we often assume they lack knowledge since they may not be able to communicate in standard mathematical terminology, which must be explicitly taught. What I learned was that the pressures teachers face in preparing students for state assessments can produce a sole focus on procedures and memorization, which can reduce some opportunities to make math meaningful, relevant, and memorable. By supplementing these procedures with a free space for students to explore and express their mathematical understanding, educators can assess students' learning and then connect important mathematical terminology to students' knowledge. Overall, through my student "drawing Taylor Swift" I realized the key to unlocking mathematical understanding lay not only in procedures or memorization, but in conjunction with the facilitation of student exploration and intentional questioning. Moving forward, I plan to continue implementing explorative activities within my mathematics instruction to facilitate both higher connection-making and a generation of math lovers.

3.2 Challenge #2: Children's Limited Engagement—How We Responded: "Orcas are Dolphins"

Reflections from the MTE

Building off of the first challenge, as we observed the mathematics lessons in the field placements, we noticed that the children engaged in classroom discussions, but were focused on sharing their answers and procedures used to solve the problems. I also realized that engaging children in mathematical conversations could be difficult if it is not common in their classrooms and we had not built relationships with the children. We thus needed to quickly build trust with the children for them to actively engage in our activities. For each activity, I asked the PSTs to engage in a brief chat sharing a little bit about themselves before jumping into the mathematics. It was my hope that by getting to know the children, engaging in problem solving, and providing manipulatives, the children would become engaged and willing to share their thinking.

Reflections from the PST

Based on our MTE's encouragement, my PST team decided to allot some of our limited activity time to connect with students via a conversation in which we introduced ourselves, explained our purpose at the school, and listed our favorite animals. I am unsure whether this last topic influenced the following comment, but during our later math activity one of the students blurted out: **"Did you know that orcas are actually dolphins, and not whales?"**

This random comment took me by surprise (especially because I had not known that orca whales were dolphins). Nonetheless, the exclamation sparked a flood of questions and a resulting conversation that helped us genuinely connect with the student. I learned that while this student strongly disliked math, he loved science. Indeed, his love truly was reflected through his discussion; he had been so enthusiastic about this topic that he felt compelled to share—even within a different academic setting and among PSTs he barely knew.

When reflecting on this enthusiasm, I realized that taking the time to genuinely know students may be a time-consuming effort, but it did (and will) significantly increase student engagement. For one, when students feel comfortable, they are far more likely to actively participate in that environment. However, in order to be comfortable, students must feel known and welcomed. Furthermore, by understanding their student's interests, educators can connect mathematical concepts to their lives to make math meaningful and relevant. Mathematics is so often hated by students typically because it is viewed as impractical (cue the "when are we ever going to use this?"). In reality however, math is simply problem solving, which young children are already constantly doing on their own; it is how they learn to navigate the world around them. If educators merge students' individualized interests with math, students' interest levels will skyrocket– and like my orca-enthusiastic student, may begin to make personal connections, develop a new passion, and share their findings with others all on their own. In short, my student's "orcas are dolphins" comment helped me realize that I too, as a future teacher, must assume a humble position as a learner. By connecting with my students, genuinely listening and seeking to understand their lives, I will be able to adapt my lessons to their interests and conquer the all-too-common challenge of lack of engagement.

3.3 Challenge #3: Limited Time to Build Students' Conceptual Understanding—How We Responded: "What if we...? What kind of...?"

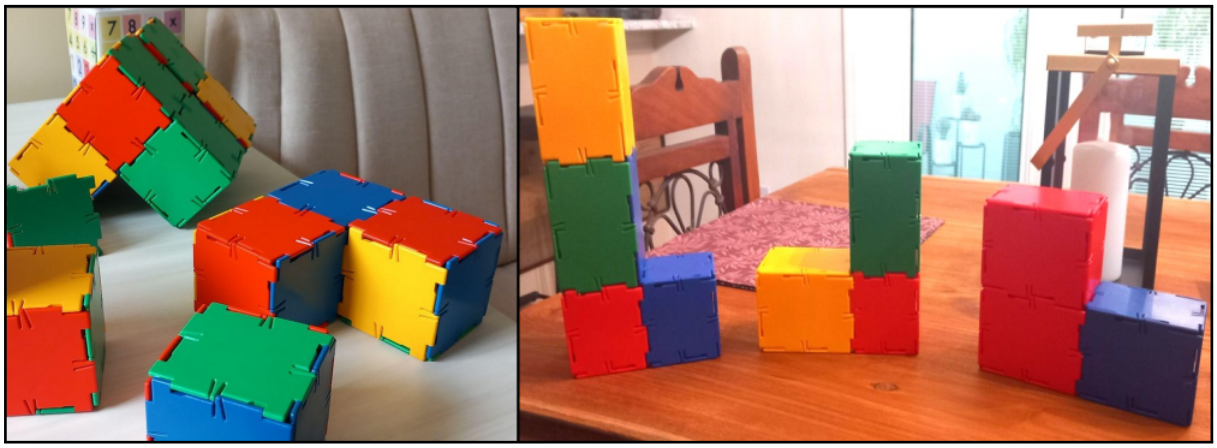
Reflections from the MTE

My original hope when planning this experience for the PSTs was that they would have the opportunity to plan and teach two, 45-minute lessons with a group of 4 to 5 children. However, because of the extreme time constraints that the teachers faced, we were limited to 15 to 20 minutes of "workshop time" to interact and present our activities. This "workshop time" was independent work time where children practiced solving problems in their workbooks that were presented during the lecture portion of the lesson. As my goal was for PSTs to have access to children, we adjusted, planned, and implemented brief activities that connected the conceptual to the procedural knowledge, even if they were unable to complete the entire activity. This was particularly important during our final teaching session where the children were able to repeat a formula, but were unable to explain what it or the solution represented.

Reflections from the PST

Despite our limited time with the students, our preservice teaching-teams opted for explorative, discussion-based activities rather than periods of explicit instruction. On our last field day, we initiated an activity working with Polydrons and counting cubes to explore the volume of 3D figures–specifically figures composed of right rectangular prisms (Figure 2). Throughout the experience, we asked students conceptual questions about volume to promote connection-making; however, shortly into the activity, our students posed an advancing question of their own. As students were manipulating the figures, one of them asked, **"What if we built a bigger shape with the Polydrons that we could fit all of the smaller cubes? What kind of shape would it need to be?"**

Figure 2: Figures composed of right rectangular prisms made using Polydrons.



This question sparked much internal cheering and celebration on my behalf. Not only had this student demonstrated understanding about volume and dimensions, but extended her learning through independently expressing a further wondering. As a future mathematics educator, my primary goal is to develop this type of motivated, curious, and intellectually autonomous learner. Before this experience, I was nervous about employing a teaching strategy that lacked explicit instruction; while our cohort had learned much about the effectiveness of activity-based techniques in our courses, working within a time limit left us no fallback if the students failed to make connections on their own.

Nonetheless, due to my students' expressed wonderings, I realized that even when working within a tight time budget (as every teacher does), utilizing explorative learning methods facilitates deeper conceptual understanding than what most textbooks typically convey in a full-length lesson. Overall, by providing space for my students to ask and answer their own "what if we? what kind?" wonderings, I am now more confident in assuming a "facilitator" role as a future mathematics educator. Not only are children more engaged within these hands-on activities, but through their resulting findings and questions, they have the opportunity to explore more math concepts than taught in standard curriculum and are able to connect math to their own interests, making learning meaningful and relevant.

4 Conclusion

While these challenges may have prevented the "smooth teaching experience" the MTE had hoped for these new educators, PSTs were still able to engage in meaningful learning, extending beyond the traditional college classroom environment. In the world of higher academia, it is easy for both MTEs and PSTs to get lost in an entanglement of educational theories, disconnected from real students and the realities of the education system. Yet, having in-field experience and facing issues like time constraints and pressures of accountability and testing helped us to realize the tensions between practice and theories and their interplay in an elementary classroom. Thus, participating in a mentor-supervised clinical experience resulted in the need to create a third space, allowing participants to reflect on these tensions and process these in-field challenges in a meaningful way (Bjerke & Nolan, 2023). This third space allowed for substantial learning with other PSTs and the MTE who shared the same experience.

Even when circumstances were not ideal, both the MTE and PSTs walked away with significant takeaways from our interactions with the staff and children at the school. Encountering challenges in the field helped to draw both the PST and MTE's focus towards the children and understanding the pressures that many teachers face in the field. Maintaining a child-

centered pedagogy is especially important in the field of mathematics, where educators must understand children's thinking in order to facilitate mathematical connection-making. However, the realities of schools with testing and time constraints do not always allow for this type of instruction, and MTEs need to support PSTs in navigating these challenges. In turn, our focus centered on our opportunity to engage with children in making the connections between procedures and concepts, which allowed PSTs to observe a variety of children's thinking processes and witness the joy in student-engaged mathematics.

All in all, experiencing a mentor-supervised clinical experience was an invaluable learning opportunity in our elementary mathematics education. We encourage MTEs who are considering this lab style to embrace the obstacles, provide a third space to reflect, and to focus on the children, the true center of education. Engaging in and responding to challenges in a mentor-supervised field experience allowed PSTs to extend and apply their knowledge and professional growth as future educators beyond that of the typical university classroom. This not only benefited the PSTs but helped to educate future generations in their interactions with children.

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