
Leveraging School-University Partnerships and Clinical Practice Experiences to Enact Equitable Mathematics Practices in Elementary Schools

Drew Polly
University of North Carolina at Charlotte

Abstract: This article describes one specific course within a large urban university that uses school-university partnerships and clinical practice experiences to prompt elementary education teacher candidates to enact equitable mathematics teaching practices in the classroom. It begins by providing a brief overview of equitable mathematics practices, describing the relevant course activities, and elucidating the work of teacher candidates in elementary schools. The article concludes by setting out the lessons that can be learned from the course and offering recommendations for other teacher educators looking to implement it in their own settings.

KEYWORDS: Clinical Practice, Elementary Education, Equity, Equity-based teaching, Mathematics education, Practice-based teacher education, Professional Development Schools, PDSs, Rehearsals, School-university partnerships

NAPDS NINE ESSENTIALS ADDRESSED:

Essential 1: A Comprehensive Mission: A professional development school (PDS) is a learning community guided by a comprehensive, articulated mission that is broader than the goals of any single partner, and that aims to advance equity, antiracism, and social justice within and among schools, colleges/universities, and their respective community and professional partners.

Essential 2: Clinical Preparation: A PDS embraces the preparation of educators through clinical practice.

Essential 4: Reflection and Innovation: A PDS makes a shared commitment to reflective practice, responsive innovation, and generative knowledge.

Background

The novel coronavirus disease 2019 (COVID-19) pandemic has left students worldwide facing numerous topics and concepts that can be classified as “unfinished learning.” This term has been advanced based on the idea that learning is an ongoing process that will continue in the future. As such, it offers a more accurate description than the media-driven idea of learning loss, which is deficit-focused (Hancock, 2021). Data suggest that the amount of unfinished learning is higher among specific populations of students who may not have had the same opportunities and supports as their peers during the pandemic. In fact, the crisis necessitated a shift to remote teaching during the spring of 2020 as well as to a variety of online, hybrid, and in-person teaching experiences being offered to students during the 2020–2021 school year, which not all students were able to access (Hodges et al., 2021; Martin et al., 2021; Polly et al., 2022).

In the field of teacher education, while our primary goal is to adequately prepare and educate both future teachers (hereafter teacher candidates) and current teachers, we would be remiss not to also consider how our work directly influences the current processes of teaching and learning in the schools in which our teacher candidates work. In this article, we describe one specific effort to leverage school-university partnerships and clinical practice experiences in order to enact equitable mathematics practices in elementary schools and, therefore, positively impact the students that teacher candidates work with.

Gutiérrez (2009) considers equitable mathematics teaching to comprise four distinct dimensions: access, power, achievement, and identity. Table 1 describes what each dimension involves. In the present article, we focus on the power dimension, which entails students having the agency and freedom to examine a given mathematics task and determine how they will solve it, including having access to various supports such as manipulatives, visuals, or paper and pencil to draw pictures or write things down.

Table 1

Equity-Based Principles for Mathematics (Adapted from Gutiérrez, 2009)

Dimension	Description
Access	Students have access to high-quality mathematics tasks and resources. Students have access to mathematics tools to help them understand the subject.
Power	Students have opportunities to make choices regarding how they explore and solve mathematics tasks. Students have opportunities to discuss and share their thinking and strategies. Students have opportunities to make sense of their tasks.
Achievement	Mathematics activities are aligned with established standards. Mathematics tasks and curricula are of a high quality. Mathematics teachers are supported as well as knowledgeable with regard to mathematics.
Identity	Students feel that they can be successful in mathematics. Students consider mathematics to be relevant to their life and part of their community.

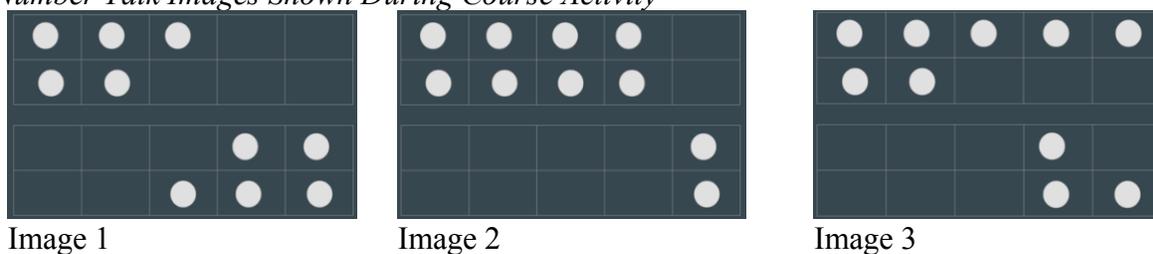
In prior studies, researchers have found that clinical practice experiences provide teacher candidates with rich opportunities to practice enacting equity-based practices, even in classrooms in which there is little evidence of equity-based teaching actually taking place (Polly, 2021). The process of providing rehearsing candidates' lessons during on-campus courses and then having them enact those same lessons led to candidates' use of questions to elicit thinking, but the quality of questions varied (Colonnese et al., in press). Further, while the model of on-campus preparation followed by clinicals may not be as robust as intensive and embedded work whereby both course meetings and clinicals occur in a school setting, teacher candidates still report positively about their growth as future teachers based on their experiences (Colonnese & Polly, in press) and demonstrate some enactment of emphasized pedagogies (Colonnese et al., in press). The next section will describe the teacher candidates' course as well as their clinical practice experiences as part of the course.

Description of Clinical Practice Experiences Intended to Promote Equity-Based Mathematics Practices

Focus on Practices: The Power Dimension and Eliciting and Interpreting Students' Mathematical Thinking

Due to the course's focus on equity-based teaching, particularly the need to provide students with opportunities that involve power, the teacher candidates worked on the high-leverage teaching practice of eliciting and interpreting students' thinking (TeachingWorks, 2020). During the first few weeks of the course, they spent time learning about the rationale behind eliciting and interpreting students' thinking, in addition to the actions on the part of teachers that are associated with it. Teacher candidates first participated as learners in the course by engaging in Kindergarten number talks where the author, who was the course instructor, quickly showed images of dots (see Figure 1). The instructor then asked teacher candidates, "Without giving the number of dots what do you notice?", "How many dots are there?", and "How did you find the total number of dots?" The desired response is that all learners begin to see and talk about different ways to group dots and combine groups to determine the total number of dots.

Figure 1
Number Talk Images Shown During Course Activity

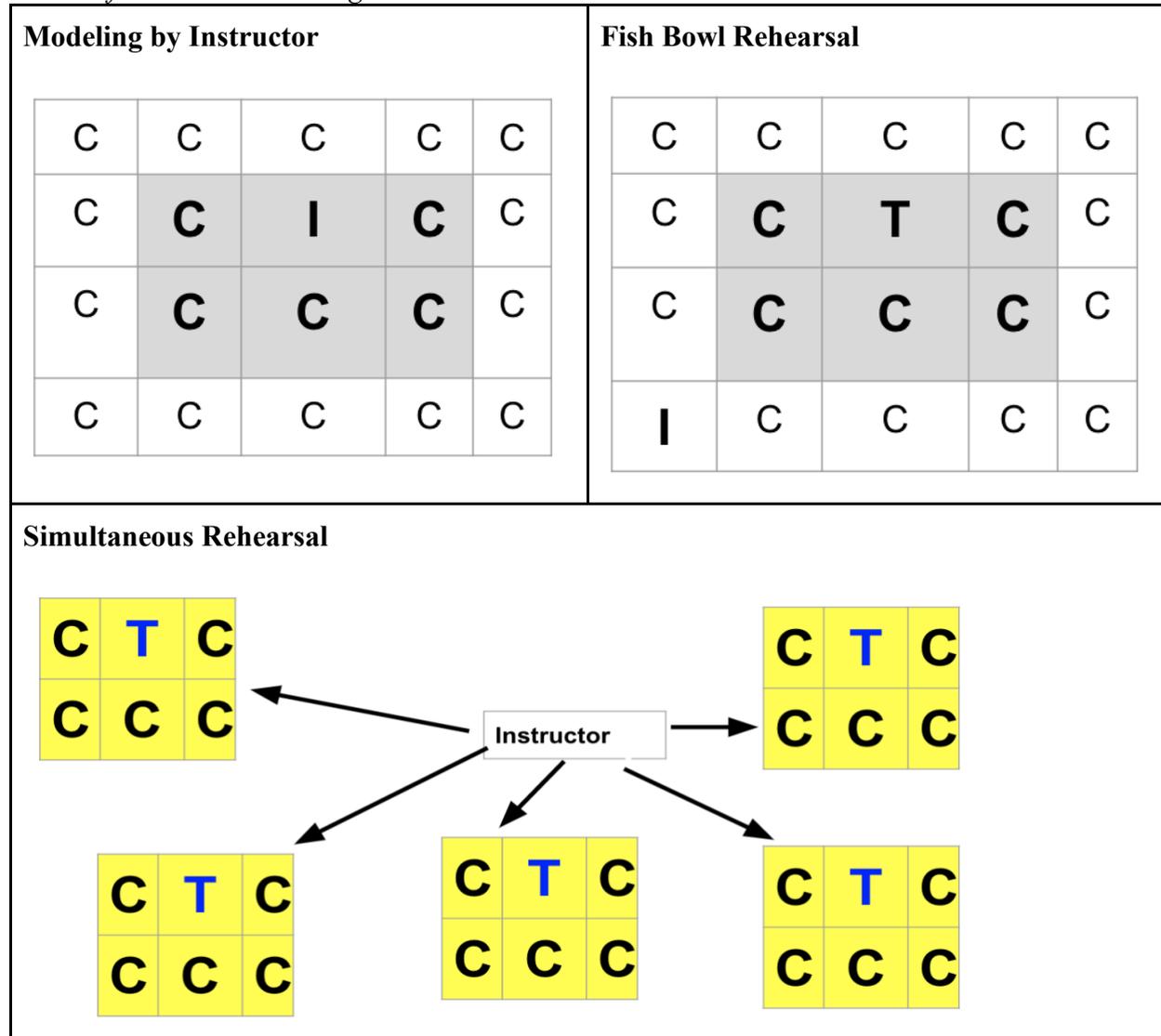


After the number talk, teacher candidates and the author discussed how teacher candidates had opportunities to have power during the activities and how the instructor used questions to elicit their thinking. The teacher candidates engaged in similar work later in the semester, with a focus on thinking about and solving word problems.

Preparation: On-Campus Coursework

Following two classroom sessions during which they participated as learners in number talks, each teacher candidate then planned their own Number Talk and rehearsed it with peers during a classroom session. Immediately after the rehearsals, the teacher candidates received feedback in the form of “glows and grows” from their peers. Figure 1 presents the various formats used during the course meetings to develop the teacher candidates in relation to their clinical practice experiences.

Figure 1
Modes of Instructor Modeling and Rehearsal



Note: C = teacher candidate; I = instructor; T = candidate serving as teacher.

As mentioned above, this cycle of the teacher candidates participating as learners was repeated a few weeks later with regard to word problems. This time around, the teacher candidates had to plan a minimum of 5 word problems: an opening problem, two problems that were easier than the opening problem, and two problems that were harder than the opening problem. This

planning process was based on the premise that the teacher candidates would have to decide in the moment whether problems should be easier or harder based on their students' work during the relevant lesson.

The on-campus coursework was intentionally designed to be as authentic as possible to adequately prepare teacher candidates to enact the same activities with elementary school students. During the rehearsal of the activities, the teacher candidates in their group would be respond as learn who were acting as students would give incorrect answers or pretend they were unsure how to get started so as to increase the authenticity of the rehearsals in terms of what actually happens during clinical practice with elementary school students.

Enactment: Working with Teacher Candidates

The teacher candidates were all first-semester juniors who were matched with partner schools through our clinical practice office to allow them to complete both mathematics and literacy clinical practice experiences in a kindergarten, first-grade, or second-grade classroom. All the partner schools agreed to allow the teacher candidates to teach small groups of students in mathematics class during the entire semester, in addition to a variety of small group lessons and one complete literacy activity. With regard to math, the teacher candidates completed the following activities during their clinical practice experiences: a baseline assessment, a Number Talk, 3 word problem lessons, a 3-Act Task lesson, and an additional optional lesson involving math games (see Table 2).

Table 2

Summary of the Clinical Practice Experiences Related to Mathematics

Assignment	Description
Baseline Assessment	Identify two assessments related to number sense to complete. Complete each assessment with two students.
Number Talk	With a small group of four to six students, complete a Number Talk that is appropriate for their grade level.
Three problem solving lessons	With a small group of four to six students, complete three problem-solving lessons.
3-Act Task	With a small group of four to six students, complete a 3-Act task that involves math in a real-world setting. Use one of the 3-Act tasks from gfletchy.com .
Optional: Math Game	If you choose, play a math game involving addition or subtraction with one or two students.

Prior to the COVID-19 pandemic, the only course requirements were the three word problem lessons. The idea behind including all these extra clinical teaching activities came from the school partners, who had expressed the desire for teacher candidates to be more actively engaged in the classroom when in schools, including working with small groups of students. The school partners also indicated that due to many of their students experiencing unfinished learning, the teacher candidates could prove very helpful in teaching students while they were there.

The teacher candidates were encouraged to work with the same small group of students for each activity, which meant that over the course of the semester, they built relationships and invested more intensively in a particular group of students rather than completing individual activities with different groups of students.

Reflection: Reactions from the Teacher Candidates

The teacher candidates all positively rated their clinical experiences in their project reflections. A cursory thematic analysis of what they learned and potential areas for future growth indicated a few common themes, which we will briefly describe below.

Teacher Candidates' Perceptions of What They Learned

With regard to what they learned from their clinical practice experiences, the teacher candidates focused on how well their students did when given opportunities and appropriate supports. As one teacher candidate shared, "I was pleasantly surprised by how much math my students knew. They did really well when I gave them a problem to solve and access to manipulatives to do so." Similarly, another teacher candidate commented as follows:

I wondered before I started if I should do direct teaching and not let them explore, but I learned that they were very capable and I needed to ask harder questions during the lesson. It made me very attentive regarding what the students could do so that I was not wasting their time and having them do things they already knew how to do.

Teacher Candidates' Perceptions of Areas for Future Growth

The teacher candidates consistently reported during multiple activities that they wanted to have more higher-level questions planned before they taught and, additionally, that they wanted to have more challenging tasks available, especially for the first problem-solving lesson. Even with the data from the baseline assessment, the teacher candidates reported that their first lesson did not give their students enough credit, while when they did not have more challenging questions and math activities ready, their students looked bored.

As one teacher candidate wrote in her reflection, "I thought I was giving all the students access by using smaller numbers and manipulatives, but I found that it was way too easy for them. I need more challenging activities in the future." In a similar vein, another teacher candidate wrote that "We did a lot on higher-level questions in class, but I did not plan to ask a lot of them. I learned that I need to have more planned."

On the whole, the teacher candidates found that while they had planned more challenging word problems, they also needed to have more higher-level questions planned.

Looking Ahead: Future Considerations Concerning the Promotion of Equity-Based Practices

This study identified three specific considerations for future semesters, namely the benefits and complexities of multiple teaching opportunities, explicitly addressing equity, and in-person classroom-based support. These considerations will be discussed in more detail below.

Benefits and Complexities of Multiple Teaching Opportunities

In an ideal world, teacher candidates would engage with and teach students each time they were in a school. During the course described in the present article, the teacher candidates taught five required activities and had the option to teach a sixth activity, which around half of them did.

One of the key outcomes that the teacher candidates reported was the fact that they derived a lot of benefit from all of the teaching they completed during their clinical practice, especially after spending classroom time doing rehearsals and receiving feedback on their lessons.

While the chance to participate in multiple teaching opportunities during clinical practice has a lot of benefits, teacher candidates are unlikely to be able to start teaching immediately at the beginning of the semester due to the need to set up placements as well as the need to plan and receive feedback on their activities from course instructors. One complexity currently being considered in relation to our course is how early teacher candidates can be expected to start teaching as juniors, especially during their first semester taking elementary education courses. In the past, teacher candidates have worked with students by reading a book or helping with an activity planned by their clinical educator, which seems more feasible for early on during the semester when compared with lessons that require planning, feedback, and rehearsals. There is a need for teacher educators and teacher education leaders to examine how many teaching activities teacher candidates, especially those new to education courses, can and should realistically complete during a semester.

Explicitly Addressing Equity

The teacher candidates involved in this study engaged in explicit activities related to Gutierrez's (2009) framework and had multiple opportunities to make connections between mathematics activities and different aspects of equity. Clinical educators have not necessarily had access to the same information and experiences. As a result, there may be a potential lack of alignment between what teacher candidates see as equitable mathematics teaching practices and their clinical educators' views on the matter. In some classrooms, the teacher candidates reported that they did not see a lot of opportunities for students to have the power and agency to choose their own mathematics strategies, other than the lessons that they had taught.

As teacher education programs continue to form school-university partnerships to enhance teacher candidates' clinical experiences, support and develop practicing teachers, and positively impact pre-kindergarten through grade 12 (hereafter PK-12) students' learning, there exists a need to consider effective ways to increase the alignment between understandings of equitable teaching and what it actually looks like in classrooms. In the case of elementary education, as classroom teachers often teach multiple subjects, there is a need for conversations about what equitable teaching looks like in relation to these various subjects so that clinical educators and teacher candidates alike have clarity and can better meet their students' needs. In the context of school-university partnerships, this could involve collaborative professional development that includes both clinical educators and teacher candidates as well as opportunities for university faculty members and clinical educators to learn more about each other's ideas concerning equitable teaching practices.

Concluding Thoughts

The aim of this article was to describe one initiative whereby clinical practices embedded in school-university partnerships focused on prompting teacher candidates to enact mathematics activities in elementary school settings that included equitable teaching practices, including a focus on providing students with power and agency in terms of how they solve mathematics problems. Due to so many students currently experiencing unfinished learning, it is critical that teachers and teacher candidates look for ways to support students' learning in an equitable fashion. In the case

of mathematics, such equitable practices could involve posing word problems that allow students the power and agency to determine which strategies they want to use to explore the problems.

The teacher candidates involved in this study, after learning about equity-based teaching, planning, and rehearsing activities, were able to successfully enact equitable practices with their students. The teacher candidates' reflections indicated that while they were pleasantly surprised by how well their students did, they needed to plan more challenging questions and activities in the future. This article should provide teacher educators with ideas about how rehearsals and clinical practice experiences can serve to support equity-based teaching and simultaneously benefit teacher candidates, clinical educators, and PK-12 students.

Essential 1 from the National Association for Professional Development Schools (NAPDS)'s Nine Essentials states that a school-university partnership "aims to advance equity, antiracism, and social justice within and among schools, colleges/universities, and their respective community and professional partners" (NAPDS, 2021). Since Professional Development Schools and school-university partnerships vary in their approach, structure, and focus of their partnership, situating equity at the center of all partnership work is critical (Zenkov et al., 2021). Through the process of designing clinical practices (Essential 2) and the "commitment to reflective practice, responsive innovation, and generative knowledge" (Essential 4), school-university partnerships can simultaneously make a positive difference in the lives of teacher candidates, clinical educators, and PK-12 students.

References

- Colonesse, M. W. & Polly, D. (accepted). Using practice-based teaching experiences to leverage teacher candidate effectiveness. *PDS Partners: Bridging Research to Practice*.
- Colonnese, M., Reinke, L. T., & Polly, D. (in press). An analysis of the questions elementary education teacher candidates pose to elicit mathematical thinking. *Action in Teacher Education*. <https://doi.org/10.1080/01626620.2021.2020696>
- Delpit, L. (2012). *"Multiplication is for white people": Raising expectations for other people's children*. The New Press.
- Gutiérrez, R. (2009). Framing equity: Helping students "play the game" and "change the game." *Teaching for Excellence and Equity in Mathematics*, 1(1), 4–8.
- Hancock, A. (2021). *Why unfinished instruction is more accurate and equitable than learning loss*. UnboundEd. <http://www.unbounded.org/blog/why-unfinished-instruction-is-more-accurate-and-equitable-than-learning-loss>.
- Hodges, C., Lockee, B., Moore, S., Trust, T., & Bond, A. (2020). The difference between emergency remote teaching and online learning. *EDUCAUSE Review*. Retrieved from: <https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning>
- Martin, C., Harbour, K., & Polly, D. (2021). Transitioning the elementary mathematics classroom to virtual learning: Exploring the perspectives and experiences of teachers. In A. Slapac, P. Balcerzak, K. O'Brien (Eds.), *Handbook of Research on the Global Empowerment of Educators and Student Learning through Action Research* (pp. 343-365). IGI Global. <http://www.doi.org/10.4018/978-1-7998-6922-1.ch015>. f
- National Association for Professional Development Schools. (2021). *What it means to be a professional development school: The nine essentials* (2nd ed.). NAPDS. <https://napds.org/nine-essentials/>.

-
- Polly, D. (2021). Advancing equity-based mathematics teaching in the primary grades: The case of two clinical practice experiences. *International Journal of Teacher Education and Professional Development*, 4(1), 68-88.
- Polly, D., Colonnese, M. W., Bacak, J., Holshouser, K. O., & Lewis, W. (2022). Teaching mathematics to elementary school learners: Vignettes related to diversity, equity and virtual teaching. In E. K. Reeves & C. J. McIntyre (Eds.), *Multidisciplinary Perspectives on Diversity and Equity in a Virtual World* (p. 213-232). IGI Global. <https://doi.org/10.4018/978-1-7998-8028-8.ch012>
- TeachingWorks. (2020). *High-leverage practices*. TeachingWorks Resource Library. <https://library.teachingworks.org/curriculum-resources/high-leverage-practices/>.
- Zenkov, K., Badiali, B., Burns, R. W., Coler, C., Cosenza, M., Goree, K., Polly, D., Stoicovy, D., Bertrand, S., Haddad, K., Crane, N., & Lague, M. (2021). The “Revised Nine Essentials” article series Essential 1: Justice is our “Comprehensive Mission.” *PDS Partners: Bridging Research to Practice*. 16(4), 21-24.

Drew Polly (drew.polly@uncc.edu) is a Professor in the Elementary Education program at the University of North Carolina at Charlotte. His research agenda focuses on examining how to best support teachers’ and teacher-candidates’ enactment of learner-centered pedagogies in mathematics classrooms.