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## Using Improvement Science to Increase Mathematical Learning through Co-Planning and Co-Teaching

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No matter what the scenario is within the field of mathematics education, one point that all teachers should agree upon is that providing opportunities for students' learning to occur should be an ultimate goal of teaching (Bransford, Brown, & Cocking, 2004; Shulman, 1999). Therefore, teacher preparation programs are challenged to equip teacher candidates with the skills needed to cultivate learning, while being cognizant of the fact that teacher candidates are also engaged in the learning process, because they are apprentices of teaching (Collins, Brown & Newman, 1988). Thus, to model the desired practices that can promote learning, teacher preparation programs are challenged to make explicit connections between coursework and field experiences for their teacher candidates (Darling-Hammond & Bransford, 2005; Sowder, 2007).

As a means to place a focus on learning in teacher education programs, the use of co-planning and co-teaching (CPCT) strategies can be employed. Co-teaching is a pedagogical practice that encourages collaboration and communication between teacher candidates and their mentor teachers who share a common space in the organization, delivery, and assessment of instruction (Bacharch, Heck, & Dahlberg, 2010). When CPCT is employed, teacher candidates are valued as teachers in the classroom from the inception of the field experiences. There are various co-teaching strategies, including: *one teach one observe*, *one teach one assist*, *station teaching*, *parallel teaching*, *alternative teaching*, and *teaming* (Friend, Cook, Hurley-Chamberlain, & Shamberger, 2010). During the co-planning meetings, which occurs before the co-taught lessons, the teacher candidates and their mentors reflect on the nature of tasks to be used, the mathematical discourse that would be encouraged, means to make mathematical connections, and instructional strategies that can be employed. Thus, employing CPCT during field experiences can be used to promote a focus on students' learning, while providing learning opportunities for both the teacher candidates and their mentors.

Traditionally, in the field of mathematics education research, we obtain results from empirical studies of students learning after the students have progressed to another grade

level, so the students who were actually studied can never benefit from changes in instructional practice indicated by the study. Improvement science offers an alternative to an empirical research design, because it is designed to study practices rapidly, make appropriate changes immediately, and to engage individuals in an ongoing cycle of improvement (Bryk, Gomez, Grunow, and LeMahieu, 2015). For example, during a medical surgery, if complications arose during the surgery, the surgeons may make immediate changes to their planned procedures in order to minimize complications while seeking to preserve their patient's life. In education, timeliness of change may not be life threatening, but making changes to practice when current actions fall short of desired results is the cornerstone of good teaching. Thus, we hypothesize that teacher candidates and mentor teachers will place a greater focus on learning by using CPCT when improvement science research design is employed.

### **Purpose**

This study seeks to describe the extent teacher candidates and their mentors placed a focus on students' mathematics learning, when CPCT strategies were used and improvement science research design was employed. Therefore, we sought to answer the following question: *In what ways does co-planning and co-teaching strategies assist the mentor teachers and teacher candidates to focus their work on students' learning of mathematics?*

### **Related Literature**

The core responsibilities of teacher education programs are to develop teacher candidates' pedagogical content knowledge, and to promote strategies that can facilitate students learning (Feiman-Nemser, 2001). Field experiences are intended to serve these purposes, but mentor teachers often view these experiences mainly as ways for teacher candidates to develop their classroom management skills, and become acculturated with didactical norms and activities (Leatham & Peterson, 2010). To address the shortcomings of traditional field experiences, co-teaching strategies can be employed. Co-teaching can promote professional growth opportunities, enhance teachers' understanding of the curriculum, improve students with disabilities academic performance, and increase teachers' job satisfaction (Bacharch, Heck & Dahlberg, 2010; Dieker, 1998; Dieker & Murawski, 2003; Idol, 2006; Rea, McLaughlin & Walter-Thomas, 2002; Rice & Zigmond, 2000). Nevertheless, professional development training is vital when seeking to implement co-teaching (Cardullo & Forsythe, 2013). During the professional development training, mentor teachers and teacher candidates learn about various co-teaching strategies, and reflect on how roles and responsibilities may change depending on which strategy will be utilized. Additionally, teacher candidates and their mentors are provided an opportunity to interact with each other, and address challenges that might be encountered (e.g., approaches to cultivate productive consultations) (Feiman-Nemser, 2001).

Co-planning lessons, which are a primary component of co-teaching, benefit the teacher candidates and their mentor teachers (Mastropieri, Scruggs, Graetz, Norland, Gardizi, & McDuffie, 2005; Scruggs, Mastropieri, & McDuffie, 2007). Although there are some challenges that can hinder effective co-planning (e.g., insufficient time), if done well, co-planning can facilitate proactive discussions across the curriculum, and about a variety of instructional practices that can be used to facilitate students' learning (Dieker & Murawski, 2003).

### **Connections to Institutional Transformation**

Since 2012, the Network Improvement Community (NIC) that focused on CPCT during clinical experiences, which is a sub-group within the clinical experiences research action cluster (RAC), has sought to design professional development modules and instruments to measure the nature of implementation of CPCT. Additionally, the NIC have sought to use improvement science systematic process (Plan-Do-Study-Act (PDSA) cycles) to improve field experiences and promoting students' success. Overtime, a focus on student learning has gained momentum and was intensified. Currently our NIC is comprised of 11 universities from 6 different states. Members of the NIC vary in their implementation of CPCT, some of our participating research sites are in the beginning stages of institutionalizing the practice of CPCT, while others have fully implemented CPCT into their clinical experiences.

### **Method**

In this pilot study, we used the systematic process of improvement science (Plan-Do-Study Act [PDSA]) to examine how CPCT can be used during field experiences to place a focus on learning. More particularly, we implemented the CPCT Apprenticeship Model for Learning (Brosnan, Jaede, Brownstein, & Stroot, 2014) in which mentor teachers initially provide guidance, and over time teacher candidates and mentor teachers share instructional responsibilities. During the 2014-2016 academic years, we gathered quantitative and qualitative data using multiple instruments (pre-survey, just-in-time survey, and focus groups). The quantitative data were analyzed using descriptive statistics and the qualitative data were analyzed using thematic analysis. Highlights of the various PDSA phases are described below.

**Plan: Focus on Learning.** Inspired by mantra oft-repeated by Brosnan, "We will no longer teach teachers how to teach. Rather, we will teach teachers how to get students to learn," we planned to implement CPCT during field experiences and encouraged both the mentor teachers and teacher candidates to place an explicit focus on students' learning. To help our mentor teachers and teacher candidates focus on learning, we asked the instructional pair to use the following three questions as a guide during their co-planning:

- What do students need to learn?
- How will you know if they learned?
- In what tasks will students engage to ensure learning happens?

By focusing on learning, the mentor teachers and teacher candidates were also asked to establish clear mathematical goals, and to pose tasks that allowed for diverse approaches to solve the problem, multiple entrée points, and multiple solutions to the tasks provided. The mentor teachers and teacher candidates were also encouraged to exhibit the Standards for Mathematical Practice (National Governors Association, 2010) within their everyday practice.

### **Do: Co-Planning and Co-Teaching (CPCT)**

During the *do* phase of the cycle, each mentor teacher and teacher candidate pair were required to attend a professional development training and establish regular meeting times to conduct their co-planning sessions. A topic was identified for these planning meetings and each participant was asked to bring ideas about the types of tasks in which they might engage their students to reach the learning needs of the class. At the beginning of the semester, the mentor teachers were responsible for most of the instructional decisions, but they were asked to explain their thinking and instructional decisions. Over time, using a guided approach, the mentor teachers and teacher candidates started to share the responsibility of contributing their ideas about instruction. During the lesson, one person was encouraged to take the lead to establish the task, and then both teacher candidates and their mentors circulated the room looking for evidence of student learning. Continuous assessment was a part of all enacted lessons. Using CPCT provided increased opportunities for both instructional pairs to engage in formative assessment measures.

University representatives also collected data about the nature of CPCT from the teacher candidates and their mentors. Data were collected via the pre-survey (Oloff-Lewis & Biagetti, 2014), just-in-time survey (Sears & Maynor, 2014), and focus group interview (Brosnan et al., 2014). The pre-survey provided insights into respondents' perspectives about Common Core Content Standards and Standards for Mathematical Practice; strategies used to teach diverse learners perspectives about CPCT; and assessment practices that are utilized. The just-in-time survey asked respondents to rate how frequently they used CPCT during their field experiences, the extent CPCT was beneficial, the extent the communication between instructional pairs were productive, and the frequency of various instructional norms occurrences. Additionally, the mentor teachers were asked to participate in a focus group interview that documented their perspectives on the CPCT process.

### **Study**

During the *study* phase, we reviewed teacher candidates and mentor teacher responses to the various instruments, and examined the extent the focus on learning during enacted lessons went as planned. We also examined their perspective about how CPCT contributed to students learning, and documented changes in their perspectives over time.

Based on the data gathered from the pre-survey, initial concerns existed relative to how instruction will be shared and the extent interns had sufficient experience to work independently as well as exhibit effective classroom management practices. However, these perceptions changed overtime based on the relationship building activities that occurred during the professional development training and subsequent CPCT interactions. Based on the data garnered from the just-in-time survey and focus group, mentors reported that using CPCT to focus on learning influenced the teacher candidates to feel more prepared and more confident to teach. Furthermore, in the era of accountability, the mentor teaches felt more at ease since they were still given a degree of control of their class progression, and was able to help teacher candidates in facilitating scaffolding activities, and acquiring skills of the discipline.

More particularly, the mentor teachers focus group interviews revealed four major implications of using CPCT to focus on students learning: their instructional practices improved, quality of mentorship was refined, the teacher candidates were better prepared, and students' academic performance was improved. The mentor teachers claimed that they became better teachers and that they became better mentors. In addition, they found that the teacher candidates had more opportunities to learn skills of the discipline thereby resulting in better-prepared teachers. And finally, they claimed that the students were the ultimate benefactors because of the focus on learning (Brosnan et al., 2014). Thus, the focus of learning during CPCT was perceived to be beneficial in multiple ways.

### **Act: Reflect on the Process**

Based on our findings, we reflected on the results and considered means to further promote students learning. We noticed that the teacher candidates and their mentor teacher reflection focused more on data drawn from formative assessments, and made students learning a more dominant focus of their reflection. This was indeed a shift from previous norms, in which teacher centered reflections were quite evident. We also noticed that the focus on learning strengthened communication channels between the instructional pairs because they sought to collaborate to support student learning, rather than concentrating solely on summative assessment measures of the teacher candidates' actions during field experiences. The variance among teacher candidates' and mentor teachers' conceptions of learning, and teaching practices, we seek to scale up our focus on learning at other institutions through our future PDSA cycles, and will further unpack the following questions.

- What does the evidence of learning we collect tell us about what students, teacher candidates, mentor teachers, know and are able to do?
- What counts as learning from the lens of the teacher candidates and mentor teachers?
- How do teacher candidates and mentor teachers use data gathered on student learning to plan for future learning?

## Conclusion

From this study, we learned that placing a focus on learning during CPCT activities increased opportunities for the mentor teachers and teacher candidates to collaborate and promote student success. We also noticed that implementing a change concept can take time, so detailed planning is vital to ensure the ideas presented are viable and sustainable. We noticed mentor teachers' perspectives about CPCT changed overtime. They saw value in welcoming teacher candidates as teachers from the onset. Collaborative efforts, which are evident when CPCT strategies are employed, can seek to maximize learning opportunities, and can be beneficial for all parties involved.

Furthermore, the collaborative partnership among MTE-P NIC members provided an opportunity to engage in research, while systematically seeking to positively transform field experiences using CPCT. Due to the partnership, the workload was shared; local school partners became aware of the success patterns and inquired about means to include CPCT within field experiences within their district. Therefore, this pilot study has helped our NIC move closer to meeting several of our goals to substantiate CPCT as a viable strategy to improve teacher learning and student mathematics learning. In the future, we intend to continue this work and implement it in a greater number of sites.

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