REAL-TIME COACHING WITH SECONDARY PRESERVICE TEACHERS: THE PRACTICES OF MATHEMATICS TEACHER EDUCATORS

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We examined the coaching practices of three mathematics teacher educators as they engaged in real-time coaching with secondary mathematics preservice teachers. Situated in a novel early field experience and under close supervision, preservice teachers instructed undergraduate students in an introductory mathematics course; teacher educators coached in real time during these teaching episodes. Forty-four preservice teachers participated in this study, resulting in a data corpus of 44 videos of their teaching. Findings indicate that direct coaching was used more than indirect coaching, and pacing was the most prevalent focus of direct coaching.

Keywords: Teacher Education – Preservice; Teacher Educators

Early development of preservice teachers' (PSTs') knowledge and practice for teaching mathematics typically occurs during a methods course and is often accompanied by school-based field experiences. One vexing challenge for the field is a disconnect between what PSTs see and experience in K-12 classrooms and what they learn about effective teaching in on-campus methods courses (Allsopp et al., 2006; Zeichner, 2010). Yet, teacher educators argue that teaching is best learned within, and from, practice (Ball & Cohen, 1999; Zeichner, 2010).

Over the last two years, we have engaged in a project designed to mitigate this challenge - a novel early field experience (EFE) for secondary mathematics PSTs called the University Teaching Experience (UTE; Bieda et al., 2020; Cirillo et al., 2020). In this model, PSTs, while enrolled in a concurrent mathematics methods course, engage in an EFE that takes place in a college-level introductory mathematics course, taught from a problems-based perspective, and under the close supervision of MTE(s). The PSTs work with small groups of students during problem-solving sessions and teach as pairs twice during the semester in a safe, collaborative, and highly mentored context. The MTE *coaches* the teaching PSTs in real-time, providing immediate feedback to the PSTs while in the act of teaching.

Coaching in the UTE resembles coaching that occurs during methods course rehearsals, where the mathematics teacher educator (MTE) can provide feedback in real time, pause the rehearsal for discussion, and/or model certain teaching moves for the PSTs to imitate (Arbaugh et al., 2019; Baldinger, Selling, & Virmani, 2016; Lampert et al., 2013). Although the field is beginning to understand coaching practices during rehearsals (e.g., Lambert et al., 2013), we know little about coaching practices in more authentic approximations of practice (Grossman et al., 2009) like the UTE. Our real-time coaching (RTC) also resembles a model used by Stahl et al. (2018), who investigated the effects of RTC with prospective English teachers through the use of "bud-in-the-ear" technology while PSTs engaged in micro-teaching with peers (although we did not use this

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technology). Stahl and colleagues found several positive benefits of RTC, including increased confidence in PSTs' knowledge, skills, and capabilities as a teacher, accelerated development of practical skills, and an increasingly discerning and critical position toward professional practice. Hence, RTC appears to be a productive method for MTEs to help PSTs improve their teaching practices and worthy of study. Akin to Lampert et al. (2014), our study was guided by this research question: What was the structure and substance of real-time coaching (RTC) as enacted in the UTE at three sites?

Methods

Data Collection: Participants, Context, and the UTE Teaching Episodes

To address our research question, we analyzed three MTEs' RTC practices at three different university sites. At one site, the UTE took place in Fall 2018; at the other two sites, the UTE took place in Spring 2019. A total of 44 PSTs participated in the UTEs across the three sites, resulting in 44 video recordings of their UTEs. These video recordings captured the interactions between the MTEs and PSTs as they taught in pairs, with each pair teaching twice in a semester.

Data Analysis

We began analysis by identifying RTC episodes in the UTE video recordings. Round one of open-coding (Miles, Huberman, & Saldaña, 2014) RTC episodes identified the *structure* of our RTC (see Table 1). Next, focusing only on the coaching episodes where direct coaching occurred, a list of *substance* codes was generated (see Table 2). The total number of coaching episodes for this study was 258; the number of direct coaching episodes was 227.

Table 1: Structure Codes

Structure Code	Description
Direct Coaching	MTE provides feedback directly to PST. Either MTE or PST may initiate this exchange.
Indirect Coaching	MTE enters the lesson as the teacher and directly addresses mathematics students for the purpose of modeling an instructional move for the PSTs.

Table 2: Direct Coaching Substance Codes

Substance Codes;	Description
Alerting PST to Notice Students	MTE interrupts or alerts the PST to notice a student who is confused or a student with their hand raised, whom the PST otherwise would not have noticed.
Asking for Volunteers	MTE advises PST on (a) how to ask for volunteers, or (b) who to ask to share an answer to the problem.
Asking PST to Expand on Mathematics	MTE requests that PST provides more information on mathematical concepts or examples.
Assisting with Classroom Technology	MTE assists PST with understanding how to use the technology they are attempting to use for their instruction.
Attending to Mathematical Precision	MTE attends to PST's written/oral language/notation, such as terminology, labeling, and mathematical symbols. This is an error in PST's communication, rather than a mathematical error.
Correcting a Mathematical Error	MTE requests that PST corrects a mathematical error. This is a mathematical error, rather than an error in communication.
Getting Math Students' Attention	MTE requests that PST refrains from giving instruction and first gains students' attention.

Getting Students to Write Notes	MTE requests that PST encourages math students to write notes.
Helping PST Understand Mathematics	MTE helps PST better understand a mathematical concept.
Helping PST Understand Student Thinking	MTE helps PST better understand a student's comment, answer, or question.
Making a Pedagogical Suggestion	MTE makes suggestions to PST regarding next steps for monitoring, whole class discussion, or other instructional moves.
Pacing	MTE coaches about speeding up or slowing down the lesson.
Providing Positive Feedback	MTE praises a PST's action.
Raising Voice	MTE asks the PST to speak louder.
Redirecting Instructional Move	PST uses a pedagogical move and the MTE redirects the PST to use a different pedagogical move.
Rephrasing PST's Language	MTE provides a rephrased question or statement for the PST to repeat to students.
Requesting Visual Display – Logistics	MTE requests that PST creates a visual display or makes the display clearer for students (emphasis on logistics; e.g., writing bigger).
Requesting Visual Display - Mathematics	MTE asks that PST adds further information to a visual display of mathematics.
Requesting Visual Representation or Verbal Communication	MTE requests that PST provides a visual representation of spoken mathematics, or to explain verbally an idea that is written.

Findings

The MTEs engaged in about seven times more direct coaching than indirect coaching (88% vs. 12% respectively), indicating that the MTEs made a large majority of their coaching comments directly to the PSTs as opposed to stepping in to teach the mathematics students and modeling teaching practices for PSTs. Examining the substance of direct coaching more closely (see Figure 1), *pacing* was the most prevalent focus of direct coaching, occurring in 24.23% of the direct coaching episodes. MTEs provided feedback to PSTs about both speeding up the lesson and slowing down the lesson. The second most prevalent type of direct coaching was *making a pedagogical suggestion*, occurring in 23.35% of the direct coaching episodes. *Making a pedagogical suggestion* covered a wide range of coaching moves. In general, these were instances where the MTE noticed something in the way mathematics students were interacting or reacting to instruction and had a suggestion for the PST that helped the PST navigate an issue. In contrast, *assisting with classroom technology* and *getting students to write notes* occurred in less than 2% of the direct teaching episodes.

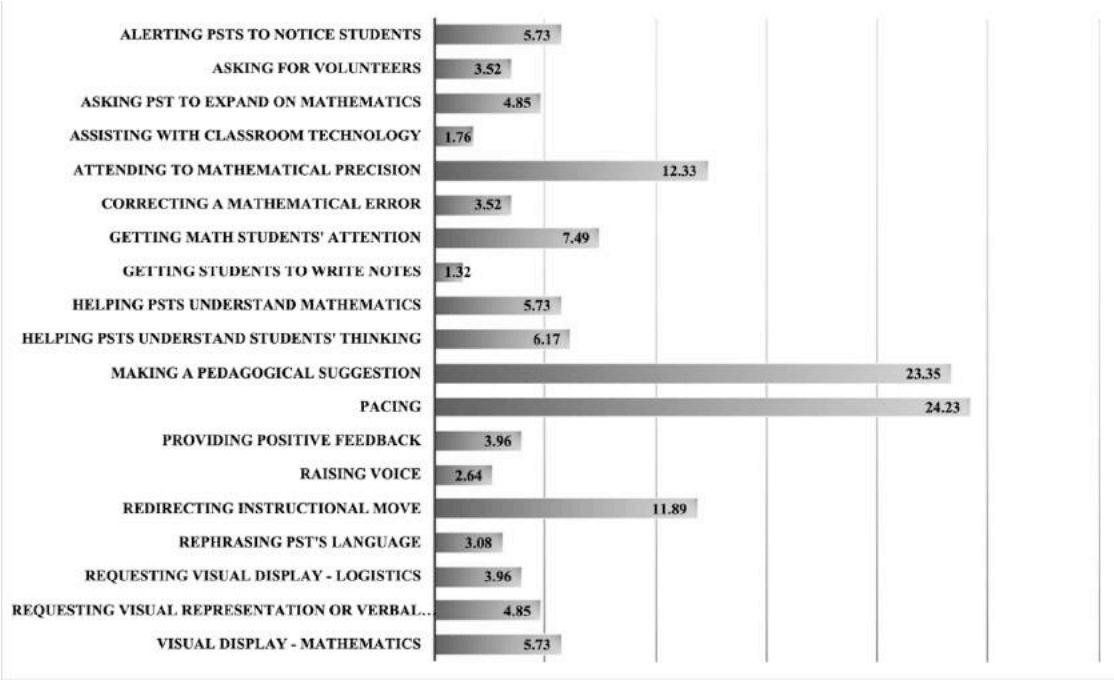

Figure 1: Percentage of Substance of Direct Coaching Episodes (Note: because some episodes were assigned multiple codes, percentages do not total 100%)

Discussion

The findings of this study extend those of Lampert et al. (2013) by providing additional ways that PSTs can be coached during instruction. Further, because PSTs in this study were teaching mathematics students (rather than their methods course peers), this study identified a new structure of coaching: *indirect coaching*. It is interesting to us that in the authentic context of PSTs teaching mathematics to students, the MTEs in this study coached about pacing more than any other focus. This stands in contrast to Lampert et al.'s finding that the MTEs in their study focused on managing time in only 4.3% of interactions between MTE and PST. Another difference between these two studies is in the area of the mathematics as a focus. In Lampert et al.'s study, the MTEs focused on *mathematics* in 11.94% of MTE/PST interactions, with mathematics being defined as "working on and understanding the mathematical content" (p. 233). In our study, while the MTEs focused on *helping PSTs understand mathematics* in 5.25% of coaching episodes, they also coached PSTs in the areas of *attending to mathematical precision* (11.38%), *visual display of mathematics* (5.28%), and *asking PST to expand on mathematics* (4.47%). Our findings show that RTC can occur while PSTs are teaching mathematics students in an authentic context, extending Stahl et al.'s (2019) work. We are left with questions about the impact of real-time coaching on PSTs' growth as mathematics teachers.

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