REHEARSALS OF AMBITIOUS TEACHING IN IMMERSE CLASSROOM SIMULATION ACTIVITIES

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Pedagogies for engaging PTs in ambitious teaching often involve rehearsals integrated into iterative cycles and this can be difficult to imbed within large teacher preparation programs. Innovative technologies utilizing immersive classroom simulation activities (ICSA) allow PTs to rehearse instructional activities with student avatars. This study found that ICSAs provide opportunities to engage aspects of ambitious teaching such eliciting and responding to student thinking and afford PTs with unique opportunities to position students as competent. The affordances and constraints are discussed

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Introduction and Purpose

As we reflect over the past forty years in mathematics education one focus of research and practice has been ambitious teaching that prioritizes the learning of all students regardless of ethnicity, race, class, or gender (Grossman, Hammerness, & McDonald, 2009). More recent research has focused on tools and structures within teacher education to successfully engage preservice teachers (PTs) in the intricacies of ambitious teaching (Thompson, Windschitl, & Braaten, 2013; Kazemi, Franke, & Lampert, 2009). Within this work pedagogies of teacher education have been examined (Lampert & Graziani, 2009; Ghousseni & Herbst, 2016) and structures such as Cycles of Enactment and Investigation (Lampert et al., 2013) have been designed to engage PTs in opportunities to deliberately practice specific teaching episodes and enact those episodes in classroom settings. As we look forward to the next forty years in mathematics education, it is vital we actualize this reconceptualization of teacher education at scale and utilize innovative technologies to support our work. The human resources needed to employ an iterative, practice-based process within teacher preparation are often unavailable at institutions with large programs. One innovative technology is virtual simulation software, such as that available from Mursion® (developed as TLE TeachLivETM), that provides immersive, interactive learning through practice-based teacher development (Dieker, et al., 2014). During the immersive classroom simulation activity (ICSA), pre-service teachers can engage with a classroom of five student avatars on a large computer screen. A simulation specialist operates the avatars and uses a simulation scenario to guide the interactions. This exploratory study extends research on cycles of enactment to examine 1) What opportunities are afforded with embedded prompts in rehearsals of ambitious teaching within an ICSA? and 2) How do PTs respond to embedded prompts within an ISCA?

Perspectives

Work by Grossman et al. (2009) defines three essential pedagogies of teacher preparation that enable novice teachers to learn through engagement in the teaching process. These pedagogies are the representation of practice, decompositions of practice, and approximation of practice, and all are needed to develop ambitious teaching. Lampert at al. (2013) has integrated these pedagogies of practice into an iterative cycle that utilizes rehearsal and classroom-teaching
episodes, titled Cycles of Enactment and Investigation (CEI). The work presented here utilizes this framework and seeks to explore the affordances and constraints of situating approximations of practice within immersive classroom simulation activities (ICSA). Within the ICSA a scenario is created to target key aspects of instruction, scripting certain student responses to provide a vast array of opportunities with the lesson. Essentially the ICSA parallels a rehearsal within the CEI, yet does not allow the same coaching.

**Methods**

**Larger Context**

This report shares preliminary findings from a study situated within a longitudinal, comparative study designed to compare the effectiveness of ICSA and peer rehearsals in the development of PTs’ ambitious teaching. PTs engage in a CEI with two number talks as the instructional activity (2 ICSA/peer rehearsals and 1 classroom enactment). The number talks are two-digit multiplication number strings. A scenario was created for the ICSA and a trained simulation specialists uses to the scenario to “act” the part of five student avatars. The PTs facilitate the number talk with the group of five student avatars (referred to as students for the remainder of the report) or with 3 peers and the teacher educator.

**Participants, Data, and Data Analysis**

Within this study three participants were randomly selected as case studies from the larger context. Participants were enrolled in an elementary mathematics methods course focused on grades 3-6 and had previously completed an elementary mathematics course focused on grades K-2. The data used in this study are three video-recorded ICSA sessions, one per participant. The sessions ranged from 8 minutes to 11 minutes. During the ICSA the participant lead a number talk with the problem “12x24.” This problem came third in a number string.

The use of GoReact©, a video analysis tool, allowed for detailed coding of each teacher and student interaction within the video-recorded ICSA. GoReact is a secure online video analysis tool that connects comments or codes directly to the segment of video for which they address. Each video was examined multiple times and each teacher and student interaction was coded using a set of a priori codes adapted from Lampert et al. (2013) that defined elements of ambitious instruction. In addition to the a priori codes unique interactions were noted in comments and these were interpreted to develop additional codes pertaining to positioning of students as competent. The goal of analyzing the videos was to identify aspects of ambitious teaching that arose within the ISCA (exemplars and missed opportunities) and illustrate unique features of the ISCA.

**Results**

Analysis of the three cases resulted in exemplars of each of the elements of ambitious teaching that were strategically coded, as well as examples of missed opportunities. In the following sections the exemplars and missed opportunities are discussed in the context of the ICSA to illustrate the affordances and constraints of the ICSA.

**Eliciting and Responding to Student Thinking**

One of the main reasons a number talk was selected as the instructional activity is the inherit requirement to elicit students’ mental strategies for solving a problem. Across the three cases the students volunteered responses, and this was a function of the classroom norms designed in the scenario. Each PT elicited strategies from three of the five students and at least one student was probed for further explanation. PTs responded to students’ decomposition strategies (i.e., \((20 \times 12) + (4 \times 12)\)) by probing for additional clarification about the factors. However, these follow-up questions elicited different student responses based on the open-ended or literal nature of the
question. For example, one PT asked “Where did this 20 come from” for which Carlos answered “the 24” while another PT asks Carlos “Why did you break into 12 x 20 and 12 x 4?” This more open-ended question elicited a more lengthy explanation of wanting to multiply by groups of 10 to make the multiplication easier to do.

In addition to differentiating responses based on question type, the ICSA was designed for one of the student to explain that they “multiplied 12 by 2 and then added a zero to get 240” when multiplying 12 x 20. The PTs did not attend to this particular student response and did not ask for further explanation to deconstruct the mathematics.

**Representation of Mathematical Ideas**

Overall, student strategies were recorded accurately on the board except for one instance. As the PTs represented the students’ strategies on the board, each PT recorded the decomposition strategies by placing the parts of the decomposed factor second in the set of equations they listed (ie., 12 x 20 = 240 and 12 x 4 = 48). This was due to the way the strategies were verbally shared by the students that were scripted in the scenario. This could be modified to allow for more complexity in how relationship of the factors is recorded.

There were two instances where the PT revoices the student’s strategy to ensure that she has recorded the students’ thinking. In one of these cases the PT was inaccurate in her representation of 12 x 25 = 300 -12 = 288. The scenario script could address this misconception by triggering a student to ask a question about the equality of a statement, such as “Does 12 x 25 = 300 -12?” This would result in the PT having to grapple with this.

**Orienting Students to One Another**

Throughout the number talks, PTs did not utilize strategies, such as turn and talk, for that would allow students to orient to one another. This may have been due to the fact that certain students, Carlos and Mina, were quick to volunteer and scenarios can be modified to include longer time before raising hands. Furthermore, PTs focused on moving to the next strategy and not using moves that would ensure students were listening to one another. There was one response from a PT that directed, “Carlos please explain to your classmates how you broke apart the 24.” In doing so, Carlos turned and spoke to his classmates instead of directly to the teacher.

**Building on Reasoning**

The scenario was designed to have two students share strategies to solve 12x24 by using the distributive property and either decomposing 12 or 24. This design element was intended to elicit questions from the PTs to address the similarities, differences, and application of the property. Interestingly, only one PT directed attention to these two strategies and asked, “How are these ways different from each other?” When Emily responds quickly that different numbers were broken down, they PT praises Emily and solicits another strategy. This missed opportunity to make the connection to the distributive property shows an area for attention.

**Students as Competent**

The students expressed frustration with the problem when it was initially posed and Will shared that he did not arrive at an answer to the problem. From these student responses arose the need to code the interactions for instances of how the PTs positioned the students as competent or not. This coding revealed that PTs send mixed messages to students about mathematics and ability. At the beginning students cry out “This is crazy, we can’t do this in our heads” and “How come these keep getting harder? I wish they used smaller numbers.” One PT responded, “You can do it. You are smart.” While she was trying to encourage students, the message she is sending them is that if you cannot do it then you are not smart. Another PT prefaces the problem with claims that it will be hard stating “This on is going to be harder…if you can’t figure it out it

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is ok because I had a hard time figuring it out and I had paper.” This response assumes students will struggle and devalues the use of mental strategies.

When Will shares that he was not able to solve the problem, all three PTs attempt to engage Will to understand his confusion; however, they prematurely abandon their efforts. One PT tries to decipher Will’s starting point when he shares, “The first thing that clicked for me was that both have twos and I thought I could do something with the two that might make it easier. But then I just got confused.” In response, this PT praises Will stating, “That’s good that you were able to start thinking and you didn’t give up when you saw the problem,” and then immediately calls on another student. Will’s interactions force PTs to grapple with how to address students’ needs and guide them to an understanding of the problem.

Lastly, Carlos and Mina are called on first in two of the cases due to volunteering. They are also called upon for further explanation in all cases. This emerging trend highlights the positioning of certain students as competent and valued while others are expected to be passive participants in the class.

Conclusion

Analysis of recorded ICSAs indicated that certain elements of ambitious teaching were evident and afforded due to the strategic development of the scenario used within the ICSA. PTs were engaged with eliciting and responding to student thinking, representing ideas, and building on reasoning, yet they were not engaged in orienting students to one another. The missed opportunities highlight the need for additional scaffolds built into the scenario and specific feedback from teacher educators to build PTs engagement in these teaching practices. Also, the ICSA provided a unique opportunity for PTs to navigate student misconceptions and frustrations with mathematics. The authentic expressions from the students are unique to this technology and not present in peer rehearsals. This affordance within the ICSA and the standardization of the scenario make this innovative tool a plausible solution to utilizing CEI at scale. Although conducting numerous peer rehearsals may not be feasible for a teacher educator, rehearsals within an ICSA will allow for strategic scenarios to be replicated without additional work. The larger research project will provide valuable insights into the comparison of ICSA and peer rehearsals and inform the ongoing reconceptualization of practice.

References


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