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FINAL REPORT: CONCEPTUALIZING ETHICS, AUTHENTICITY, AND EFFICACY OF SIMULATIONS IN TEACHER EDUCATION

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This working group was a continuation of working groups in 2019 and 2021 that initially aimed to focus on equity in simulations of practice in mathematics teacher education. We began by discussing our conceptualizations of simulations and equity. Next, we reflected on the lack of work that currently exists at the intersection of simulations and equity as well as our limited collective expertise in this space. We proposed the following areas of potential research: Access, Design, Affective Domains, Teaching Practices, Assessment, Critical Conversations. Attendees self-selected into focus groups and met to discuss their current work and how future work could focus more on equity and access. At the conclusion of our time together we developed a plan for achieving our key goal of disseminating a book that documents the landscape of the field.

Keywords: Equity, Inclusion, and Diversity, Instructional Activities and Practices, Preservice Teacher Education

Introduction

We draw our work from practice-based approaches to mathematics teacher education (Ball & Cohen, 1999). According to this approach, educator preparation programs (EPPs) should focus the work of preservice teachers (PSTs) on practicing the complexities of teaching (Kavanagh & Danielson, 2020). Grossman and colleagues' (2009) framework of pedagogies of practices conceptualizes how representations, decompositions, and approximations of practice can engage PSTs in aspects of teaching with varying levels of complexity and authenticity (Ball & Cohen, 1999; Ball & Forzani, 2009; Grossman et al., 2009; Zeichner, 2012). In our proposal, we focus on approximations of practice.

Approximations refer to the practices that are more or less proximal to those of the profession (Grossman et al., 2009). Mathematics teacher educators (MTEs) can vary the level of authenticity and complexity by focusing only on certain practices (e.g., decomposing) and providing scaffolding (Tyminski et al., 2014). MTEs can intentionally begin with less complex or authentic experiences initially and gradually increase the levels of complexity and authenticity over time (Bannister et al., 2018; Grossman et al., 2009).

Some MTEs express concerns about the limitations of approximations. Klein and Taylor (2017) argue that the simplified nature of approximations may not prepare PSTs for the social and cultural complexities of classrooms. Trent (2013) points out that approximations do not sufficiently prepare PSTs in transiting into their teaching roles. Particularly, MTEs have cautioned that PSTs may struggle to adapt approximated practices into enacted practices in school contexts (Zeichner, 2012). Few approximation studies have a strong equity framing

(Buttimer et al., 2022; Self & Stengel, 2020). In fact, the field has been criticized for foregrounding Whiteness (Daniels & Varghese, 2020), pushing aside issues of equity and justice (Philip et al., 2019), and stereotypically representing students (Baker-White, 2021; Bondurant & Reinholz, 2023).

Drawing upon the literature and our past work, we seek to explore the affordances and constraints of varying levels of complexity and authenticity in simulations (Bondurant et al., 2021; Howell et al., 2019; Howell & Mikeska, 2021). Furthermore, we aimed to expand the literature at the intersection of approximations and equity. Here, we report on an overview of our participants' critical reflections on how simulating the social and cultural components of classrooms might (a) cause biases and stereotypes about traditionally marginalized learners to surface, be exaggerated, or perpetuated as well as (b) strategies for mitigating this from occurring. Finally, we report on our dissemination plans.
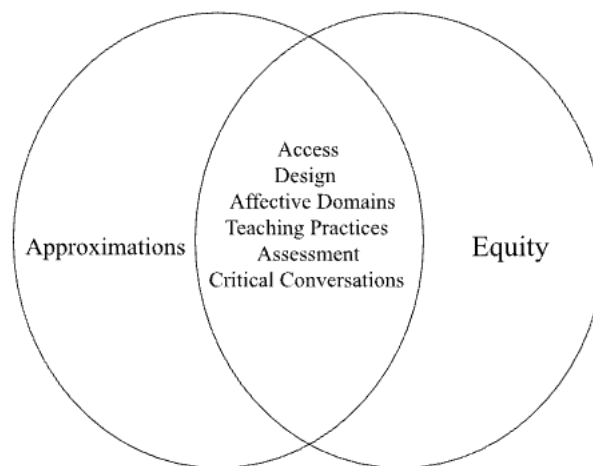

Figure 1: Research Space

Leadership Preparation for PME-NA

Leading up to the PME-NA 44 Conference the leadership team met for two main purposes. First, we met to develop a proposal for a special issue. Over the course of several weeks, we collaboratively developed a strong proposal and sixteen scholars in the field agreed to serve as reviewers for our proposed special issue. Although the special issue editors did not select our proposal, composing the proposal pushed us to conceptualize six topics at the intersection of equity and simulations (see Table 1). Secondly, we met to establish a detailed plan for our time together at PME-NA. The topics we developed for the special issue proposal laid the groundwork for our conversations at PME-NA 44. Despite our initial special issue proposal's rejection, the process of detailing how we would approach an edited collection of work in this space inspired us to keep this as a goal. We entered PME-NA eager to continue this important work.

Table 1: Topics at the Intersection of Equity and Simulations

Access	cost, program variability, differentiation of and access to experiences, disenfranchisement
Design	authenticity of representations, scenarios, students,

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	cultural contextualization and relevance
Affective Domains	biases, beliefs, identity, positionality
Teaching Practices	demonstrating high expectations for all learners, positioning all learners as experts. planning culturally relevant curricula, implementing culturally relevant curricula, leveraging early conceptions and prior knowledge, soliciting equitable participation
Assessment	equitable assessment strategies, providing asset-based feedback, blinded grading practices, writing formative and summative assessments, justifying assessment policies
Critical Conversations	meeting with stakeholders, critical race theory, social emotional learning (SEL), book banning, bullying, othering, tracking, social justice

Grouping Work Summary

Fourteen scholars shared openly and thoughtfully over the course of our three sessions. We attribute our increase in attendance to the saliency of approximation work and also to our efforts to publicize our group in advance of the conference. The conference committee disseminated a promotional graphic we created to invite attendees to join us. We also asked our colleagues who participate in the Association of Mathematics Teacher Educators (AMTE) Community Circle on simulations to participate in our PME-NA working group. We were excited to see returning members, colleagues from the AMTE Community Circle, and new participants join us. On day one, the leadership team began by sharing our research journey with both digital and non-digital simulations over the past four years. Next, we reached a consensus on our terminology and goals. We decided to use the broader terminology of *Approximations of Practice* to describe the space we are exploring. Moreover, we shared the dimensions of variability we developed in 2019 to situate our work in this diverse space (Howell et al., 2019). The majority of our time on day one was spent sharing our approximations research, with equity as our unifying lens. We had fruitful discussions surrounding how we can foreground equity and access in our approximations work by considering what mathematics is taught, whose mathematics is taught, and how mathematics is taught (Aguirre et al., 2013).

On days two and three we divided into three groups based on participants' interests in topics proposed by the leadership team (Table 1). Participants were most interested in Design, Affective Domains, and Teaching Practices. In each group, participants shared in depth descriptions of their work and how it fits within the space. We provided groups with prompts to begin outlining a 1–2-page prospectus (see Figure 2).

Please include the following:
I. Proposed authorship with affiliations

II.	What type of approximation does this prospectus address/feature (e.g., digital with live actor(s), in person rehearsal, online practice space, etc.)?
III.	How does the prospectus connect to equity?
IV.	What type of chapter does the prospectus describe (e.g., a specific research study, a call to action, a theoretical piece, a literature review, etc.)
V.	Statement of issue or topic to be explored
VI.	Key literature that guides your thinking
VII.	Brief summary of methods
VIII.	Description of impact

Figure 2: Approximations and Equity Prospectus Outline

Collaborating on the prospectus outlines provided opportunities for us to critically reflect on our work. Many participants began expressing concern about the lack of focus they currently place on issues of equity and access. As we came together at the end of the second day, we grappled with the concerns we were feeling. Our whole group discussion led us to consider a different direction for the proposed collection of work, which we continued to mold on day three. As a team we decided that an edited book, which we further articulate in the next section, would be the best outlet for our work. We reached a consensus that the edited book would include approximation work from scholars at different places along the continuum of foregrounding equity. We envisioned that this edited book would provide the field with an overview of the current landscape as well as our aspirational equity-focused vision. We discussed how authors and editors could serve as critical friends during the writing and editing process, pushing each other towards our collective goal of foregrounding equity in our approximations work.

Results from the Working Group: A Shift in Focus

We collectively decided to make a number of key shifts to our initial vision and mission. One collective decision we made was to shift to the broader term *approximations of practice* rather than the term *simulations*. As noted in our prior working group, the field lacks clarity on the distinction between the two (e.g., using simulations to refer to only digital simulations). We chose to use the broader term *approximations* to avoid the risk of potential authors, particularly new collaborators, not classifying their work in this space due to our use of the narrower term *simulations*. We also noted that while equity considerations might play out differently in different approximation formats, few of them are unique to format alone, and there are cases in which the contrast between different approaches or technologies might yield useful insights.

A second key shift was the decision to produce an edited book rather than a special issue. This decision was based on four key factors that emerged during our discussions. First, the enthusiastic responses from potential reviewers coupled with the eagerness of working group participants to contribute made it clear that an edited book would be needed to provide ample space for contributions. Secondly, we realized that working alone scholars may struggle to realize our goal of sharing work that places a dual emphasis on equity and approximations. We recognize that equity is a journey, not a destination. Therefore, scholars in this space are continuously striving for growth. We discussed how authors and editors could serve as critical friends during the writing and editing process, encouraging each other to continue and extend their work towards our collective goal of foregrounding equity in our approximations work. We

decided that an edited book would be needed to share approximation work from scholars at different places along the continuum of foregrounding equity in their work. Third, we decided that an edited book would allow us to organize both empirical and theoretical work in this space into thematic sections without the limitation of a single editorial introduction, which is often a constraint of special issues. Finally, we felt an edited book would create space to be provocative in what we ask the field to focus on moving forward.

Our resulting proposed outline is an edited book with three sections, each of which would consist of an introductory chapter followed by 3-5 short chapters. The first is a landscape section, that seeks to broadly demonstrate how approximations of practice are being used in the field. This section would include empirical pieces that showcase approaches that are different from one another. Some approaches that foreground equity would be discussed in this section. However, we would not limit this section to equity-focused uses because the current state of the field does not reflect this focus. Overall, in this section, we aim to help the reader understand the breadth of work that characterizes approximations of practice for mathematics PSTs.

The second section shifts to asking how the field is or could be foregrounding equity in approximations work. Our vision for this section, because of the limited work that focuses clearly at the intersection of approximations and equity in mathematics education, is to pair willing authors in the mathematics education approximations space with co-authors with equity-focused research experience. We believe collaborators will serve as critical friends, encourage each other to extend their research, and expand the work at the intersection of approximations and equity. We hope these unique chapters will provide examples of how to do the hard work of placing a dual emphasis on equity and approximations. Potential authors will be asked to self-identify their willingness to have their work featured in this section in their chapter proposal. The editors plan to support the co-authoring teams intensively throughout the process.

The third section will focus on what equity-focused approximations should or could be in the future. This section is less likely to feature specific projects or empirical work, although forward thinking and provocative projects might be featured here. We would also welcome short chapters exploring where scholars would recommend focusing, or innovative approaches that might address challenges in ways that have not yet been operationalized or used in the field.

Conclusion

Our leadership team left Nashville eager to take action on our plans to edit a book. We created documentation of our new framework and shared it with working group members. We have also continued conversations via email, virtual biweekly meetings, and collaborative projects. Additionally, we have met quarterly through AMTE's Simulations Community Circle. We are currently working with IGI Global: International Academic Publisher to finalize a book proposal. With our evolved framework, we are motivated to bring voices together in the space of approximations of practice and equity to inform the work of MTEs. There is a plethora of important work to do in this space, and we aim to invite others to join us in our journeys towards foregrounding equity in approximations of practice.

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APPROXIMATIONS OF PRACTICE AND EQUITY: SURVEYING THE SPACES

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After three years of meeting as a working group at PME-NA, we will be editing a book on how several models of approximations of practice support or hinder the creation of equitable mathematics learning and thinking spaces. Participants and working group leaders will serve as critical friends as we use a fishbowl format and small groups to provide spaces for refinement and challenge. Participants will leave with a network of thought partners and a draft chapter. At the end of the working group, we will identify overarching themes about affordances and limitations of several models of digital and non-digital forms of approximations of practices in order to develop preservice teachers (PSTs') equitable teaching practices.

Keywords: Equity, Inclusion, and Diversity, Instructional Activities and Practices, Preservice Teacher Education

Background

In the last two decades, mathematics teacher education programs have emphasized designing and implementing practice-based experiences (Ball & Cohen, 1999; Janssen et al., 2015; Zeichner, 2012). Approximations of practice, a type of practice-based experience, "opportunities for novices to engage in practices that are more or less proximal to the practices of a profession" (Grossman et al., 2009, p. 2058); however, there is a risk of oversimplifying the social and cultural aspects of classrooms (Grossman et al., 2009; Zeichner, 2012). Thus, mathematics teacher educators (MTEs) have begun foregrounding their approximation research on several aspects of equity, such as how students' identities might influence their thinking and learning (Shah, 2017), what counts as knowledge, and who generates it (Gutiérrez, 2018).

Equity-focused approximations have the potential to prepare PSTs to use equitable practices in their planning, instruction, and assessment when working with diverse students, including those from marginalized populations. As we mentioned earlier, there is limited research on how different digital and non-digital forms of approximations provide PSTs with opportunities to develop equitable teaching practices. Self's & Stengel's (2020) SHIFT project and Buttimer and colleagues' (2022) MIT Teaching Systems Lab projects are two examples of equity-focused digital simulations projects, but more attention is needed to fully understand the potential work that could occur in this space.

We anticipate MTEs interested in foregrounding equity in their approximations work will be eager to participate in our working group. We plan to dedicate our time together at PME-NA to writing, providing feedback, and revising chapters for an edited book. Participants will serve as "critical friends" (Schuck et al., 2008) who "[act as] sounding board, offer opportunities for reflection, [will be] co-learners, and will ask challenging questions" (Russell & Schunk, 2004, p.

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2013). We envision this working group as a space, where MTEs challenge each other to reflect on their current work and collaborate to develop approximations that foreground equity.

Focus of the Work

This working group is an extension of a group that began in 2019. During the 2022 conference our group engaged sixteen participants. Collectively, the leadership team and participants decided to produce an edited book (Wilkerson et al., 2023). We are working with IGI publishers on an edited book. We will send a call for chapter proposals out in May 2023. Chapter proposals will be due December 2023 and authors will be notified in February 2024. Our meeting times during PME-NA will provide a collaborative space for authors to shape their work. We plan to solicit chapter proposals on professional listservs, Twitter, in the Association of Mathematics Teacher Educators (AMTE) *Connections* newsletter, and AMTE Simulations Community Circle. Our PME-NA sessions will focus on these key questions that stem from the organization of the book (outlined more in depth in our 2022 Final Report):

1) What are several models of approximations of practice currently used in the field?
2) What are unique affordances and limitations of those approximations to foreground equity in teacher preparation?
3) How design elements of approximations could be altered in order to optimize PSTs' opportunities to develop equitable teaching practices?

Organization and Plan for Active Engagement

The working group sessions will be structured parallel to the edited book's three sections. The first session will highlight the breadth of work that characterizes PSTs approximations. The second and third sessions will push beyond the current approximations work to forefront equity. Specifically, we will provide space for authors to collaborate and critically analyze how equity can be foregrounded in their work. Time will be spent writing, providing feedback, and revising.

Session 1: Approximations of practice as spaces to forefront equity

During Session 1 the leadership team will provide a brief overview of current research in approximations and our group's plans to publish an edited book. We will engage participants in an activity to place their work within a conceptual map of the space of approximations. We will form Critical Friend Groups (CFGs) based on participants' interests. CFGs will meet to share their work and how they are currently attending to equity. At the conclusion of the first session, participants will be given a CFG document to focus their work during Session 2.

Session 2: Critical conversations to expand our spaces

Prior to PMENA, we will select one approximation article and during Session 2 the leadership team will use this article to model the process of engaging in critical conversations to foreground equity. We will use a modified CFG protocol (Braaten, Grandados & Bradford, 2022) to facilitate critical conversations on how the study could foreground equity. We will set norms and allow time for multiple points of view to be shared in a productive and transformative way. This activity models the process authors of chapters in the second section will use.

Session 3: Future spaces within approximations of practice

During Session 3 CFGs will engage in provocative and aspirational conversations regarding our visions for the future. Everyone from graduate students to veteran scholars will be provided space and time to share their perspectives and goals. Editors will also meet one on one with participants who would like feedback on their chapter proposals.

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