Developing a disruptive pedagogy theoretical lens for studying the practices of mathematics teacher educators

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In this paper, we explore the notion of disruptive pedagogy, and propose a disruptive pedagogy theoretical lens to study the practices of mathematics teacher educators (MTEs) in their post-field courses. While much is known about prospective teachers (PTs)' transition from university to field experience, less is known about the under-researched transition from field experience and back to university. We propose that perspectives borrowed from literature focused on disruptive pedagogy can shed light on this transition and help MTEs to better understand their role in unpacking PTs' field experiences. The lens consists of four key areas of focus (two on challenging current practices and two on promoting new practices). We close this paper by exemplifying what these 'challenges' and 'promotions' might look like in the context of MTE post-field practices.

Keywords: Mathematics teacher educator, disruptive pedagogy, theory-practice, theoretical lens.

Introduction

Improving teacher education is a constant concern. In that respect, research on the theory-practice transitions has been extensive (Allen & Wright, 2014; Britzman, 2003; Gainsburg, 2012), including transitions from university (theory) to field experience (practice), as well as transitions from the process of becoming a teacher (university) to the first few years of being a teacher in schools (Nolan, 2014). Another key transition in teacher education programs is the under-researched transition from field experience back to university, where "[l]ittle is known about the way in which teacher educators integrate prospective teachers' actual experiences when they return to university after fieldwork" (Eriksen & Bjerke, 2019, p. 9). This 'unpacking' of field-back-to-university transitions is relevant to the community of teacher educators since teacher education programs, and corresponding field experiences, are frequently critiqued for being steeped in technical-rational approaches (Nolan & Tupper, 2020). Mathematics teacher educators (MTEs) in particular struggle with the tensions implicit in these transitions, as they seek to disrupt dominant 'technique-oriented' discourses of school mathematics and becoming a teacher.

We acknowledge that the use of theory and practice to describe transitions between university teacher education courses and school-based field experiences creates a false binary and hierarchy (Zeichner, 2010). While we draw here on theory-practice language, in reality our interests are positioned within a hybrid space of research where we study the role of MTEs in disrupting and reimagining knowledge constructed in the crucial movement from university to field and back to university. Within this movement, it is the post-field context of teacher education that we focus our attention.

Drawing on Anderson and Justice (2015) and their way of seeing a pedagogy as disruptive if it "requires students to challenge or change their epistemologies and participation in their learning" (p. 400), we propose a theoretical lens of disruptive pedagogies that enables us to better understand the

roles and practices of MTEs in post-field contexts and to re-conceptualize post-field possibilities in teacher education. We suggest that such a lens can be applied to study a central question underpinning theory-practice transitions: What are MTEs' roles in unpacking prospective teachers' (PTs') field experiences?

Disruptive pedagogies

The use of the term *disruptive* first emerged in juxtaposition with the introduction of new technologies in companies, where "the degree of disruptiveness" was crucial in predicting its success or failure (Christensen, 1997, p. 169). Acknowledging that technological disruptions may provide the opportunity for new ways of thinking, learning, and teaching (despite possible internal resistance to adoption) resulted in Christensen and Raynor (2013) expanding the idea of disruption and introducing the term *disruptive innovation*, where innovations were seen as disruptive if they replaced a dominant current technology.

These lines of inquiry sparked an interest in exploring more generally the impact of new technologies in educational settings (Christensen et al., 2011; Hedberg, 2011; Stevenson & Hedberg, 2011) and also within teacher education contexts, where the possibilities that emerge from the uptake of new technologies were investigated as a *disruptive pedagogy* (DP) (Anderson & Justice, 2015). In this way, DP emerged out of innovation with respect to technologies (Christensen, 1997), not more general pedagogies. To date, however, few teacher education studies have a non-technology focus with respect to DP, and fewer still (if any) turn the lens of DP toward mathematics teacher education and MTEs in particular.

Anderson and Justice (2015) define disruption as "an analytical construct that allows for the investigation of how individual learning and changes in local practice mutually influence the other within a purposefully designed learning context" (p. 401). As with our work, these authors express interest in "disruptive innovations within teacher education contexts" (p. 401); however, they do so with an explicit focus only on pedagogies that engage prospective teachers with technology; that is, they "do not attempt to examine pedagogy independently from technology or technology independent from pedagogy" (p. 401). Thus, our exploration here contributes more generally to the theory and practice of DPs in teacher education as we, in this paper, expand upon that work in DP and propose a theoretical lens to investigate MTEs' post-field pedagogical practices. We propose that such a DP lens can be used to view post-field contexts to understand the extent to which MTE practices address practice-theory gaps and contribute to a wider goal of improving mathematics teacher education.

Introducing the Research Study

As noted previously, our research interest is in exploring the question: What are MTEs' roles in unpacking PTs' field experiences? In a recent paper (Nolan & Bjerke, 2021), we discuss and present a list of barriers/challenges encountered in theory-practice transitions (from university to field experience). Primarily based on findings from our own research on theory-practice transitions in teacher education, these barriers/challenges formed the basis for the construction of research interview questions designed to study the roles and practices of MTEs in the next transition – the practice-theory transition (from field experience back to university). The interview questions included asking MTEs to share their own professional challenges with respect to practice-theory

transitions, the pedagogical strategies and theoretical tools they draw on to challenge and/or disrupt these transitions in working with PTs in post-field courses, and what they view as their primary role(s) in the post-field context of mathematics teacher education. Hence, we focus here on the work of teacher educators, not so much the actions of PTs, within teacher education.

As MTEs, we know that PTs bring countless stories of success and failure from different mathematics classrooms to their post-field courses, many of which can serve as starting points for reflections – at least for the one who *owns* the story. However, reflection is challenging for PTs (Stiler & Philleo, 2003), and such individual-level reflections are found to have little real value in bringing about lasting change within complex school environments (Forde et al., 2006). Instead, PTs must be skilled at reflecting critically, with a depth and quality that challenges the teacher education community and allows for "disruption" (Anderson & Justice, 2015). Given the shortcomings of a reflection-focused post-field context, we saw a need to develop a lens for analysis in conjunction with collecting our data, as a way to move beyond reflecting on single field experiences, and to move toward a way of detecting those disruptive and transformative practices initiated by MTEs. Here, we offer a theoretical lens that highlights the promising concept of disruption in the context of MTE practices.

Introducing the theoretical lens

Our aim in this section is two-fold: To describe our methods in selecting and reviewing research literature on DP and to present the lens itself.

Once the need to construct a DP theoretical lens was established, we proceeded to locate research texts focusing on DP. Our aim in this engagement with the research literature was to learn about the diverse ways in which authors defined or described disruptive pedagogy. That is, our intention was to return to the roots of DP, not to conduct a comprehensive literature review. Thus, from each of the research texts located, we synthesized key ideas that spoke specifically to how the authors defined/conceptualized the pedagogy, including its aims and examples of what it might look like in practice in classrooms. Through careful study of these synthesized ideas, we noticed that, in some cases, the researchers sought primarily to *challenge* current status quo or traditional practices through DP while, in other cases, the goal was focused more on *promoting* different practices which were intended to disrupt and/or replace these current practices. In this way, it became clear how the literature suggested the existence of certain current pedagogies and practices teacher educators want to shift away from, and also pedagogies they want to promote, or 'shifts towards'. In the end, our synthesis of ideas directed us toward the construction of four key areas of focus, or themes, across the literature on DP: two focused on challenging current practices and two focused on promoting new practices. When we introduce and describe the themes below, we maintain more general teacher educator language; however, after describing each theme with a summary of its focus, we outline a key question that directs our attention toward practices specific to MTEs. The four themes and their accompanying MTE-question constitute our DP lens.

I. Challenge traditional and technical-rational approaches to teaching and learning

The body of research on DP provides us with some helpful insights on 'what currently is'. Acknowledging that something important is lost when inquiry/problem-based teaching and learning are marginalized (Anderson & Justice, 2015), we want to disrupt the conservative nature of traditional

teaching cultures (Hedberg, 2011). Instead, we want to push PTs "to challenge ideas, beliefs, and practices that they were not comfortable with, providing them with the opportunity for a re-examination of their own beliefs, values, and practices in the classroom" (Anderson & Justice, 2015, pp. 406-407). This re-examination should include challenging assessment practices associated with traditional, linear ways of "defin[ing] pedagogical content and reduc[ing] learning to the tools which measure it" (Beighton, 2017, p. 114). As well, DP challenges the reducing of "teaching and learning to the application of 'recipes' of 'good practice'" (Beighton, 2017, p. 117). We need to go beyond a focus on simple recall, recognition and reproduction of ideas and performances (Mills et al., 2009, pp. 72-73), which support a deterministic view of learning (Iftody & Sumara, 2010). In this regard, we can learn from Vratulis et al. (2011) who highlight the importance of moving away from those 'additive' pedagogies which are "integrated to support existing, often teacher directed, classroom practice" (p. 1180). Taken together, this leads us ask: To what extent do MTEs work toward a (mathematics) teacher education that challenges pedagogies based on traditional and technical-rational approaches to teaching and learning?

II. Challenge practices informed by non-critical approaches

Evidence of teacher educator practices which make knowledge problematic, and demand that PTs critically reflect on their own belief systems and learning experiences, is important due to "the culture of resistance for pedagogical change" that is embedded in schools (Vratulis et al., 2011, p. 1181). To unpack such resistance, Weis and Fine (2001) propose that teacher educators stage "act[s] designed to disrupt the asymmetric relations embedded in a capitalistic economy and racism" (p. 520), and draw attention to how schools "serve to perpetuate and indeed legitimize widespread structural inequalities" (p. 497). Sidebottom (2019) calls for teacher educators to challenge "the neoliberal, performative constraints on our abilities to realise socially-just academic organisations" (p. 233).

To legitimize and promote social justice processes, Mills (1997) proposes a disruptive pedagogy to challenge "the legitimacy of school processes which produce and reproduce oppressive relations of power" (pp. 35-36). Such a critical perspective calls for a pedagogy which moves beyond 'valuing' diversity and a culture of tolerance "to a critical understanding of difference that … recognizes micro and macro power relations, and problematizes knowledge about 'community'" (Mills et al., 2009, p. 75). In this regard, Beighton (2017) offers the idea that "teacher educators can examine how non-diversified practices at the local [micro] level constitute barriers to meaningful student participation and undermine teachers' responses to issues of equity and social justice" (p. 113). Hence, we ask: To what extent do MTEs work toward a (mathematics) teacher education that challenges current practices from perspectives informed by critical mathematics education?

III. Promote non-traditional and participatory approaches to teaching and learning

While the two first themes were concerned with what DP aims to shift away from, we now turn to two themes that are more concerned with what DP promotes, or 'shifts towards'. Generally speaking, this third theme is concerned with promoting pedagogies which introduce "new ways of thinking, learning, and teaching" (Anderson & Justice, 2015, p. 405), which frequently imply the "[n]eed for teachers to unlearn traditional teaching beliefs and practices" (Hedberg, 2011, p. 2). The theme embraces a disruptive view of learning which highlights how learning can only be provoked, not

predicted (Iftody & Sumara, 2010, p. 105). In addition to provocation, an invitation to PTs to share their insights and stories is also key in this dimension of DP (Sidebottom, 2019); that is, inviting students into teaching and learning conversations is an important step in replacing the "formulaic deficit models" of teaching with "a creative engagement of and crucially *with* learners" (Beighton, 2017, p. 120). Anderson and Justice (2015) advocate for disrupting traditional practices of teacher education courses by creating "a participatory environment that publicly challenges [PTs'] epistemologies and the community practices in the learning process through both their engagement with the content and interactions with their peers" (p. 404).

In sum, a key aim of this DP theme is to mentor/support PTs to "fully engage in transformative, radical educational acts… required to constantly reposition, redefine, and rethink their roles and to deconstruct and redesign their objects of study" (Bastos, 2009, p. 5). Moreover, and above all, this third theme seeks evidence of teacher educator pedagogies that encourage PTs to "experiment with pedagogical approaches learned in their teacher education programs… [even] if they are not evident in schools and may not be supported by sponsor teachers on practicum" (Vratulis et al, 2011, p. 1181).

In light of this theme description, we return our attention to mathematics teacher education, and ask: To what extent do MTEs work toward a (mathematics) teacher education that promotes pedagogies focused on non-traditional and participatory approaches to teaching and learning?

IV. Promote practices informed by equity and social justice aims

Here, we seek evidence of teacher educator pedagogies that promote an agenda grounded in equity and social justice aims. To promote such an agenda, teacher educators are called upon to model pedagogies that "challenge inequities and social injustice rather than… projecting a vision of an ideal school" (Mills, 1997, p. 39). This means teacher educators are called to work toward teaching practices that promote change in the existing relations of power that appear throughout the routines of life within a school Mills, 1997). It also means emphasizing the importance of providing challenging work for students from traditionally underachieving backgrounds (Mills et al., 2009) while paying "more attention to our own agency and responsibility" (Sidebottom, 2019, p. 233) in the face of systemic barriers to social justice. Given the critical and equity-focused aims of this theme, we ask: To what extent do MTEs work toward a (mathematics) teacher education that promotes practices from perspectives informed by equity and social justice aims?

The DP lens in the context of MTE post-field practices

With the four DP inspired themes established, and the way in which they raise questions that directs us to the practices of MTEs, we return to the language of mathematics teacher education and ask: What might these pedagogies—those that 'challenge' and 'promote'— look like in the context of MTE post-field practices? As it would be an impossible task to provide a comprehensive list, we aim here to suggest a few examples. At the same time, we remind the reader that this is a work in progress, and that the next step is to examine our study's data through the four themes of this DP lens with a goal of understanding the pedagogical strategies and theoretical tools MTEs report to draw on as a way to bring about disruptions in their post-field work with PTs; that is, we aim to understand the extent to which there is evidence of disruptions in the post-field approaches of MTEs that set out to effect lasting changes in PTs' practices.

Drawing on the points raised within our theme summaries, a disruptive pedagogy in mathematics teacher education would involve, for example, MTEs *challenging* different instrumentalist technique-oriented approaches, for instance what Skovsmose (2001) refers to as the "exercise paradigm". DP might also be characterized by MTEs providing opportunities for PTs to challenge their belief systems and learning experiences that have an impact on their ability to consider alternative discourses for what it means to know and learn mathematics. This would necessarily include challenging systems and structures of mathematics education that continue to colonize the learner toward deficit views with respect to who can succeed at mathematics, including misrecognizing the power of mathematics and its uses in schools and in society more generally (Andersson & Nolan, 2021).

In the same manner, a disruptive pedagogy in mathematics teacher education would involve MTEs *promoting*, for example, more experimental task- and inquiry-based mathematics teaching and learning, thus "emphasizing that planning can be about inquiry and joint discovery rather than prediction and transmission" (Beighton, 2017, p. 119). Additionally, in keeping with an equity and social justice focused agenda, MTEs would move "critical mathematics education forward… with the goal of educating critically aware students who have power to question the mathematics that influences and formats their lives" (p. 45). Admittedly, it is no easy task for MTEs to practice disruptive pedagogies; however, Beighton (2017) reminds us, as "teacher educators [we] need to understand that learning, with all its difficulties and complexities, is not a problem to be fixed or a weakness to be confessed, but an ongoing process of engagement with what is becoming" (p. 120).

Implications for the existing research in the area – and for MTEs

Situating their work in the context of PTs working with technological innovations, Anderson and Justice (2015, p. 408) found that the practices of PTs in response to pedagogical disruptions fell into three distinct categories: transformative practices (where PTs took up the disruptive practices), performance of untransformed practices (where PTs participated to 'get it done'), and practices that were resistant to the disruption (where PTs pushed back) (p. 408). In this way, their findings "provide a starting point for examining the implications of disruptive pedagogical practices within pre-service teacher education programs" (p. 416). Our lens construction is a recent development initiated to engage with MTEs', rather than PTs', perspectives on DPs. It remains to be seen whether MTE practices brought forth by our disruptive theoretical lens fall into categories similar to these, or perhaps very different ones.

Our next step of data analysis will provide insights into how we may improve upon and enhance this DP theoretical lens by grounding its application in research data. In addition, presenting our lens for discussion in a community of MTEs (as in this CERME-12 TWG 27 focused on the professional practices, preparation and support of MTEs) will provide opportunities for us to further reflect on our conceptualization of this DP lens, as well as provide a desirable context for sharing this innovative theoretical lens for other MTEs to consider in their own research and practice.

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