ATTUNING TO THE QUANTUM LEAP:
NEW MATERIALISM AND FIELD EXPERIENCE IN TEACHER EDUCATION

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Abstract

While practicum experience is considered foundational to most teacher education programs, its methods of analyses often perpetuate humanist behaviorism. This is problematic in a world increasingly understood as dynamic and agential outside of categories of human determination, including those of subjectivity. Specifically, this dissertation addresses methods, in practica experience, as apparatuses which include practical exercises for reassembling subjectivities of participants in ways that extend awareness of a broader social regime. I ask what more the practicum might offer after the insight that observation and experience are inseparable from social and theoretical assumptions and where the field experience’s intra-activity changes and exceeds and precedes supposed determinants. In this reconsideration of the field experience, I draw extensively on the work of Karen Barad and new materialist theory to advocate for diffractive methodologies that are broader than humanist rationality currently perpetuated in methods of reflection and reflexivity and to ask how matter is thought and constituted through entanglements of human and non-human bodies, affects, objects and cultural practices. In my research, I worked with 8 teacher education students, 6 cooperating teachers and 2 coaches. Each had high performance experience which I hoped would indicate interest in what one might become in the midst of the materiality of practice. My methods, *Interview to the Double* and *Currere*, are ones that I argue are useful in diffractive, rather than reflective, ways. The participants and I each grappled with habitual reflective tendencies in relation to analyzing the research data. According to new materialist thinking, each of our contributions were significant however to what emerges, in that they met other contributing measures at least part way in generating degrees of felt potential for further movement and they revealed the significance of feeling flexible alterabilities of an apparatus.
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Putting thanks into words is one of the most difficult things to do. Through the words allotted within this space, I wish to express my gratitude for the support and care and interactions that have been provided by others throughout this process. I would like to thank my supervisor, Dr. Jennifer Tupper for her support throughout the years and for her kindness in not ascribing rigid boundaries to my study and learning, as well as how her thoughtful feedback worked to strengthen this dissertation. Thank you Jennifer for experimenting with me. To my dissertation committee members, Dr. Twyla Salm, Dr. Ken Montgomery and Dr. Anna Mudde, I thank you for the support, care, encouragement and conversation each of you offered as I attempted to write something that might be worth reading. This day would not have happened without each of you. I would like to thank each of my research participants for joining me in this study. Your steadfast openness, enthusiasm and vulnerability made this study something worth doing. Each of you offered me ways to move into next moments with hope. I have such gratitude too, for the Regina Catholic School Division’s hospitality and support which allowed me to undertake this project. I am indebted to the University of Regina’s Faculty of Graduate Studies and Research office for the substantial scholarship funds they provided, funds which made engaging and finishing this work easier. To Valerie Triggs, who provided so much to allow this work to be completed, love and gratitude, always.
Dedication

The term material comes from the Latin term mater (mother). This is because both matter and mother provide sustenance. This is a sustenance that does not fit into preconceived plans but is rather, a relational sustenance for difference. New materialism provides a way of considering the usefulness of the excess that cannot be contained in discourses of teaching or parenting. Amidst theories of new materialism, I have come to realize the methodological ubiquity of how knowledge and thoughts, personal and social histories are channeled and communicated into streams of rationality, while from quantum physics, I’ve learned that the tighter our assessments of self and other, the less potential can be felt for ever really knowing them. I have begun to look for pedagogic and mothering possibilities that are made available when the authority of meaning is called into question and to feel potential to move on in the midst of unsanctioned strategies usually erased from regulating rules of conduct.

With this theoretical framework, I can write that this research work is dedicated to my deceased mother who continues to exert the influence of not only the actualities of her personal and social histories, ideologies, personal desires and justifications, but also the unused potential she precipitated in surprisingly generative forms of my everyday experience. I’d like her to know this.

Most importantly, I dedicate this work to my daughter, Mackenzie, who is drawn to another sense of materiality, the ocean, an environment in which the bodies of marine life are evidence of the worlds they have evolved to live in, where the sensations of living creatures are not diluted by what they think they already know. The opportunity to mother and love Mackenzie has returned me to the dignity and courage of the physicality of care
and its unknowable bounds. It is this relationship in my life that provides ways of bringing a situatedness of love and self-division into serious and invigorating discussions of what it means to give and accept sustenance in a material world.
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CHAPTER ONE: Introduction

This dissertation contributes to new practices and alternative descriptive tools in pre-service teacher field experience. I propose a more ethical project by which the field experience employs methods that preserve the elements of heterogeneity such that all participants are engaged in practices that help to actualize this vision. The preservice teacher field experience continues to be foundational to most teacher education programs. Since the early 20th century however, teacher education, including the field experience, has been significantly influenced by behaviourist orientations and traditional empiricist understandings. Behaviourism posits that one’s disposition and role in life may entirely be understood as a consequence of one’s previous experience; as such, one’s behaviour can always and entirely, be explained in relation to previous events. While our bodies are always marked by previous situations and our bodies are always there, along with other things, whatever else we have learned or thought or done, behaviourism misses the potential that arises with each interaction within experience, each minutiae of events and instead, explains behaviour away using rational standards of cause and effect. There is a behaviourist belief in learning as a predeterminable stimulus-response effect. Traditional empiricist understandings also contribute to current field experience practice in terms of the valuing of sense-data. Rather than denying the importance of empiricism however, this research seeks to consider it with exceptional seriousness. Although no longer classifiable according to individual sense data, the body’s visceral perception/sensation can attune to feelings of capacity to vary in all of its many and varied entanglements. The constitution of field experience, however, generally draws on traditional empiricism to acknowledge the role of context and experience in learning.
Ken Zeichner (1990) argues that the Flowers report of 1948 (in Clarke, Triggs & Nielsen, 2014) which claimed that the practicum experience should never be considered apart from the entire teacher education program, set the focus for schools in the modern era. From the early awareness of the significance of practice for learning albeit in its modernist beginnings, field experience continues to be very much grounded in ideas of cooperating teacher as expert and the pre-service teacher as guest recipient of largely, technical feedback (Clarke, Triggs & Nielsen, 2014; Kagan, 1988; Clarke, 2006; Miller, Hudson, & Lignugaris/Kraft, 1992; Spear, Lock, & McCullock, 1997), along with human-controlled transfer of knowledge from cooperating teacher to candidate.

My own teacher education practicum experience was one that addressed me both as having had no previous experience of significance and as destined to learn in an implicit direct cause and effect logic, a logic that proved ineffective for making sense of the loss of self that occurred through the undervaluation of my previous life experience. Although difference was valued in my overall teacher education program, this difference was essentially comparative (Gendlin, 1997). While educational practices are generally not disturbed by the fact that its measuring scales are constructed in inseparable ways from all sorts of social and theoretical assumptions, any measurement has interactional effects. My own practicum arrangement of cooperating teacher and intern continues to offer me an opportunity to think through needs for comparison and identity reference, but certainly not in ways that are given in advance.

Comparing and identifying in advance reduces the potential in interactions by missing the reality of the ways comparison and identity depend on particular actualities. This
form of subjectivity cannot address the necessary relationality between all methods of contact.

More useful for participants in the field experience than tools of identity reference that look for final results, or understand subjectivity by its constructedness in relation to productive forces of dominant teacher education discourse of reflection and reform, might be the development of capacities for ways of coping responsively, artfully and thoughtfully. Furthermore, the field might be understood as neither fixed nor idealized, nor as a passive participant, if educational practice is to “preserve variety in a world with powerful pressures toward conformity” (Bennett, 2002, p. xxix). Teacher education’s current trend towards reflective practices designed to jeopardize closure in one’s practice still connect too tightly between already determined practices and next choices and do not sufficiently convey the continuing vitality and potential inherent in all things.

This dissertation addresses what more the teacher education field experience might offer after considering the insight that observation and experience are inseparable from all sorts of social and theoretical assumptions, where the internship’s interactivity changes and exceeds and precedes the supposed determinants. It also addresses the necessity of a counterforce to the powerful lures of convention, tradition and normality. It challenges the disenchantment that comes with a focus on the inevitabilities of the forces of scientific and instrumental rationality, individualism and bureaucratic institutions. In this challenge, field experience “cannot be reduced to its own history because it continually wrestles itself from this history in order to create new concepts that fall back into history but are not forever tied to it” (Haraway, 1994, p. 96). This dissertation aims to locate and translate the teacher education field
experience within its methods rather than provide a sustained focus on the ‘what’ or the ‘why’ of field experience.

In this research, I draw my metaphors from both quantum science and the craft of coaching, particularly in relation to tennis. From the first source, I reinvigorate my early interests in science and ideas currently being generated in new materialist thinking. From the latter, I draw the sensibility that methods are more than self-discovery and that a coach and her tools and materials of words, observations, imaginations, tennis racquet, memories, dreams, and tennis court often coincide. It is hard to distinguish between raw materials and the emerging art of movement. Rather than explaining, the coach and player enact each analysis and each analysis conceals as it reveals. Both sources of interest engage in a similar struggle where the world is doubled. Both court an awareness that identities congeal in response to some “contingent set of aspirations, priorities, histories and geographies and yet, these human artifacts do not yield readily or entirely to human control or understanding: bodies are made of materials with a life of their own” (Bennett, 2002, p. xxvii).

Specifically, my research aims to develop a contribution towards the means, in particular, methods, as apparatuses for reassembling the making of pre-service teachers and their cooperating teachers’ subjectivities in ways that extend across social regimes and are not limited to only certain domains. This research examines what might change with a shift in theoretical understanding that invites practical exercises in processes of ethical self constitution and in particular, in the ways in which one comes to feel their emergent teacher subjectivity through capacities of attentive choice-making. To provide opportunity for this reconsideration of the field experience, I draw extensively on the work of Karen Barad and new materialist research that
considers a more expanded empiricism, one that considers a world of experience that does not look to certain criteria to determine which interactions are more true, but rather seeks a responsive kind of knowledge practice, one that is sensitive to the generative opportunities arising in the midst of the multiple ways in which things are entangled. The word entanglement seems to carry a sense of the depth to which things overlap and interweave, including the potential that is not necessarily seen but can perhaps be felt.

The concept of entanglement, from physics, assumes this interconnection to much more complex and possibly more useful understandings. Entanglement involves systems that relate to other systems to the extent, as Eugene Gendlin describes (1997), that they cannot fully be described without considering what is more than them, cannot be factored out into the products of their elements or particles, cannot be expressed as direct products of states that make up the system and cannot be expressed as a sum or a superposition of basic observable states. To begin to understand the concept of entanglement, physicist and feminist, Barad (2007) writes:

Entities are not separately determinate individuals but rather inseparable parts of a single phenomenon. In particular, there are not pre-existing individually determinate entities with determinate spatial positions communicating instantaneously at some remove from one another outside of a phenomenon that determinately resolves the boundaries and properties of the entangled components in a way that gives meaning to the notion of individual. Indeed, "individual" is ontologically and semantically indeterminate in the absence of an apparatus that resolves the inherent indeterminacy in a way that makes this notion intelligible (p. 316).
Barad (2003) further suggests, “Entanglement does not presume independent or even interdependent entities with distinct and inherent characteristics” (p. 816). Although it is generally considered that our observations of difference are not supposed to change anything, in Barad’s thinking they actively reconfigure reality, and what is being described is not reality itself but rather our intra-activity as part of reality, including the potential that observation practices ignite. This idea that observations of difference reconfigure reality intra-actively, is drawn directly from Niels Bohr’s work in quantum events (Barad, 2007). While I elaborate the idea more completely in Chapter Two, I offer the following to clarify my points here. What quantum physicists call ‘observer effect’, grew from the work of Bohr, and others, who found that even the passive observation of phenomenon actually changes the phenomenon of observation. Observation in this sense is different from what traditional empiricism considered seeing to be. Observation in this understanding maintains that looking is actually engaging with something materially, either by apparatus, instrument, embodied relational presence, etc. and it is the engagement that produces a change. What physicists discovered when they shot a particle through a two-slit apparatus was the appearance of two identical band patterns on a wall/screen. When they shot a wave through the same apparatus they noticed the production of interference patterns on the wall. Uncertain about why this was happening physicists began working with the quanta (electrons). They noted that the result of shooting an electron through a two-slit apparatus, was a series of wave-like interference patterns. From this they determined that the electron was interfering with itself – that is, it seemed to be going through both slits and interfering with itself on the other side prior to hitting the wall.
Thinking that this was impossible, quantum physicists conducted a ‘which-slit’
experiment to see if they could determine which slit the electron passed through.
Physicists found that with the presence of a measurement tool or observation, the
electron did not produce an interference pattern and instead produced a two band
pattern on the wall. What they concluded was that the observation, via the apparatus
[measurement], collapsed the wave function of the electron (Barad, 2007), thereby
affecting what it might become. The passage of light became the expected observation,
as expressed in the apparatus. As a result of what slips away beyond each
measurement or observation, the more data that we have on some aspect of reality, the
less we actually know about it and the more is generated that we can never truly know.
Insensitivity to the potential in any concept not only changes the concept, but also the
one who conceptualizes. It was out of these ideas that Bohr began to work with
theories of entanglement and that the observation was key to understanding particular
experimental outcomes. Ultimately, the experiments showing wave-particle duality
allow us to say that the world is never fully captured by any human determinations or
measures. Instead, the conditions under which we can know about the world involve
decisions that respond to the world’s particular provocations by striving to augment
the ongoing flourishing of entire assemblages, rather than perpetuating already
determined categories.

Jane Bennett (2010) explains the costs of denying or forgetting about our
profound entanglement in the world and the disenchantment arising from modernist
traditions where the “process of rationalization in modernity threatens our attachment
to the world” (p. 160). Rational thinking emphasizes personal sense-making and seeks
to impose a logical order on all areas of knowledge (Davis, 2004). Bennett further
suggests that the process of rationalization is taken up in critical theory in ways that
encourage emotional detachment; the result of which is a tenuous relationship with ethicality. Ethicality for Bennett involves maintaining our responsiveness to a world that is full of “lively and incalculable potential” (2002, p. xxiv). While she acknowledges that there is plenty of cruelty and violence in the world, ethicality involves practicing our sensibilities of being open to new and disruptive engagements and then narrating our experience in ways that highlight our capacity to surprise and challenge the dominant disenchantment of modern life. Bennett’s thinking resonates with Karen Barad who argues that critical theory can be a “practice about subtraction, distancing and othering” (Barad in Dolphijn & van der Tuin, 2012). The tenuous relationship with ethics therefore, arises when one attempts to deny their entanglement in the world. Barad (2007) is helpful here as she reminds that:

To be entangled is not simply to be intertwined with another, as in the joining of separate entities, but to lack an independent, self-contained existence. Existence is not an individual affair, rather, individuals emerge through and as part of their entangled intra-relating (p. ix)

Considering entanglement in this way—beyond Cartesian binaries—we can begin to see our place in the world differently and thus, we become differently accountable. “Responsibility is not a calculation to be performed. It is a relation always already integral to the world’s ongoing intra-active becoming and not-becoming” (Barad, 2010, p. 265). In other words, what Barad proposes is an onto-epistemology tied to ethics where ethics is regarded as a quantum entanglement that demonstrates that because we are part of the world, we can no longer see ourselves as innocent bystanders, observing the world from a freestanding perspective (Haraway, 1988). Whereby, Barad’s model
of an “ethics of entanglement” is fundamentally about discovering and following up on these ethical demands (Barad, 2011, p. 150).

When it is accepted uncritically that difference and referent identity are abstract enough and critical enough of the world’s reality (which is not exhausted by the events into which it enters), there may be a loss of the sense of potential that remains within reality for its ongoing continual transformative modulation. Bennett (2010) argues for the need of a (re)enchantment with the world that emphasizes our attachment to it and provides motives for ethical engagement. She suggests that enchantment energizes and enlivens us by “presenting a world that is vibrant, quirky and overflowing with an abundance of energy from which we might draw” (p. 162). She argues that without enchantment with the world, “feelings of disenchantment creep in and we see the world as lifeless, dull and essentially unfulfilling” (p. 162). The effects of disenchantment are explained by Bennett (2002) who considers its loss as subsequent with the loss of ethical generosity in social relations. Instead, she argues for methods that wrestle with a world that is construed by minute observations of the field through one’s practice as well as by belonging to a universe that “articulates through them and extends beyond them” (p. xxvii).

This research is interested in what might encourage people currently participating in the teacher education practicum experience, as well as future cooperating teacher/intern couplings, to feel more of the complexity and the potential of materiality; how they might be reminded of the ways they are entangled with the world and to think of the world as a field that is not something ‘out there’ but rather, a set of intra-acting forces at work at the limits of all bodies or entities. Barad argues that attending to a broader empiricism involves re-situating things in relation to intra-
activity already underway. She uses the concept of intra-activity to provide an understanding of how bodies and things mutually inter-connect in repetitive intra-actions and thereby influence learning and the production of knowledge (2007, p. 149). As well, intra-activity brings attention to the agency of the environment, things, materials and places in the ongoing interrelations and mutual processes of transformation (or events) emerging in-between human organisms and matter and in-between different matter outside of human intervention (Barad, 2007, p. 152). In this sense, my use of the term agency varies from traditionally humanist assumptions of a self-determining rational subject and instead considers agency as having a distributed force; that is, agency is not entirely attributable to singular individuals but is extended to include the agentic capacity that all matter holds. This understanding of agency in a new materialist context frames agency as that which emerges from combined energy of what scholars like Bennett (2010) call ‘vibrant matter’. Humanism constructs the subject, or individual as “a conscious, stable, unified, rational, coherent, knowing, autonomous and ahistoric individual who is endowed with a will, a freedom, an intentionality which is then subsequently ‘expressed’ in language, in action, in the public domain” (Butler, 1995, p. 136). The humanist self has an inherent agency since it is able to produce knowledge and the power to effect change (St. Pierre, 2000).

Rather than theorizing that the subject is one constituted or constructed through its interaction with the world, I follow Barad’s interpretation of the subject that emerges from the world and does not precede its interactions but rather arises in the midst. The subject is not contained in categories and organizational practices even as it is generated by them; its immersion in minute details issue instead a distinctive sense of a surplus that escapes human classification. The subject that I am addressing is one that has the
potential to become aware of living doubly, in striving to “know the world without attempting to capture it, to describe detail in a way that displays how the world always fades into an indefiniteness that exceeds our best capacity for inventory” (Bennett, 2002, p. 30). The subject is doubled because it both knows and does not know itself. In my work I wonder what this repositioning of subjects as more than creatures of theories, will add to a practicum experience in which people might find themselves enchanted by the undeniably interesting potential for indeterminacy that teaching offers and will begin to question how education contributes to the subject in its continual response to the reality of its profound entanglement.

Barad’s engagement with new materialist theory has the potential to offer qualities and theoretical encouragement I need to engage and sustain this work. At the most basic level of understanding, it opens up space for remembering that:

Nature is agentic, it acts, and those actions have consequences for both the human and the non-human world. We need ways of understanding the agency, significance and ongoing transformative power of the world – ways that account for myriad “intra-actions” (Barad’s terms) between phenomena that are material, discursive, human, more than human, corporeal, and technological (Alaimo and Heckman, 2008, p. 5).

Rosi Braidotti (2013) describes new materialism as, “dissolve[ing] boundaries between the natural and the cultural, mind and matter” (p. 3) and reminds researchers that we cannot ignore “the power of matter and the ways it materializes in our ordinary experiences, or fails to acknowledge the primacy of matter in our theories” (Coole and Frost, 2010, p. 1). The invitation of new materialism is to think about
research in a way that moves beyond conceptualizing that privileges language, to a
consideration of the nonhuman. Barad (2007) claims:

There is an important sense in which practices of knowing cannot fully be claimed
as human practice, not simply because we use nonhuman elements in our practices
but because knowing is a matter of part of the world making itself intelligible to
another part (p.185).

One of the ways that new materialist philosophy moves beyond the notion
that language situates what the subject can do is through the various approaches that
are critical of transcendental and humanist philosophies that are evident throughout
modernity and that impose the supremacy of human control in the construction of the
self/subject and subjectivity (Sargento, 2013, p. 116). Subjectivity in these
approaches is considered as being the elementary quality of movement.

Alternatively, Brian Massumi (2002) describes this movement as one in which the
subject must depart from itself; the subject/object symmetry of reflection is broken.
A new position of mutual entanglement is engendered and the gap left by the
departed subject is not filled by a new subject but by a process that encompasses this
disjuncture. A theory of agential realism, explained further in the next chapter, is
helpful to understanding the idea of subjectivity in these more complex terms. Barad
offers a theory of subjectivity in which the subject cannot be understood apart from
material-discursive phenomena because each intervene in and extend subjectivity.

Therefore, not only is the subject constituted and reconstituted out of
historically and culturally specific iterative intra-actions of material-discursive
apparatuses of bodily production” (Barad, 2007, p. 217), it includes the apparatuses or
phenomena out of which it is constituted. In the diffracted subject that emerges, the
measure with which it underwent its changes is included. In other words, the subject is made not only of a ‘what’ and a ‘why’ but more specifically of its means, or its methods of movement. Furthermore, no matter is passive and therefore subjectivity in new materialism does not just offer “a unified theory of cultural and natural forces but inquires into the very practices through which they are differentiated” (Barad, 2007, p. 66).

Specifically, new materialism does not restrict powers of productivity to the domain of the social, where they emerge as an end product, but asks how matter makes itself matter, seeking an account of the agential contributions of all material forces both social and natural. Subjectivity from this view troubles the very notion of dichotomy which takes the pre-existence of a simple split between subject and object for granted and suggesting that movement occurs only between one fixed position and another. This ignores the potential for anything more than what is already known. Maintaining dichotomies is a way of maintaining human constructed divides that maintain dominant discourse and societal norms. The practicum student, for example, is not noted as praiseworthy if she does not revere the field’s norms.

Bennett (2002) describes how individual fears about the efficacy of one’s actions can be soothed by the “great body of tradition” and how disruptive thoughts are clamped down by the “cumulative weight of convention” (p. 3). Teacher education operates largely through these binaries in quickly and definitively answering the question: What ought I to do? Or, what should I have done? Having a ready answer that moves one from one already understood position to another relieves anxiety and provides safety against re-formations of self. Furthermore, working
within binaries allows the subject to separate itself out from whatever it chooses to observe or measure at a distance. Barad furthers this understanding as she writes:

[The subject is] always already threaded through with anticipation of where it is going but will never simply reach and of a past that has yet to come. It is not merely that the future and the past are not ‘there’ and never sit still, but that the present is not simply here-now (Barad, 2010, p. 244).

This is a helpful and innovative framework for considering subjectivity of becoming a teacher in a field experience where agency cannot be owned and the relationship between events and their measures are intra-actively produced.

1.1 Practicum experience in teacher education programs

Research suggests that student teachers believe the practicum to be the most important element of their teacher preparation programs (Glickman and Bey, 1990). Additionally, in an extensive review of the field experience undertaken by A. Clarke, V. Triggs, and W. Nielsen (2014) they contemnorize the centrality of the field experience as they write, “student teachers universally regard the practicum as the most important component of their Bachelor of Education degree” (p. 163). Further, in a recent review of what is considered as program features that mattered to pre-service teachers, Linda Darling-Hammond (2014) suggests that the field experience be extended to, “at least 30 weeks of supervised practicum and student teaching opportunities in each program” (p. 548). Further, cooperating teachers themselves view their role in teacher education as the most important part of the teacher education process (American Association of Colleges for Teacher Education, 1990; Murray & Male, 2005; Cruickshank & Armaline, 1986) in teacher education.
Accordingly, Weiss and Weiss (2001) argue that it is generally accepted by students, teachers, and faculty members that “cooperating teachers are the most powerful influence on the quality of the student learning experience and often shape what students learn by the way they mentor” (p. 134). Having recognized the centrality of the cooperating teacher, universities often provide professional development programs for school advisors as well as preparatory classes for teacher interns in an attempt to bridge gaps between these two places of learning, between student teacher and cooperating teacher (Clarke, Triggs & Nielsen, 2014). These programs vary from institution to institution and may include single workshops or once a week meetings, to come to terms with university program expectations for student teacher growth and advancement.

Despite the efforts of universities, Tabachnick (1981) informs us that teacher education programs are often perceived as “washed out in the practicum” suggesting that the liberating tendencies that some university settings encourage are silenced when teacher education students move into the field experiences where they bump up against evaluative powers that demand a return to traditional (and some might say, technical rational) well-practiced ways of knowing and being (Zeichner, 1990). Meg Macquire (2000) cites this as a tension between teacher education’s obligation to a professional proximity to the field experience and the obligation to adapt to the expectations of the university as difficult to resolve because of a divergence of expectations and interests in the worlds of university and the field. Echoing this, Elana Joram (2007) conducted a study with pre-service teachers with findings that suggest within teacher education programs the values and interests there are distinct from the values and interest of classroom teaching. In Joram’s study she found that pre-service teachers indicated
that they did not value university classroom instruction as much as their field experience.

Joram’s participants indicated that a primary focus was to acquire specific skills of teaching. In their view, the university classes, for example, designed to enhance critical thinking skills in current educational issues would likely be considered irrelevant in that they were not dealing with ‘how to skills’. This does not take the practicum experience too far from the original normal schools of teacher education in which the norms of the profession were aligned with metaphysical assumptions that there is a set of normative standards that can shape and organize all learners. In these cases, practice that is considered to be completely captured by theory promotes social conformity and relational mindlessness. Furthermore, drawing on individual experience to mentor preservice teachers does not offer a critical enough approach as it tends to respond to and rely on traditional empirical observation. Both theory and empirical observation are apparatuses that, if driven by causal explanations, may be oblivious to the ways that they actually add to reality rather than providing the elimination of aspects of reality people may not want to perpetuate. Things change continually and if the linkages in explanation between theory and practice are not continually retested we might be attempting to prepare teacher education students for accepted matters of fact which have actually moved on to a very different place. A more critical engagement of our critiquing apparatuses involves noticing that the apparatuses are not neutral. This will be addressed more fully in Chapter Four.

1.2 Purpose

The aim of this educational research is to consider the reconceptualization of the practicum or field experience in initial teacher education. I approach the field
experience as involving the forces that brings something into being rather than just a location in which pre-service teachers are apprenticed into a community of practice. This approach is an attempt to be more specific to situations rather than to the more generic concept of context. I will work to develop an understanding of how pre-service teacher intern subjectivity changes in a theoretic and methodologic move from discursive and performative thinking and understanding as suggested by Barad (1998, 2003, 2007), to an agential realist and diffractive thinking, and relational materialist rendering inspired by her theories (2007; 2008). I will explain the significance of this shift/move in more detail in Chapter Two. In this chapter I develop fully the theoretical framework guiding this research. The hope is that the field experience, as an entangled force that brings something into being, will render a subject that senses the qualities of its moving body rather than one that is locked into position as student teacher or cooperating teacher. In addition, I include two high performance tennis coaches in the research. My decision to include these coaches is based on my own high performance tennis playing, and coaching and because the high performance coaching is also a field of practice in which expanding body understanding and feeling for increasing options for interaction or more specifically, intra-action, is considered valuable.

1.3 Materiality and the Subject

Within Barad’s (2007, 2003) notion of agential realism, subjectivity is not to be understood to be characteristic of individual entities. Rather, it is a process through which the causal intra-action of different parts of the world produce intelligible phenomena (Hames-García, 2008, p. 325). In an agential realist account, matter does not refer to a fixed substance; rather, matter is substance in its intra-active becoming—not a thing, but a doing, a congealing of temporary agency. Matter is a stabilizing and
destabilizing process of iterative intra-activity (Barad, 2003, p. 822). This notion of matter as something always in becoming can be understood in light of Barad’s elaboration on quantum leaps; never from a certain there-then to a certain here-now, not following a linear route, and without predictive outcomes (Barad, 2007).

As a way to streamline Barad’s use of Bohr’s thinking about objectivity and subjectivity and to render what is offered in further chapters more intelligible, I suggest four ways in which previous assumptions have shifted. First, rather than separating objectivist research assumptions of generalizations from subjectivist assumptions of contextual dependence, subjectivity is both a distributed and contingent phenomenon. This means that it includes the interference of data, apparatus, participants and human generalities. Rather than denying the subjective, the objective needs the subjective to produce accurate human knowledge of the world.

Human beings must be there to measure, observe and engage with it. This does not mean that our objective descriptions of what the world and humans have done become simple facts of the world but rather that knowledge is something that requires a knower and thus the knower must be part of the situation that produces the knowing. Secondly, rather than separating the objectivist focus of testing hypotheses from the subjectivist assumption of focusing on understanding experience, intra-action includes the testing apparatus within its event. Rather than having to separate systematic protocol and technique from direct work with participants, the apparatuses cannot be separated out.

Thirdly, while not doing away with the logic of probabilities in objectivist assumptions nor the comparative logic in the subjectivist tradition, Bohr premises the
logic of potential, a term from physics that is something all natural things actualize without exhausting. The logic of potential sidesteps criteria, understanding and explanation and maintains indeterminacy. And fourthly, rather than separating the statistical analysis of data from the interpretive analysis of data, a diffractive analysis encourages another analysis, one that in its ongoing differentiating provides an indeterminate vector field for forward movement.

1.4 New Materialism’s “Newness”

There is an ontological distinction between materialism and new materialism, which may not be seen as simply an adherence to and a continuation of previous strands of materialism. Noela Davis (2014) argues, new materialism can be understood as a renewed interest in matter and materiality. Tracing the materialist roots of new materialism back to predating modernity, Barad (2003), along with Susan Coole and Samantha Frost (2010) reference Democritus, René Descartes and Isaac Newton, as influential for contemporary western understanding of materiality and its relation to human culture.

Democritus, a Greek philosopher in the 5th century, proposed, well before he could demonstrate it, that everything in the world is built from the same smallest material, termed atoms (Barad, 2003). He arrived at this conclusion rationally since he realized that cutting something apart to understand it cannot go on indefinitely or there would be nothing left. Democritus was a rationalist who made the theoretical decision that there must then be some things that cannot be cut and these must be the essence of things. As a result, René Descartes, who was influenced in his understanding of matter by Democritus, defined matter as “corporeal substance constituted of length, breadth, and thickness; as extended, uniform, and inert” (Coole & Frost, 2010, p.7). According
to this thinking, matter was understood as passive, which provided the impetus for the Cartesian dualism of body-mind. From a western perspective, Isaac Newton laid the foundation of modern physics in the 17th century, and in turn was influenced by Descartes’ understanding of matter. This is significant for new materialists who see matter as more than passive material and instead, take empirical experiences seriously including experiences of vitality, force, and self-creativity all of which cannot be readily observable in the traditional empiricist sense.

As such, new materialism understands materiality as “always something more than ‘mere’ matter: an excess, force, vitality, relationality, or difference that renders matter active, self-creative, productive, unpredictable” (Coole & Frost, 2010, p. 9). New materialism is not entirely new in terms of contemporary thought since a variety of philosophers of classical pragmatism, such as Alfred North Whitehead and William James, for example, contributed much to unsettling modern philosophy by speaking against orthodox empiricism and by understanding materiality more radically in terms of forces and liveliness which traditional empiricism found creepy and non-empirical.

Iris van de Tuin uses a new materialist approach to understand the genealogy of new materialism. She argues “it is still unclear how new materialism is new” (2011, p. 276), and that a new materialist understanding of quantum leaps could be used to understand its genealogy. Instead of looking at new materialism as a paradigm shift or a move away from the linguistic turn, she argues new materialism can be seen as a leap into the future (Van de Tuin, 2011). For this, she uses Barad’s explanation on the notion of quantum leaps. In Barad’s words,

Quantum leaps aren’t jumps (large or small) through space and time. An electron that ‘leaps’ from one orbital to another does not travel along some
continuous trajectory from here-now to there-then. What makes a quantum leap unlike any other is that there is no determinate answer to the question of where and when they happen. The point is that it is the intra-play of continuity and discontinuity, determinacy and indeterminacy, possibility and impossibility that constitutes the differential space-time mattering of the world (Barad, 2007, p. 182).

Another way to conceive of new materialism is in response to the cultural and linguistic turn (Barad, 2003; Coole & Frost, 2010), where it can be appreciated as a reaction to the use of matter which has been rendered as merely passive and immutable (Barad, 2003). Through new materialism, matter and materiality is brought to the foreground again. Coole and Frost (2010) argue that matter is everywhere; we are immersed in it, and in light of this, the power of matter cannot be ignored.

Coole and Frost (2010) point to three events in which new materialism has been a reaction. Firstly, advances in natural sciences, especially those of particle physics and chaos and complexity theory, have given new light to socio-material processes. Following, in light of these recent developments, socio-material processes should be understood as part of a “wider natural environment” (Coole & Frost, 2010, p.13). For instance, Barad argues that representationalism is intrinsically embedded within Western culture, meaning that there is widespread Western assumption that representations are understood as ontologically distinct from what they represent (Barad, 2003). Barad traces this representationalism back to Democritus’s atomism, in which he proposed that all matter is built from atoms (Barad, 2003). This notion has been used to come to an understanding of matter as fixed and stable, since everything is built from the same fixed and stable atoms. However, the discovery of electrons,
neutrons, and protons – the building stones of atoms – has radically changed this understanding.

Neutrons and protons are built from quarks, which are elements that cannot be understood as fixed or passive. They jump in and out of existence, radically altering our previous understanding of all matter being fixed. Barad explains that electrons defy the previously presumed clear-cut ontological distinction between particles and waves, being both and neither at the same time (van der Tuin, 2011). This leads to what is thought, as a classical view, to be a contradicting ontology, since a particle is a localized entity, and one of its characteristics is that it cannot be at the same place at the same time as another particle. Waves, however, *can* occupy the same place at the same time. Think for instance of waves created by two pebbles in a pond. The resultant waves of each pebble interfere with one another. They propagate and overlap with each other causing a pattern of variation in which there are areas that intensify the interference and areas that decrease the interference. In light of these new discoveries, the ontology of matter changed, and new materialism argues that socio-material processes should therefore be understood through these recent developments (Coole & Frost, 2010) rather than continuing to be based on a more atomistic understanding of reality.

Secondly, Coole and Frost (2010) point to the ethical and political concerns linked to advances in natural sciences. This can be linked to new materialist endeavours in explorations and elaborations in matter and living matter. In contemporary times, there seems to be an awareness that boundaries and dichotomies between human and nonhuman are fuzzier than was thought, leading to new ethical and political concerns. The third element to which Coole and Frost (2010) point, is the exhaustion of “radicalism of the dominant discourses which have flourished under the cultural turn”,
leading to a material realist approach (Coole & Frost, 2010, p. 6). They ask how new conceptions of matter might actually reconfigure our models of society by transforming our sense of the patterns of matter’s movement as well as our modernist presumptions of stable, predictable material substance.

Debates oriented around the methodological–theoretical concerns of new materialism (St. Pierre, 2011, Coole and Frost 2010, Fox and Alldred, 2016), offer a means of rethinking the thinking that underpins the ‘doing’ of research practice. In this dissertation, I will explore how new materialism challenges ontological assumptions of humanist traditions of qualitative research that have focused on understanding the meanings of individual and collective human experiences. New materialism draws its methodological inspiration from critical post-humanist debates concerned with the limitations of how humanness has been thought in dualistic ways that privilege certain identities over others (e.g. masculinity over femininity, human over nonhuman and culture over nature). Pushing our thinking beyond ‘human experience’ are ontological questions about how ‘matter’ is thought and constituted through entanglements of human and non-human bodies, affects, objects and cultural practices. Becoming sensitive to experience beyond the human reorients thinking around relational questions about the material-discursive forces that are co-implicated in what bodies can ‘do’ and how matter ‘acts’. This focus differs from more conventional approaches concerned with what a body ‘is’, or the agentic meaning of experience that has characterized humanist interpretivist traditions (St. Pierre, 2014, 2015). In particular, new materialism emphasizes the importance of formulating research approaches that move beyond dualistic categories of human being and knowing that have underpinned
humanist thinking: objective/subjective, reason/emotion, culture/nature, mind/body, human/nonhuman and self/other.

Following a new materialist understanding, Barad argues that “theories that focus exclusively on the materialization of ‘human’ bodies miss the crucial point that the very practices by which the differential boundaries of the ‘human’ and the ‘nonhuman’ are drawn are always already implicated in particular materializations” (Barad, 2003, p. 824). Therefore, a dichotomy between human and nonhuman makes no sense in light of new materialism, linking it to the scholarly advances of this framework (Barad, 2003). My theoretical understanding of new materialism is inspired as an ontological exploration of materiality, the lines between ontology and epistemology moving towards onto-epistemology. Traditional notions of epistemology tend to be used throughout the disciplines in the social sciences to refer to a theoretical and/or explanatory position for a researcher/participants’ understanding of knowledge and the way this information informs their work and is shaped by ontological assumptions (Guba and Lincoln, 1994, p. 37). In addition, traditional Western philosophical thinking, ontology is considered as something stable, singular and out of reach.

Barad (2003) complicates the distinctions between ontology and epistemology by advancing the notion of onto-epistemology, to suggest matter and meaning as “immanently enfolded and transitional” (van der Tuin, 2011, p. 58), leaving epistemology and ontology intrinsically entangled together. By drawing on Barad’s theoretical framework, I apply a new materialistic perspective to the materialities of bodies and everyday acts and objects in the lives of teachers, pre-service teachers, and high performance coaches.
1.5 My Intra-Active Beginnings: Inspiration for this Work

Despite many reasons one might articulate for undertaking the gruelling work of a dissertation, this kind of work seems always already rooted in the personal or in what someone I encountered in my life called ‘folk philosophy’. Life experiences and their ongoing felt, embodied, forcefulness and destructiveness are the basis for this dissertation. Having sought a variety of methods to overcome, deny and absorb these experiences with no resolve, life, in its movement and longing for something more is most likely what has called me to do this work. Deborah Britzman (2009) asserts that the earliest experiences of being cared for as a child leave their marks, and if those experiences involved trauma and remain unresolved, they haunt the self. I am haunted.

There are, however, a number of inspirational foundations however, for this work. One of them resides in the structure of school, and how it, in its variations, has always been a place of safety, hope and expectation for something more of me than what my experiences so far had made of me. School has faithfully offered me a sense of self filled with great hope that there was more to the world than what took place at home. Therefore, when I seek to understand motivation for this dissertation, I should not be surprised that I return to the field that as a child, cared for me so well, a place where I belonged, was loved, and was supported to find some form of what William Pinar suggests as a (1994) “release from the past, release from arrest, release into movement” (p. 45). In the writing of this dissertation I have come to a deeper understanding about why, prior to entering the field of education more formally as a site of study, I was drawn to the field of child protection social work. The twelve years in which I practiced social work, were a place for me to gain some insight into how it is that parents and caregivers can mistreat their children; how mine could have
mistreated me despite their claims to actually love (me) the children they were harming. Eventually, after twelve years of practicing child protection social work, my mother actually required physical care from me. I left my employment and became a caregiver for her, ending an almost twelve-year silence that she had imposed between us.

Other impetus for this work is rooted in my history of being a high performance tennis player from age 11 to 19 years of age. As I have considered my time playing tennis in California the term ‘training’ surfaces in ways that feel similar to my own experience in a teacher education program and the internship experience I undertook. In sports, the term ‘training’ was synonymous with ‘drills’; the repetition of skills to refine technique, improve coordination and enhance precision and execution. In my experience in coaching, there was a convergence between the scientific community and sports, fostering the belief that bodily capacities were fixed and could only be improved through constant repetition (Beamish & Ritchie, 2006, p. 416). Performance then, when aligned with this thinking, only improved through increased precision and technique not as a result of influences inherent in previous or present experience. The latter thinking was also prominent in my own teacher education field experience.

Entering the field of education following my years in child protection social work, I yearned for something more, for a place where my combined work and life experience might be valued and valuable. It was not as easy as it had sounded in my head when I first decided to become a teacher. During the teacher education program, I was in a course entitled Principles of Teaching (POT), which was an additional component of the four-month internship experience. In this course we were offered ideas about how to behave as guests in our assigned schools: what to expect and what was expected. I vividly recall our cohort’s faculty advisor saying the following: “As
you get ready for your time in the school, girls remember to wear dresses, and boys it would be good if every so often you wore a tie”.

It had been about twenty years since I had worn a dress and I sensed, already, that the experience that lay ahead was going to have some trouble, some trouble that extended even beyond clothing choice. Eventually it became clear that life experience before education did not matter. The call to begin anew in the absence of my life experience was present and preserved for the four-month experience and in the end made me question my commitment to be a teacher. There was a rational way to become a teacher – a very certain way to gain entrée into the field of teaching. There was a commitment to concepts of order, control and mastery over what it meant to become a teacher; ideas that are indicative of the engrained desire to centre the humanist subject as the purpose of education, and the cohesive field experience as the machine of purification and refinement for a subject already knowable through representations of teacher fixed in time and space. In a way then, this dissertation marks a time and space of bringing together life experiences, both mine and those of the participants in this study that sees the benefit of thinking beyond what it means to know in advance who one should be; to offer hope about difference that might emerge and the means by which one feels a capacity to differ when one attunes to the potential of the next encounter, and next moments.

Another motivation for this work comes my failure in psychoanalysis. It was not until I read the work of Donna Hardaway and Karen Barad that I was able to come to grapple with why, despite my earnestness to be a ‘good’ patient engaged in ‘talking therapy’ (psychoanalysis) for nearly twenty-five years, I felt no release from these hauntings. Through reading, in particular the work of Barad, and her notion of
diffraction versus reflection, I began to come to terms with why the years of therapy may not have ‘worked’. Psychoanalysis for me was geared towards finding a way to reflect on the past, moving then toward a resurrection of a self that was better, more rational and in tune with the needs of the present, and as a way to escape the past. Through reading Barad, I was struck by her discussions about the way reflection involves the optical phenomenon which is more about staying steeped in sameness and instead her work on diffraction, the two-slit experiment and the notion of indeterminacy became the basis of my translation of her work and the work of new materialism into a space for hope. Barad’s approach to what else a self might become, suggests that, rather than attempting to resurrect a ‘better self’, we might consider how that self was concretely materialised (conditioned, but not determined) and responsive to concrete situations; or as Donna Haraway wonders, this work considers how we might come to notice that knowing the self can be useful, not for the past, but for thinking about how to be and do now, responsibly. This is hope for me and hopefully for others, particularly because it is not a framework that stipulates, in advance, what hope and healing look like nor as things ownable by particular human subjects. There is much hope in thinking like this.

1.6 Outline of Dissertation Chapters.

In Chapter Two, after this introductory chapter, I set out the theoretical framework from which the subsequent research presented in this thesis can be understood. I will provide an overview of the various concepts and interpretations associated with new materialism drawing most heavily on the work of Barad. I suggest new materialism as a broad way to think beyond the dominance of the humanist subject in education. I also describe new materialist theory as a way of acknowledging the nonhuman and material contingencies that shape our world. I outline the concepts of
agential realism, intra-action and material-discursive entanglement as ways of understanding the orientation of new materialism. I will argue that education and educational research have been dominated by dualist and humanist orderings that assume a particular arrangement of the world and especially how they persistently function to draw a distinction between human and non-human, significantly limiting how education can be understood in relation to how the subject comes to be in the field experience in teacher education.

In Chapter Three, I draw on the notion of diffraction that has been taken forward in the work of Barad (2007, 2010, 2014, 2015). Barad, drawing on the work of Haraway, not only regards diffraction as an optical metaphor, but also as a method and a practice that pays attention to material engagement with data and the ‘relations of difference and how they matter’ (Barad, 2007, p. 71). Diffraction is understood by Barad as a process of being attentive to how differences get made and what the effects of these differences are. Barad’s notion of diffraction is derived from the physical phenomenon of diffraction which she extends to other forms of knowledge production. Diffraction from her perspective can be used to acknowledge the influential role of the knower in knowledge production and particularly how we learn about ‘material configurations of the world’s becoming’ (p. 91). For Barad, diffraction is a useful tool highlighting the entanglement of material-discursive phenomena in the world. Diffraction is thus predicated on a relational ontology, an ongoing process in which matter and meaning are co-constituted.

In addition, I introduce and elaborate the diffractive methods of the Interview to the Double (Davide Nicolini, 2013) and Currere (Pinar, 1976, 2004). These are methods, I argue, which might offer ways for research participants to think beyond
current life practices, as well as what it means to become a teacher and to practicum fieldwork. These methods may also offer participants opportunity for making connections between the two fields of teaching and coaching. For each of these methods, the focus of looking at the constitution of the self with practice and with the past is opposed to a critique of either, which is different from what often happens when we use the methods of reflection and reflexivity. This work is aimed at making an affirmative pragmatic understanding of the self as opposed to merely classifying and criticizing ideas about who the self ought to be.

In Chapter Four, I review the literature regarding the purpose, and value of the field experience, which appears to stipulate a reliance on the technical rational underpinnings of this experience. Along with a review of reconceptualizations of education against technical rational approaches, this chapter adds some new materialist thinking. New materialist theorizing contributes to moves away from anthropocentric understanding that focuses on human rational thinking and logocentric perspectives which position the knower and the known as distinct technical entities in a pedagogical context. In this chapter, the technical, in relation to the technical rational approach, is considered in terms of something that continues to evolve but only within the bounds of its definition, where the rational in the technical rational approach refers to human conscious awareness and its capacity for certainty.

In Chapter Five, I offer some arguments against traditional coding in data analysis and offer instead the benefits of diffractive analysis along with the ways a new materialist lens offers alternative ways to understand onto-epistemological becomings of teaching bodies in the field experience. To accomplish this, I provide a review of some ideas that are positioned in opposition to conventional qualitative research.
practices. Humanist thinkers who wanted to formulate rational objective knowledge did so through creating a separation between the subject and the world at the center of the universe with an emphasis on the rationality of the human mind being the central tenet in humanist thought. Humanist thinkers who wanted to formulate rational objective knowledge did so through creating a separation between the subject and the world.

Chapter Six is the data analysis chapter, in which I suggest that a diffractive analysis highlights the entanglement of the apparatus in the production of the self during the research process. I show how diffraction provides additional affordances through its connection of the discursive and the material, with knowledges making themselves intelligible to each other in creative and unpredictable ways. Barad’s (2007) combination of the onto-epistemological revitalizes the research process, making it methodologically powerful through its enlarged vision of making a difference in the world (Mazzei, 2014, p. 743). One of the important propositions that this dissertation makes is that diffraction is an affirmative methodology which has a great deal to offer for reconsidering humanist practices used in research methodology and in field experience.

In Chapter Seven, I present the data that was collected from the two high performance tennis coaches. Both coaches completed all aspects of the Interview to the Double; however, due to unanticipated travel and coaching schedules neither was able to complete the Currere writing.

In Chapter Eight, I conclude the dissertation by suggesting ways in which new materialism, through the example of the field experience, articulates the call for new concepts and thinking that might help us think and live differently. The subject’s idea
of what movement is or is not, is determined by the human apparatus or its *self*. A human being experiences the world with particular representations of what human capacity is and what the self should do; failure to live up to these representations also has myriad representations – representations that stultify the self so that it stops yearning for what is more. These categorizations then make it harder for the subject to attune to small movements or change. These are the limitations of the human apparatus. A movement can also be so small—or large—that it is not visible to the human eye. Accordingly, just because movement is imperceptible to human senses does not mean that the subject is stable and does not have agential qualities. Seeing the world as impermanent and the human relation as a part of this movement, may offer some relief from the past and propel people into notions of what the self might yet become. Most importantly, in this research, I consider movement to be a movement that is in the midst of entangled experience rather than between fixed or already determined entities.
CHAPTER TWO: Theoretical Framework: Agential Realism

My dissertation research explains, explores, and uses Barad’s (2007) performative theoretical framework called agential realism in an analysis of the production of the pre-service teacher subject during the internship experience. Barad, who is a physicist, uses the work of (theoretical and quantum physicist) Niels Bohr to manifest a host of philosophical positions that are both feminist in their origins and part of a broader “new materialist” (see Barad, 2012; Hird, 2004) turn in social theory. This turn is characterized by commitments to various conceptions of realism. New materialism is not just a new pre-occupation with the material world, though this would not be insignificant; it is also an assumption that everything materializes and matter possesses its own modes of self-transforming, self-organization and directedness. New materialisms challenge modernist notions of matter and language as separable, ambitions towards cognitive and practical mastery over the world, as well as ideas of individuality that capture agency and foreclose individual freedom by not taking into relation the context of actions, the dynamic inter- and intra-relationships including the transformative effects of these relationships.

In Barad’s (2003; 2007) research in the emerging field of new materialism, she calls for mutually-informed transformations of scientific and social scientific disciplines, and she describes this mutual transformation as “engagement”. She argues that her theoretical framework called agential realism and elaborated more fully in the following pages, is an engagement of Niels Bohr’s philosophy-physics, which concerns the epistemological and, to an extent, ontological consequences of new theories and experiments associated with the quantum revolution of the early twentieth century
(Barad, 2007). Following Barad’s engagement with Bohr, this dissertation is also a work of engagement with Barad, which calls for mutually informed transformations in the analysis of the pre-intern subject in the teacher education practicum experience. This engagement will necessitate the use of methods that do not disentangle phenomenon into seemingly independent subsystems but which will instead, question the protocols, conventions and limits that allow educational practices to sustain themselves in stable categories. Accordingly, my efforts will be towards inviting further engagement.

As opposed to classical materialism which considered structures that are generated to be primary reality, new materialism claims that matter is both material and representational. Barad draws on Bohr’s work in the 1920s, in which he was concerned with quanta 1 which he found to be entities that neither directly nor empirically correspond to either particles or waves but rather have certain properties of each. Eventually, he found that it was measurement itself that proved to be what resolved this wave-particle duality. One type of measuring apparatus produced patterns associated with particles, and another, patterns associated with waves. As a result, Bohr argued that “agencies of observation” (in Barad, 2007, p. 114) provide the conditions for the possibility of observed phenomena in the first place. In other words, observing, measuring, and representing practices constitute the phenomenal context in which phenomenon are described. While this might be interpreted as a contextual or sitespecific understanding of reality, Bohr argued instead that quantum science is not an objective endeavor that can provide a correct depiction of ‘reality’ and instead,

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1 The minimum amount of any physical entity involved in an interaction.
experimental apparatuses are “both causally significant (providing the conditions for enacting a local causal structure) and also the condition for the possibility of the objective description of material phenomena” (Barad, 2007, p. 175). This understanding does not assume the possibility of an objective stance in which what is measured can be separated from the measure itself.

Theories of quantum mechanics and their quantum indeterminacy challenge much of what is currently accepted as a common sense view of reality that maintains movement between already determined entities. Bohr’s theory challenges the assumption that “subjects, objects, words, methodologies, or even systems” have “identifying outlines as entities or atomic individuations that communicate, or relate to each other, with causal effect” (Kirby, 2011, p.viii), or with what Barad (2007) calls particularism. Particularism seems to signify the practices of taking the world to always already divided into separate particulars. Theories of quantum mechanics develop, instead, a different understanding of causality. Barad coins the term intra-action to signify “the mutual constitution of entangled agencies… recogniz[ing] that distinct agencies do not precede, but rather emerge through, their intra-action” (2007, p. 33).

Unlike ‘interaction’ which presumes particularism, intra-action assumes matter “never sits still” (Barad, 2007, p. 170) and is instead, always reconfiguring/reconfigured without end. This understanding of human response and change as productive rather than just descriptive is described by Barad as an “agential realism” and within the broader field of new materialisms, Barad specifically highlights this intra-activity as central to discussions about subjectivity.
In the next sections of this chapter, I will elaborate on agential realism as a framework for this dissertation’s research trajectory. I begin by discussing quantum mechanics and Bohr’s philosophy-physics, relying on Barad’s analysis in her 2007 work, and other articles (1998; 1999; 2003; 2010; 2012) as well as an interview (in Dolphijn and van der Tuin, 2012), supplemented by original articles by the physicists Niels Bohr (1935 & 1949, in Barad, 2007), Albert Einstein (1965 [1905], in Barad, 2007), and Werner Heisenberg (1949 in Barad, 2007). I explain how Barad is informed by philosophy-physics in the development of agential realism. I clarify my definitions and use of the agential realist tools for data analysis which include the concepts of phenomenon, agential cut, apparatus, and intra-action. Throughout, I note how the tools are used in forthcoming analyses.

2.1 Articulating a Framework: Philosophy-Physics and Agential Realism

Philosophy-physics and the inclusion of measure

The development of quantum mechanics regarding the ever-increasing and radical complexities of a world of movement, was a profound paradigm shift in physics in the 1920s. Prior to the quantum revolution, physicists’ theories assumed that observation or measurement of a system does not affect its behavior in ways that could not be accounted for in analysis (Barad, 2007). There was believed to be distinct separateness, between the system being measured and the measuring apparatuses. Barad explains that the theories of what is now referred to as classical or Newtonian physics substantiate a particularism where objects have atomistic, identifying outlines independent of interactions with other objects. According to Barad, classical physics “takes the notion of separation as foundational” (2007, p. 137). She explains:
Classical epistemological and ontological assumptions, such as the ones found to underlie Newtonian physics, include the existence of individual objects with determinate properties that are independent of our experimental investigations of them. It is assumed that objects and observers occupy physically and conceptually separable positions. Objects are assumed to possess individually determinate attributes, and it is the job of the scientist to cleverly discern these inherent characteristics by obtaining the values of the corresponding observation independent variables through some benignly invasive measurement procedure (Barad, 2007, p. 106).

For example, according to the theories of classical physics, all that is required to predict what a particle will do in a given range of time is knowledge of its *initial conditions* (i.e. the position and momentum of a particle at any one instant in time)” (Barad, 2007, p. 107), as well as knowledge of the forces acting upon it. The initial conditions of position and momentum can be measured in any number of ways, and then analyzed in relation to acting forces in order to determine the particle’s future path. According to Barad, classical physicists understood that measuring the initial conditions would disturb them. However, they argued that “the measurement-independent values of the object’s position and momentum can be found nonetheless because the disturbance can always be determined and subtracted out” (Barad, 2007, p. 108) using mathematical equations. Classical physicists, therefore, theorized that measurements provide “representations of intrinsic properties that characterize the objects of an observation-independent reality” (Barad, 2007, p. 107),
and that the initial position and the momentum of an experimental object can be simultaneously known.

In addition to the notion that simultaneous measurements reveal the reality of independent objects, classical physicists posited that “electrons, neutrons, atoms, and so on are either waves or particles” (Barad, 2007, p.100). Waves and particles are completely different phenomena that do not share common characteristics. Particles were thought to be material objects occupying a particular space at a given time, while waves were disturbances in some medium. Unlike particles, waves occupy more than one position at the same time; likewise, more than one wave can occupy the same position at the same time. In this way, waves were considered distinct from particles in that they can produce diffraction, which in physics refers to the bending and overlapping patterns made by interfering waves (Barad, 2007). Since classical physics measurements are reproducible in experimentation and predictions affirmed in application, classical physicists argued that reality is described completely by classical physics theories (Barad, 2007, p. 107). By theorizing an observation-independent reality made up of particles and waves, Barad describes classical physics as particularist. By theorizing that measurements represent this observation’s independent reality, Barad claims that classical physics is also representationalist meaning that it maintains an ability to depict accurate physical appearance that reduces something to its sign or category, or to capture complete reality with its words or images.

However, as a result of both thought experiments and actual experiments conducted in the early twentieth century regarding the nature of light, physicists’ confidence/certainty that they had developed theories that provide a complete picture
of reality was challenged. Barad (2007) helps understand this challenge more fully as she writes about experiments where light demonstrated behaviors characteristic of particles in some experiments but diffraction patterns, which are characteristic of waves, in others. According to her, these experiments indicated to physicists that light exhibits “a dual ‘wave-particle’ feature” (Barad, 2007, p. 100), or wave-particle duality. Albert Einstein first addressed this in 1905, when he wrote that light rays, normally thought of as waves, appear to be quantized: that is, emitted in particle-like packets (in Barad, 2007).

It seems to me that the observations associated with the emission or transformation of light are more readily understood if one assumes that the energy of light is discontinuously distributed in space. In accordance with the assumption to be considered here, the energy of a light ray spreading out from a point source is not continuously distributed over an increasing space but consists of a finite number of energy quanta which are localized at points in space, which move without dividing, and which can only be produced and absorbed as complete units (Einstein, 1965 [1905], in Barad, 2007, p. 118).

Two thought experiments, referred to as Gedanken, the two-slit (or double slit) experiments, were central to physicists’ exploration of the nature and meaning of wave particle duality. The basic design of the first experiment, adapted from one developed by Thomas Young (1801, in Barad, 2007), includes a light source that emits

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2 Gedanken (thought) experiments are pedagogical devices that are tools for bringing into focus key conceptual issues. Generally speaking, there is not expectation that a gedanken will ever be realized as an actual laboratory experiment. Gedanken experiments became the testing ground for contrary understandings in physics. Bohr and other physicists drew from these thought experiments to actually experiment with the ideas in the laboratory (Barad, 2007, p.117)
toward a plate that has two slits through which the light can pass (Bohr, 1949 in Barad, 2007). On the other side of this plate is a sensor that displays the pattern created by the light after it has passed through the slits. According to classical physics, if light is made of particles, the light passing through the plate should create two bands corresponding to the two slits on the sensor. However, physicists found that rather than two corresponding bands, a diffraction pattern consisting of many bands on the sensor is created. This same result occurs even if light is emitted as single photons, which are the quanta of light addressed by Einstein in 1905. This first experiment suggests, therefore, that light is a wave (Barad, 2007). The key point here is that the position of a particle is only expressed as a likelihood or probability until a measurement is made thereby making the outcome indeterminate.

Given this indeterminacy of light, physicists attempted the same experiment with electrons which were also understood as particles. When fired through the two slits, electrons created a similar diffraction pattern. This was unexpected since classical physics deemed electrons particles and particles do not behave like waves. Explanations were then offered that included the particles as interacting and interfering with one another. However, a diffraction pattern occurred even when only one electron was passed through the two slit device. Physicists concluded that the particles must be somehow, interacting with themselves (Barad, 2007).

A second thought experiment which lead to a laboratory experiment, however, eliminates the possibility that an electron interferes with itself to create diffraction patterns. This experiment is very similar to the first but with one modification. The apparatus consists of a plate with one slit in it. To the plate, a second plate, also has a
slit, is attached with springs. As with the first experiment, there is an emitting source on one side of the device and a sensor on the other (Barad, 2007; Bohr, 1949, in Barad, 2007). When particles are passed through this two-slit device, movement of the spring plate indicates that a particle has passed through the second slit. If no movement occurs, this means that the particle must have passed through the first slit. As such, the second plate is a measuring device called a ‘which-path’ indicator, because it determines through which slit the particle has passed (Barad, 2007; Bohr, 1949 in Barad, 2007). Specifically, it is a device that measures position, in the sense that both slits are specific sites in which particles can be located at a particular point in time.

What is found in this second experiment is that, with the addition of the ‘which path indicator’, the diffraction pattern exhibited by electrons in the first experiment does not appear (Barad, 2007, p. 104). Instead, two bands corresponding to the slits are made on the sensor, which is a pattern expected of particles. Surprisingly, the same result occurs when light, emitted very dimly, passes through the device. By indicating, therefore, that light consists of particles (called photons), the second experiment contradicts findings of the first that light is a wave (Barad, 2007). Direct empirical evidence proves that matter (electrons), not just light, also manifests wave behavior. Since waves and particles were thought to be absolutely distinct prior to these experiments, the ‘wave-particle duality paradox’ became a real theoretical and practical problem in physics. Barad writes that “the dual nature of light and matter presented a quandary of the first order: an object is either localized or extended; it can’t be both” (2007, p. 100).
In addition to this quandary/dilemma, the actualizing of thought experiments gave rise to another point of consideration, which Bohr emphasizes. During the experiments, it appeared that measuring (e.g. using the which-path indicator) influenced the nature of light and of matter: they both behaved as waves in experiments that measured wave behaviors, and as particles in experiments that measured particle behaviors. A sort of consequential problem arose with results showing that wave-like and particle-like qualities of light and matter cannot be simultaneously measured. They require two different apparatuses (e.g. the first and second two-slit experiments). From this fact Bohr argues that since the effect of measurement is not just a disturbance in position or momentum but a determination of the very nature of the measured object—that is, whether it is a wave or a particle—it is impossible to ‘subtract out’ the effect of measurement on the phenomenon being measured. This eliminates the possibility that a pre-measurement state (i.e. ‘initial conditions’) can be represented by measured values of position and momentum.

The theories of Bohr and his contemporary Heisenberg that explain these results are together referred to as the Copenhagen interpretation of quantum mechanics, which is today the predominant interpretation (Barad, 2007, p. 27). Two essential concepts in the Copenhagen interpretation, which I explain below, are the uncertainty principle theorized by Heisenberg, and the idea of complementarity theorized by Bohr (Barad, 2007, p. 453-454). However, there are ongoing inconsistencies among these concepts, and it is these inconsistencies with which Barad is greatly concerned. Barad argues that her notion of agential realism offers a way to resolve/address these inconsistencies and she draws specifically from Bohr in her resolution. The fact that quantum systems, such
as electrons and protons, have indeterminate aspects means they exist as possibilities rather than actualities. This gives them the property of being things that, until ‘they’ are measured/observed in a specific apparatus, might be or might happen, rather than things that are.

2.2 Uncertainty

According to Barad (2007), Heisenberg framed wave-particle duality as an epistemological problem, where measuring a phenomenon necessarily affects what we can know about that phenomenon. He called this the uncertainty principle. He wrote that the uncertainty principle may be expressed in concise and general terms by saying that every experiment destroys some of the knowledge of the system which was obtained by previous experiments. (Heisenberg, 1949: 20, in Barad, 2007, p. 261) For example, Heisenberg argued that when measuring either position or momentum of a system, the other is necessarily uncertain. In this case, uncertainty refers to an epistemological limitation of what can be known about simultaneous values of position and momentum “owing to the unavoidable disturbance caused by the measurement interaction” (Barad, 2007, p. 116).

2.3 Complementarity

While Bohr agreed that the experimenter cannot claim that the value obtained in measurement reflects the pre-measurement state of the entity being measured, and the state emerges only from the specific material arrangement of the apparatus (Barad, 2007, p.111-115), he argues that we must understand waves and particles as complementary, maintaining that only one can be observed in any given experiment,
because the other is mutually exclusive and objects have complementary properties that cannot all be observed or measured simultaneously. Position and momentum also exist in this complementarity. In other words, movement can never be entirely subtracted from anything.

However, Bohr disagreed with Heisenberg that the problem to be addressed by new quantum theorizations were only epistemological, concerning what we might know. Bohr argued that since measuring position and measuring momentum require two different experimental setups, these concepts are only meaningful as materialized in and operationalized by specific and mutually exclusive experimental apparatuses. Bohr wrote, “in the phenomena concerned, we are not dealing with an incomplete description characterized by the arbitrary picking out of different elements, but with a rational discrimination between essentially different experimental arrangements and procedures which are suited either for an unambiguous use of the idea of space location [i.e. position], or for a legitimate application of the conservation theorem of momentum. (1935, p. 669, in Barad, 2007, p. 328) Therefore, in contrast to Heisenberg, Bohr argued that complementary positions or momentums of measured phenomena are not uncertain: rather, more strongly, they are indeterminate outside of specific apparatuses.

2.4 Indeterminacy

Because the phenomena of position and momentum, and of particle and wave, are complementary and arise only out of specified apparatuses, the boundary between what Bohr called the agencies of observation and the observed object is indeterminate (Barad, 2007) rather than uncertain or complementary. And contrary to classical
physics, Bohr argued that the effect of the agencies of observation on measured phenomena cannot be subtracted from results to leave an accurate ‘representation’ of a system as it exists prior to measurement. Instead, measurement entails an irreducible and inseparable relation between the agencies of observation, which include the experimental setup, the scientist, the concepts they adopt to make sense of observation, as well as the concepts embodied by the measuring system itself. This inseparability and irreducibility provides the conditions for the ontological possibility of the observed phenomena in the first place. Although Bohr did not use this term, as an alternative to the uncertainty principle, Barad articulates this as the “indeterminacy principle” (2007, p. 296).

According to the indeterminacy principle, the implications of wave-particle duality are not only epistemological, concerning what we can know, but ontological, concerning what exists. Barad sums up Bohr’s disagreement with Heisenberg: Bohr rejects Heisenberg’s suggestion that what is at issue is a disturbance created in the act of measurement and that this alleged disturbance limits our knowledge of presumably (always already) well-defined variables or attributes of the object being measured. Instead, Bohr insists that what is at issue are the very possibilities for definition of concepts and the determinateness of the properties and boundaries of the ‘object,’ which depend on the specific nature of the experimental arrangement. That is, Bohr offers an ontic-semantic\textsuperscript{3} interpretation of the indeterminate reciprocity relations, in

\textsuperscript{3} Bohr rejects Heisenberg’s idea that the disturbance which occurs during measurement, limits our knowledge being measured. Bohr, on the other hand, insists that what is at issue are the very
contrast to Heisenberg’s, admittedly incorrect epistemic interpretation (2007, p. 301-302). Heisenberg’s interpretation concerned the limits of what can be known, while Bohr’s interpretation included the limits of what could not be known.

These key thought experiments that confounded theories of classical physics were relevant for the development of quantum mechanics and for resolving the waveparticle duality. Beginning in the 1970s, it became technologically possible to experimentally test various aspects of the thought experiments with which Bohr, Heisenberg, and Einstein were concerned (Barad, 2007, p.302-310). While I do not fully review these experiments here, I note that Barad argues that these experiments affirm Bohr’s interpretation of quantum mechanics. It is not a quantity of movement that is a representation of physical reality independently made up of waves or particles; rather, position, momentum, waves, and particles are potentiated as Barad argues, by specific material arrangements or apparatuses which are productive of such phenomena in the first place. This irreducible relation between the apparatuses and the measured phenomena undermines representationalism as well as particularism. There is no single situation that can be abstracted out from reality.

This means for Barad (2007), that measurement is not just an epistemological phenomenon, but also an ontological one meaning that our assessments of reality have to do with the limits of what can be known as well as what cannot be known and they

possibilities for definition of the concepts and determinates of the properties and boundaries of the ‘object’, which depends on the specific nature of the experimental arrangements.

Following a heated discussion wherein Bohr offers serious challenges to Heisenberg’s uncertainty, Heisenberg acquiesces and offers an admission of his shortcomings in relation to Bohr’s notion of indeterminacy (Barad, 2007, p. 301).
come together: ontological and epistemological. She argues that this evidence necessitates a “crucial rethinking of much of Western epistemology and ontology” (p. 83). It seems that implications of quantum mechanics are wide-ranging, practical, and philosophical, extending far beyond the narrow concerns of the discipline of physics. While I do not suppose I fully understand the full extent of Barad’s physics, I feel her transdisciplinary thinking has much to offer to educational theories and practice currently based on more traditional and static understandings of the physical world.

2.5 Agential Realism

Barad believes that successful scientific theories are capable of providing reliable and understandable access to the ontology of the world (Cushing, in Barad, p. 43). She uses the term agential realism to describe her onto-epistemological framework, that does not assume particularism but, rather, a performative theory of matter and mattering attends to productions of difference, instead of difference already known. Agential realism is an onto-epistemology in that it relates knowing (epistemology) and being (ontology) as irreducible and inseparable, theorizing how “specific material phenomena” arise with “apparatuses of bodily production” (Barad, 2007, p. 139). In agential realism, realism is not about something fixed but rather an emphasis that intra-action has real effects that become agential in new relations and other open-ended assemblages. To account for her interpretation of quantum mechanics as agential realism, Barad conveys a variety of philosophical positions: philosophy-physics, phenomenon, agential cut, apparatus and intra-action, which I will describe briefly in the paragraphs below and will elaborate more as I make sense of them in relation to my research process and data. Barad predicates these aspects of agential realism upon
Bohr’s interpretation of quantum mechanics, which Barad finds to be coextensive with a number of her philosophical concerns regarding representationalism and particularism and which I find useful in ensuing chapters where I engage Barad’s arguments in considering the production of the pre-service teacher subject during the internship experience.

2.6 Philosophy-physics

Barad explains an important inspiration for her term agential realism as stemming from Bohr’s “philosophy-physics” (p. 66). She explains that he uses this term rather than philosophy of physics because he wanted to think the natural and social words together, as well as convey that “we are a part of that nature that we seek to understand” (p. 67). Any measure of difference is an instance of matter and meaning literally meeting and hence, Bohr is highlighting the “constitutive role of measurement processes in the construction of knowledge” (p. 67), and doing so in such a way that attempts to move beyond representationalism and particularism.

For Bohr, things do not have inherently determinate boundaries or properties, and as such, words used to refer to the world, do not have inherently determinate meanings. Bohr (in Barad, 2007) also calls into question the related Cartesian belief in the inherent distinction between subject and object, and knower and known. Neither the cultural nor the material are privileged in agential realism; the measures of all apparatus\textsuperscript{5} of bodily production are of material and culture. Discursive practices and material phenomena do not stand in a relationship of externality to each other. They are

\textsuperscript{5} For Barad (2007), “Apparatuses are specific material reconfigurings that do not merely emerge in time but iteratively reconfigure spacetime matter as part of the ongoing dynamism of becoming” (p. 142). Apparatuses are explained in the next few pages of this dissertation.
mutually implicated in the movement of intra-activity: neither are ontologically nor epistemologically prior; neither can be explained in terms of the other and neither is reducible to the other. Material conditions matter not because they support particular discourses that are the actual generative factors in the formation of bodies, but because “matter” comes to matter through the iterative intra-activity of the world in its becoming (Barad, 2007). The fact that material and discursive constraints and exclusions are intertwined points to the limited validity of analyses that attempt to determine individual effects of material or discursive factors. Indeed, Bohr’s philosophy-physics poses a radical challenge not only to Newtonian physics but also to Cartesian epistemology and its representationalist structure of words, knowers, and things (Barad, 2007, p.138).

2.7 Phenomenon

Bohr (in Barad, 2007) uses the term phenomenon to refer to the indistinguishability of subject and object, or to agencies of observation and the observed (Barad, 2007, p.139). The word phenomenon, he wrote, should be used “exclusively to refer to the observations obtained under specified circumstances, including an account of the whole experimental arrangement” (Bohr cited in Barad, 2007, p. 195). Rather, “by an experiment we simply understand an event about which we are able in an unambiguous way to state the conditions necessary for the reproduction of the phenomena” (Bohr cited in Barad, 2007, p.196). Bohr emphasized that physics does not describe a reality independent of it; instead, it only accounts for phenomena. Barad also utilizes the notion of phenomena to refer to the irreducibility and inseparability of the observed object and the agencies of observation. Barad
expands the significance of phenomena beyond physics by developing an ontological statement for agential realism: “the primary ontological unit is not independent objects with inherent boundaries and properties but rather phenomena” (2007, p.139). According to agential realism, the universe is made up of phenomena. Phenomena, then, are not merely results of laboratory experiments; they are all the patterns of mattering in the universe, including the pre-service teacher subject production.

Barad writes:

There is no unambiguous way to differentiate between object and agencies of observation” [emphasis in original] (Barad, 1999, p. 3) because the strategies that differentiate those, too, are “apparatuses, in Bohr’s sense, [which] are not passive observing instruments. On the contrary, they are productive of (and part of) phenomena (1999, p.5).

Phenomena are the only reality because objects don’t possess properties independent of their intra-actions in the world. This is a philosophical position that radically changes the study of the teacher education subject in my dissertation, in a variety of ways that will be explained throughout the remainder of this chapter as well as in the chapter addressing methodology.

2.8 Apparatuses

For Barad, an apparatus is a boundary-making practice which could be anything that resolves ambiguity, but in new materialist thinking, more broadly, it must also be understood as part of what is being described. Throughout this dissertation, I use the term phenomena to refer to the Baradian inseparability of objects and apparatuses. I refer specifically to the inseparability of the production of the pre-service teacher
subject from apparatuses that are used, according to scientific realism, to understand and describe pre-service teachers as who they are and how they have emerged. Barad (2007) describes apparatuses as “not merely observing instruments but boundary drawing practices specific material (re)configuring of the world which come to matter” (p. 140). Barad explains that reality is not composed of “things-in-themselves or things behind-phenomena but of things-in-phenomena” (p. 140). This runs in opposition to models of social reality often engaged in educational practice that posit the individual as the primary unit of understanding rather than phenomena. In new materialism phenomena are considered to be relations without pre-existing relations: they are ontologically irreducible relations and are generated in diffractive movement with other phenomena.

Bohr (in Barad, 2007) specified certain criteria for apparatuses that assigned them a more active and intimate role than classical physics allowed. However, his insistence that only measures that were readable by a human observer are meaningful, implicates the human as the measure of all things. Barad argues that this account of an apparatus seems to forget Bohr’s own lesson regarding the inclusion of the measure in the measured and leaves the apparatus fixed, ignoring the “dynamics of discursive practices and the co-constitution of subjects along with objects” (p. 145). She explains that instead, apparatuses are natural-cultural and material-discursive; they do not have to involve humans, and their boundary-drawing quite literally adds reality, rather than offering untroubled vantage points from which to view reality. For example, as I will explain in greater detail later in this chapter, theoretical concepts like position and
momentum are only meaningful when actualized in particular apparatuses (Barad, 2007, p. 139). Barad describes this as “the entanglement of matter and meaning” (Barad in Dolphijn and van der Tuin, 2012, p.50).

2.9 Agential cuts

Agential cuts are enacted by an apparatus. Within phenomena, there are no inherent differences or boundaries between agencies of observation and objects; rather, differences and boundaries are instantiated by what Barad calls agential cuts (1999; 2003; 2007) in other words, there are no pre-existing relations. The term agential cut refers to the “emergence and co-constitution of the objects of observation and the agencies of observation through particular material and conceptual epistemic practices” (Barad, 2007, p.195). Barad explains that “the agential cut enacts a resolution within the phenomenon of the inherent ontological (and semantic) indeterminacy” (2007, p.140). Agential cuts therefore, effect distinctions between subjects and objects out of phenomena, or between the agencies of observation and observed. Agential cuts produce determinacy from indeterminacy; they produce difference out of phenomena. They, in fact, produce all difference and are productive of all knowledge.

This understanding of knowledge as agential cuts, renders it as the non-innocent enactment of intelligibility, entailing “specific practices through which the world is differentially articulated and accounted for” (Barad, 2007, p. 149). Every instance of knowing is therefore both productive, instantiating the possibility of knowledge about something, as well as exclusive, disabling the possibility of other forms of intelligibility.
Barad explains: “only part of the world can be made intelligible to itself at a time, because the other part of the world has to be the part that it makes a difference to” (2007, p.351). Therefore, all measurement is in some way, one part of the universe meeting another part of the world halfway.

A new materialist approach, like Barad’s, for understanding pre-service teacher subject production is helpful because agential realism rejects the idea that pre-existing things relate to each other (i.e. particularism) and argues that it is agential cuts that remove uncertainty for the agencies of observation and the observed. This can be understood to mean that agential cuts do not enact permanent difference. Agential cuts do not reify subjects and objects, but rather temporarily separate phenomena such that subjects and objects can become meaningful, intelligible, and make differences to each other. Barad (2007) writes,

Bohr argues that no inherent distinction pre-exists the measurement process, that every measurement involves a particular choice of apparatus, providing the conditions necessary to define a particular set of classical variables, to the exclusion of other equally essential variables, thereby embodying a particular constructed cut delineating the object from the agencies of observation. This particular constructed cut resolves the ambiguities only for a given context; it marks off, and is part of, a particular instance of wholeness (i.e. the phenomenon) (p. 197).

Thus, Barad writes that “one of the crucial lessons we have learned is that agential cuts, cut things together and apart” (2007, p. 179). Rather than creating separation, further entanglement is generated.

Agential cuts are not strictly made by human endeavours or intention. Difference lures difference. For example, Barad explores nonhuman onto-
epistemology in her discussion of the Brittle Star, an echinoderm sea creature related to the starfish. Echinoderms usually have five-point radial systems and hard spiny covers. Brittle Stars do not have eyes per se; instead, they have specialized nerve sensors all over their bodies that can detect chemical signals as well as the presence of light. Brittle Stars discern food, predators, and mates, discernments that are agential cuts because they causally configure differences that are necessary for Brittle Star survival and existence in the universe and for them to make differences in the universe (Barad, 2007, p. 375-376). Barad uses the Brittle Star as an example of how nonhumans must be recognized for their knowledge-making practices that may not include humans at all.
In its inclusion of the more than human, Barad’s theory of agential realism aligns with new materialist theories. New materialism, according to Barad, “doesn’t presume the separateness of any ‘thing’, let alone the alleged spatial, ontological, and epistemological distinction that sets humans apart” (2007, p.136). New materialisms are concerned with accounting for the agential cuts by which humans and nonhumans are delineated in the first instances as well as the effects of such differences. Agency is therefore understood as an enactment or practice, rather than a property or capacity of objects or individuals. Indeed, objects and individuals “do not pre-exist as such” (Barad, 2007, p. 178); rather, they are indeterminate within phenomena.
2.10 Intra-action

The most significant conceptualization in Barad’s work is the neologism ‘intra-action’ (Barad, 1998; 1999; 2003; 2007) which is an agential realist alternative to interaction. Interaction refers to the contact between two or more a priori independently existing entities that have the attribute of agency. Additionally, interaction signifies particularism because of the assumption of already distinct entities that can become related by interacting. Intra-action, on the other hand, “signifies the mutual constitution of entangled agencies” (Barad, 2007, p. 33), where agency is not an attribute or quality of an object but the instantiation of phenomena. Intra-action refers to “the exteriority within-phenomena” (Barad, 2007, p.140) where ‘cut-up’ parts are yet always constitutive of phenomena. With this thinking then, intra-action signifies things becoming relatable, that is temporarily distinguished and revealed as engaged.

Therefore, we are ourselves part of the reality we are investigating. “There is no definite and self-evident cut between ourselves as investigating subjects and the world as investigated object” (Hammarström, 2010, p. 6).

Throughout this research, I use the term intra-action to refer to the ways in which pre-service teacher subjects are cut both apart and together within phenomena. This means that I have had to seek methods which do not presume and are not productive of subject particularism in pre-service teacher experience, and to work in ways that do not consider particularism necessarily ‘natural,’ but rather the result of agential cuts that resolve what, according to Barad, is the real indeterminacy of phenomena. My research aims to articulate exclusion practices of the pre-service teacher as well as the ways in which these practices could be otherwise, given different
apparatuses and different agential cuts. Intra-action attends to the productive effects of exclusion practices (agential cuts), acknowledging that exclusions are constitutive of subjects and objects (Barad, 2007, p. 57). Agential cuts are productive of difference and therefore, actually make a difference and also, continue to make difference.
CHAPTER THREE: Diffractive Methodology: Practicing Patterns of Indeterminate Detail

Within the field of education, post-qualitative research continues to be emergent (Lather and St. Pierre, 2013). Elizabeth St. Pierre (2013) explains that the original aim of qualitative research was to establish an alternative to quantitative social science methodology, "ironically, by relying chiefly on positivist markers such as systematicity, linear processes, technique, clarity and transparency of language, accurate observation, representation, and so on" (p. 654). Patricia Clough (2009) argues that qualitative methodologies assuming empirical reality become meaningful through interpretive processes. These interpretations, however, are obtained through naturalistic observation, which is a process that continues to presume the independence of the empirical world from interpretation. The problem with qualitative research seems to lie in the ways it adheres to a positivist epistemology and ontology (Lather & St. Pierre, 2013).

Given this, and despite this, there are many research undertakings that use postqualitative approaches which utilize theoretical frameworks that work beyond the realm of humanism and without adherence to modes of positivism and certitude. Some of these frameworks fall under headings such as new materialism (Lenz Taguchi, 2010; 2012; MacLure, 2013), posthumanism (Braidotti, 2013, Barad, 1999, 2003, 2007, Blaise, 2013, Jackson, 2013, Mazzei & McCoy, 2010; Mazzei, 2013), indigenous theories (Lather, 2013, Gerda Roelvink & Magdalena Zolkos, 2015), actor-network theory (Fenwick & Edwards, 2010; Latour, 2004), and more. In addition, post-
qualitative researchers are exploring new ways to do research non-hierarchically, non-representatively, and from non-essential grounds (Lather & St. Pierre, 2013).

In this chapter, a new materialist perspective about undertaking educational research will be explored using the methodology of diffraction. What connects theories used in new materialist research is a renewed focus on ontology, (Dolphijn & van der Tuin, 2012). What is offered in this chapter is not meant to explore new methodologies and methods in order to bring more perspectives to the research. That sort of approach is a kind of perspectivism suggesting that the phenomena is one (e.g. an ontologically stable reality), and that the knowledge of the phenomena is multiple (e.g. multiple epistemologies). Rather, in this chapter, I draw from Barad’s research to explain the use of diffraction as a methodology that considers difference as immanent to diffraction or, in other words, diffraction as a way of doing research that exists and thrives in difference. Diffraction is a technical term from physics and refers to patterns made when waves of any kind pass through a narrowed measurement resulting in waves being spread out and divided as well as interfering with one another generating even more and indeterminate, difference. Barad credits Haraway with coining the term diffraction in place of reflection. Haraway (in Barad, 2007) writes, “Diffraction is a narrative, graphic, psychological, spiritual and political technology for making consequential meanings” (p. 73).

Barad was partially inspired to adopt diffraction as a methodology by Haraway’s earlier elaboration of the ways in which diffraction is an effect not of “the same, displaced, as reflection and refraction... [but] a mapping of interference” (Haraway, 2004, p. 70). That is, for Haraway, reflection is problematic because it
expects and sameness, representational outcomes whereas as opposed to those differences which occur in diffraction. An example that Barad (2007) offers and which I paraphrase, describes the resultant effect when two stones are dropped into the same pond within a certain period of time. The ripple effects of each will interfere with the other, producing diffraction/interference patterns of increased amplitudes and troughs where the equivalent points of each wave meet. When this happens, their amplitudes combine and the resultant formation is a composite waveform. This behaviour of waves is in contrast to that of matter as particles in considering reflection, which by occupying a point in space, at a particular point in time, are not able to overlap with each other. Diffraction engages both difference that materializes and that which continues on beyond its capture. Barad argues that with this as a methodology, there is opportunity to attune to productions of differences, including consequences of exclusions as well as potential for other difference to be noticed. Experiments with diffraction are central to the quantum mechanical theorizations upon which agential realism is based, so it serves as an apt descriptor for Barad’s methodology.

As has been elaborated more fully in Chapter Two, Barad credits Niels Bohr with much of the shift in understandings of the world in which wave particle duality is found to be a feature of both light and matter. Bohr’s two-slit experimental diagram radically problematized the mutual exclusivity of the wave/particle pairing and is found in what is known as a two-slit diffraction experiment. To paraphrase Barad in my very unsophisticated understanding, this procedure shoots matter at a board which features two equally sized cut slits. According to classical physics the matter should either leave a record of which slit it passed through, indicating particle behaviour, or otherwise be
observable as an interference pattern on a final screen, exemplifying wave behaviour that has passed through both slits (Barad, 2007, p. 80-94). Barad explains that it would be expected that the bulk of the particles would wind up opposite one slit or the other with no alternating pattern. In classical physics, only waves produce differential patterns and particles do not, since they cannot occupy the same place at the same time.

In classical physics, diffraction apparatuses are instruments that produce patterns that mark differences in relative characters such as vibration and availability of waves as they combine. To recap, in reflection, particles bounce off of surfaces and can be explained as an approximation scheme and diffraction makes light’s wavelike behaviour explicit.

What was discovered with the two-slit experiment, is that under certain circumstances matter which is usually thought of as being made of particles, is found to produce a differential pattern of areas where a significant number of particles hit the screen and of other areas where hardly any did. It seems that sometimes matter behaves like particles and sometimes light manifests particle behavior. While waves and particles are distinct phenomena with mutually exclusive characteristics, different apparatuses yielded different results indicating a superposition in quantum mechanics is a combination of adding to and cancelling out. Once a measurement is made and its energy and position is known, the superposition is lost and we have a particle in a known state.

The experiment makes evident that devices don’t disclose pre-existing values but rather specific material configurations that gives definition to the notion of the property in question. They enact a cut between the “object” and the “measuring
instrument” and produce determinate values for the corresponding measured quantity, leaving the complementary quantities indeterminate. This is not to say that human observers determine the results; the data doesn’t come out however we want, but rather the specific nature of the material arrangement of the apparatus is responsible for the specifics of the enactment of the cut. (Barad, 2007, p. 264)

Barad emphasizes the significance of methods, of how and what we ask in research and pedagogic questions become what is determined. She argues that when introducing an experimental arrangement that presumes the particle-like nature of what we want to determine, if the phenomenon will not allow it, it is particle-like behavior we will find, with no interference pattern. For Bohr, this is a matter of the way in which “the material specificity of the experimental arrangement that gives meaning to certain classical variables to the exclusion of others, enacts a specific cut between the object and agents of observation, and produces a determinate value of the corresponding property” (p. 268).

Diffraction is also an optical term and is a useful concept for understanding what reflection does not do, as well as for drawing attention to the entanglements of difference. Barad (2007) considers diffraction as an optical phenomenon not only in classical physics but also in quantum physics. It is a common educational practice to use optical metaphors in describing matters of epistemology and methodology. Distinguishing between the optics of reflection and diffraction highlights the difficulties inherent in theories of representation which continue to be as prevalent in qualitative methodologies as in methodological positivism. The intertwining of vision
and knowledge in Western thought has been traced by Keller and Grontkowski (in Barad, 2007) back to the time of the Greeks. According to Barad, optical metaphors are “pervasive tropes for knowing” (2007, p. 72). Both representationalism and performativity, as Barad defines them, draw upon optical metaphors to describe how knowledge is produced. However, while representationalist metaphors reveal assumptions about distances between subjects and objects and knowers and known (i.e. particularism), performative metaphors concern how these very distances are instantiated.

In addition, physicists have also noted an interesting connection between the study of physical movement and optics, invoking this analogy to gain insights about both areas. The study of optics, according to Barad, is divided into two categories: classical optics and quantum optics which I will elaborate on in the next few pages. Classical optics are studied from the point of view of classical physics and quantum optics are used to understand phenomena involving light and its interactions with matter. In classical optics Barad explains there are two methods of investigation: geometrical optics and physical optics. Taking a closer look at these tools of optics will be helpful. Reflection can be explained using geometrical optics but not diffraction. Diffraction includes physical optics.

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6 Performativity involves things being constructed through repetitive performance.
Figure 2: Geometrical Optics vs Quantum Optics

Geometrical optics is an approximation tool for studying optical instruments such as “different configurations of lenses, mirrors, prisms, etc.” (Barad, 2007, p. 84) and it is focused on where light goes or what it can be made to do on or through different optical instruments. Light’s nature is of no concern in geometrical optics; it does not
provide any method for distinguishing between wave and particle behaviour. Based on the two-slit experiment, geometrical optics seems to work well when the wavelength of light is small compared to the dimensions of the object it is interacting with, such as the size of the slit that the light passes through. In effect, Barad claims, it is a shortcut way of deriving correct results when the wavelength is smaller than other dimensions in the experiment.

There are important difficulties with the consideration of reflection as a theory or method of knowing. Representationalism purports that knowers make representations that attempt to ‘mirror’ reality, and as such, knowledge is a ‘reflection’ of reality. To achieve the most ‘accurate’ reflection, methodologies are concerned with subtracting the influence of the knower in the production of representations. This is traditionally called ‘objectivity,’ and it is foundational to scientific realism. In this view the scientific method is able to describe the real world as it is independent of the human knower, or the traditional view that we can know objectively as long as the personal biases or apparatuses of scientists are eliminated by the control of reproducible experiments and measurement practices. Barad explains:

To see your image in the mirror there necessarily has to be a distance between you and the mirror. So there is a separation of subject and object, and objectivity is about mirror images of the world (in Dolphijn and van der Tuin, 2012, p. 52).

While it is common in both research and pedagogy for reflection to be used as a metaphor for thinking, reflecting invites an illusion of essential and fixed positions. The basis of this metaphor stems from the consideration of an atom, as the building block of classical physical reality and which cannot exhibit both wave
behaviour and particle behaviour. Classical physics typically considers matter as waveform and matter as particle to be mutually exclusive.

Haraway and Barad argue that what is produced in reflection is a ‘mirror image’ (official knowledge), a sameness that finds sustenance in homogeneity. As a result, premising only reflection as the model of knowledge ensures that consideration of matter and waveform remain mutually exclusive, Haraway and Barad both agree that reflection can only be explained with an approximation scheme in which light might well be a particle that bounces off surfaces and approximations refer to using simpler models when the correct model is difficult to use or if incomplete information prevents use of exact representations in a need to make calculations easier. In reflection, light is considered a tool but not an object of inquiry and the nature of light is not considered as important as human rational thinking.

Reflection does not use the full theory of physical optics which involves light as well as its interactions with matter, where diffraction is an active agent of change that can be mapped for locating its inhabitants, and their movement. Diffraction makes light’s wave-like behavior explicit. Considering reflection only, involves a conception of space as a container, a practice that Barad argues pervades western epistemologies. She recalls the understanding of the world prior to the beginning of the twentieth century where everything could be sorted into distinct categories of either waves or particles and “each bit of nature had a distinct identity that landed it a place in one column or another” (2007, p. 100). She argues that much of that understanding continues today despite this finding being a “seismic shift in our understanding of the nature of scientific knowledge and the nature of the world” (p. 106). Everything in the
world is doing at least two things at once depending on the apparatus that is entangled with it. Humans have a much graver responsibility in knowing that they cannot separate themselves out from any of their observations and that every knowing contains unknowables that are greater or fewer depending on how tight, smug or narrow our observation. This understanding of the world may offer much to the sensitivity needed in our everyday relating to what we think we already know.

To address the concerns of reflection, reflexive praxes found in social constructivism has emphasized the subjectivity of the knower as integral to representations. Donald Schön introduced education to the concept of the reflective practitioner in 1979, making great strides towards alleviating education’s separation of theory from practice through his generative metaphor that was useful in an interpretive way. Reflection has become increasingly important in teacher education field experience (Nicolini & Roe, 2014). For example, Linda Finlay (2003) claims: As qualitative researchers, we now accept that the researcher is a central figure who actively constructs the collection, selection and interpretation of data. We appreciate that the researcher is co-constituted – a joint product of the participants, researcher, and their relationship. We realise that meanings are negotiated within particular social contexts so that another researcher will unfold a different story. We no longer seek to abolish the researcher’s presence. (2003, p. 5).

 Reflexive praxes purportedly “turn the mirror back on itself” (Barad, 2007, p, 86), critically exposing and appraising biases imparted by social positionality. Rahel
Wasserfall, (1993) for example, writes that “reflexivity is a process by which an ethnographer while engaging in her fieldwork becomes more aware and produces a ‘better representation,’ more in tune with the reality she encounters” (p. 25).

Where reflection “leaves the knower out of the equation,” “reflexivity aims to acknowledge the tripartite arrangement between objects, representations, and knowers that produces knowledge” (Barad, 2007, p. 86). However, in maintaining this tripartite ontology, reflexivity “still hold[s] the world at a distance” (Barad, 2007, p. 87). As such, Barad claims emphatically that scientific realism and social constructivism “are of course both about mirroring” (Barad in Dolphijn and van der Tuin, 2012, p. 51), which she finds a problematic support of particularism. Alternatively, physical optics is interested in investigating the nature of light. Light is not merely a tool but also an object of inquiry. Diffraction can only be accounted for by using the full theory of physical optics. Diffraction optics are ways of producing patterns that mark difference as the qualitative functions of individual waves as they combine; they make light’s wavelike behaviour explicit.

Quantum mechanics and physical optics are understood to be methods that can account for phenomena at all length scales. They highlight, Barad argues, the way in which the universe is not broken up into different scales with different sets of physical laws for each. Diffraction is not only a metaphor; it is evident everywhere we look in the world. According to Barad, a diffractive methodology is achieved by reading “insights from… different areas of study through one another” (2007, p. 25) in the same way that waves interfere. Barad describes how diffraction is “attentive to fine detail”
in that waves will diffract around even the tiniest of obstructions such as a single molecule. Each detail generates potential for other insights/observations: “small details can make profound differences” (2007, p. 92). Inherent in new materialism is that even the words we use, are not separate from what materializes.

Diffractive methodology is also attentive to fine details of different kinds of knowledge by attuning to specialized arguments and methods from different disciplines without installing one discipline as the arbiter of truth about the phenomenon under investigation. While the “more usual approaches” in “thinking insights from scientific and social theories through one another” position “one in a static geometrical relation to another” (Barad, 2007, p. 92-93), diffractive methodology engages science and social theory in a dynamic, iterative ‘conversation’ in which the boundaries between them are scrutinized simultaneously with their objects of study. This is possible because diffraction presents not only difference that is captured but also at its ongoing differing. Barad explains that the goal of diffractive methodology is to provide “a transdisciplinary approach that remains rigorously attentive to important details of specialized arguments within a given field, in an effort to foster constructive engagements across (and a reworking of) disciplinary boundaries” (2007, p. 25). The scientific and the social no longer stand apart in inquiry and they are brought together in new materialism through creative experimentation that does not necessarily seek to expose error or unmask ideology but rather to contribute to how things entangle and re-entangle. Physics and philosophy, and science and the humanities, now fold into each other in relation and it becomes evident that there was never a sharp boundary between physics and philosophy (Barad, 2012). Barad’s central principles of diffraction
and agential realism are beneficial to counter any “exceptionally narrow framing of scientific concerns and scientific literacy” (Barad in Dolphijn & van der Tuin, 2012, p. 59) as well as any notions of a technical-rational agenda in the subjective production of the pre-service teacher education student. Research with diffractive methodology is considered an entangled assemblage, which “comprises bodies, things and abstractions that get caught up in our social inquiry including the events that are studied, the tools, models and precepts of research and the researchers” (Fox & Alldred, 2014, p. 400).

In *Meeting the Universe Halfway* (2007, p. 79), Barad proposes diffraction as an alternative to the methodological approaches of reflection and reflexivity. As explained earlier, diffraction refers to patterns made when waves of any kind including water (or other liquid), sound, or light, pass over an edge or aperture or when two or more waves interfere with each other, thereby bending, interfering, spreading, and propagating in space. Barad explains, “When this happens, their amplitudes combine to form a composite waveform… [T]he resultant wave is a sum of the effects of each individual component wave” (2007, p. 76). Diffraction is different than reflection and reflexivity because diffraction instantiates no “self-referential glance” (Barad, 2007, p. 88), meaning it does not result in a self that stands apart from its changing, and instead, marks interferences that make differences in the qualities (i.e. amplitude and phase) of the waves that combine.

In classical scientific tradition, an object is often considered a stable entity which a researcher, a subject, can study, measure and classify (Haraway, 1997). Subjectivity is the perspective of the human subject considered as the one with agency that effects and utilizes the passive object. However, as Barad (2007) shows, using
Niels Bohr’s theories on quantum physics, no object can be studied as an independent entity, rather, it is always already changing, and changes the emerging subject.

In Bohr’s account intentionality cannot be taken for granted:

Pre-existing determinate mental states of individual human beings…. attending to the complex material conditions needed to specify ‘intentions’ in a meaningful way prevents us from assuming that ‘intentions’ are (1) pre-existing states of mind, and (2) properly assigned to individuals. Perhaps intentionality might better be understood as attributable to a complex network of human and non-human agents, including historically specific sets of material conditions that exceed the traditional notion of the individual. Or perhaps it is less that there is an assemblage of agents that there is an entangled state of agencies’ (Barad 2007, pp. 22-23).

The agential cuts that generate reality are not about othering, but about making more complex connections and commitments, and opening and reworking agential conditions of possibility. As described in Chapter Two, agential realism is premised on the ways that separate individual subjects do not precede their intra-action but emerge, distinct and explicit, only in mutual entanglement. This means there is no such thing as existence in the form of individual elements. Furthermore, agential realism is an account of matter (or for my purposes, of the teacher education student subject) in its intra-active becoming.

The starting point of a philosophy-physics then, is not separated entities, which could be described in various ways as dependent on perspective. Instead, the phenomena, the relation and its differing are the starting point, and the parts of the
relation to the *relata* derives from the relation (Barad, 2003). Barad (2003, 2007) uses the example of the wave-particle duality paradox, based on Bohr’s physical philosophical arguments. Revisiting the experiment described earlier in this chapter and in Chapter Two, it was shown that light appeared as a wave, and in the same experiment, also behaving as sometimes a wave and other times a particle. More experiments did not lead to one single solution, and instead, light is evidenced as *both* a wave and a particle. This does not render light itself as the starting point, rather it is the phenomena of light in relation to the two slit experiment that is the starting point. How Bohr resolves this paradox is by shifting from multiple epistemologies and an ontology of the thing, to an ontology of the phenomena. This involves viewing the world as admitting multiple ontologies, not just multiple perspectives. Relation does not have pre-existing relata, instead, relata have pre-existing relations, hence Barad’s (2003, 2007) shift from interaction to intra-action.

In the previous chapter I sought to lay some groundwork by describing new materialism’s theoretical framework, through which to examine the subject in teacher education practicum experience. Theoretical frameworks are about aspects of human existence that are considered applicable to the study of actual events. Barad explains, however, physicist Niels Bohr’s reluctance to consider his emerging ideas about light as part of a theory. Bohr realized that the very nature of diffraction and its existence in every *thing*, prevents any matching linguistic representation of pre-existing things

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7 Relata are would-be antecedent components of relations. According to metaphysics of atomism, individual relata always pre-exist any relations that may hold between them (Barad, 2003, p. 12)
because diffraction does not fix what is object or subject in advance. Instead, in any
given moment, everything involves both what it is and what it is not.

Furthermore, light’s movement, as time or as diffraction, is not accessible to
everyday understandings of vision and instead involves encounters that are more about
a kind of seeing that engages the sense of touch. As a result, Barad (2007) draws from
Ian Hacking in arguing that “seeing requires practice” (Hacking, in Barad, p. 53). Barad
embraces Bohr’s belief that because of a world of diffraction, theorizing is actually an
embodied practice. Knowledge is a direct mutual engagement and theorizing is a
material practice in an emerging field of tensions, contradictions and hesitations. It is
in this vein of thought I am considering my current understandings of new materialism
as an embodied practice.

3.1 Diffraction in educational research

Diffraction as a methodology has been used in educational settings. Lisa Mazzei
(2014) for example, uses diffractive analysis as an alternative to coding data. Instead
of focusing only on what the researcher does with the data, the focus is also on being
sensitive towards what the data might do to the researcher and vice versa. In so doing,
this diffractive analysis takes into consideration, intra-active forces of data and
researcher. Hillevi Lenz Taguchi (2012) is also engaged with post-qualitative research,
rethinking methodology using different though related methodologies such as the
Barad/Haraway influenced diffraction. In a research project undertaken by Lenz
Taguchi and Anna Palmer (2014), young girls’ ill-/well-being was analyzed using a
multiplicity of data. Narrative data about a girl taking the subway to school is placed
next to an excerpt from an article in a daily newspaper, and an interview with a psychotherapist. When being affected by the data, a memory was written down and added to the data, hence expanding the data. Lenz Taguchi and Palmer (2014) write, "When reading these kind of data into each other, a memory story, told by one of the researchers, emerges, and after that the reader is presented with the memory story. Hence, the data is affecting the researchers, and they acknowledge this event” (p. 32). Here we can see the use of an affirmative, affective approach towards analyzing, but also a way of dealing with a multiplicity of data. For a philosophy of education, using a diffractive method means to read texts affirmatively, being open to the affective traces they leave and rendering awareness to potential that is generated as we move to another reading. Rather than seeking to uncover something hidden, it acknowledges new reality continually being added to the world. Diffraction’s focus on affirmation and multiplicity makes possible alternative and creative ways to analyze and view philosophical data beyond unproblematic interpretations of texts.

3.2 Implications of Diffraction and Agential Realism: Into the Field.

The focus of the next part of this chapter will be the implications of diffraction and agential realism in terms of well-accepted field experience methods including representation in both reflexive practice and autobiographical reflection. It will highlight two alternative methods/practices/apparatuses that seem to lend themselves to the nature of diffraction and agential realism. These include Interview to the Double (ITTD), first conceived of in the 1970s by Italian work psychologists led by Ivar Oddone, Alessandra Re and Gianni Briante, and Currere, developed by American
curriculum scholar William Pinar in 1975. Before describing these in more detail, I revisit another synopsis of the difference between diffractive and reflective/reflexive methods.

3.3 Methods

3.3.1 Diffraction and reflective/reflexive practice

Diffraction can be understood as the effect of waves overlapping and constantly interfering with each other. The diffractive capacity for comprehending one’s involvement in the world and its production rather than mere observation, were some of the reasons that Haraway adopted the concept of diffraction (Barad, 2007). She wanted to move images of difference from oppositional to differential, from static to productive and ideas of scientific knowledge from relative disinterested judgments to mattering, embedded involvement.

The optical metaphor of diffraction that Haraway has proposed as a pattern of mapping the effects of difference has been taken up by Barad as a “methodological approach of reading insights through one another in attending to and responding to the details and specificities of relations of difference and how they matter [in both senses of the word]” (2007, p. 71). This means that as a quantum way of knowing according to Barad, diffraction apparatuses not only "measure the effects of difference [but] even more profoundly, they highlight, exhibit, and make evident the entangled structure of the changing and contingent ontology of the world, including the ontology of knowing” (p.73). As a methodology, this involves making, keeping, and attending to these records of change of passage and about engaging in research that seeks to embody it.
Because diffraction patterns reveal no sharp boundaries between dark and light but rather a series of dark and light displaying shadows in light regions and bright spots in dark regions, they act with/in figurations, to alter the “politics and construct knowledge differently. [I]t is about changing knowledge, reconstructing knowledge practices such that alternative understandings of these knowledges emerge” (Barad, 2007, p. 102). Unlike reflections, diffractions do not displace the same elsewhere (Haraway, 1997, p. 273). Instead, when measured, they move in unexpected trajectories. Barad (2007) explains that while edges and boundaries are not determinate either ontologically or visually; it is not uncertainty that is the issue because there is no “pre-existing determinate property to be uncertain about” (p. 459). Instead, as indicated earlier, indeterminacy is a better descriptor for relations of reciprocity. There is possibility here for turning research towards subtler nuances where there are “small but consequential differences”, and “the processing of differences…[are] about ways of life” (Haraway, in Barad, 2007, p. 29).

Diffraction patterns are concerned with entanglements rather than individualism and they attend to the relational nature of difference. Rather than mapping where differences appear in an attempt to uncover a world of separate facts in themselves, it “maps where the effects of difference appear” (Haraway, 2004, p. 70). In my concern for mapping the effects that difference makes, I am considering how research might make sense of the different paths that emerge in the context of this research event? How might I engage the capacity that diffractive methodology offers in reading stories and theoretical insights through one another and thus configuring new ways of understanding how moments of teacher education field experience might be practiced in relationally different ways.
Many people refer to Schön’s reflective practice as reflexivity when it is undertaken more frequently and in particular in relation to using emergent findings from intermediate stages to inform next interviews and analyses. Much of the focus of reflexivity is designed to destabilize broad, general categories, to find hidden preconceptions, stereotypes, idiosyncratic concepts and to become more aware of situational dynamics in order to find new strategies. In some literature (Kirby & McKenna, 1989) it seems that one’s conceptual baggage can be rationally determined in terms of broad and decontextualized categories and then perhaps be moved beyond. Barad cautions that methods must be intensely respectful of the entanglement of ideas and other materials in their “full display of intricate patterns and reverberations with all the vibrancy, richness and vitality” (Barad, 2007, p. 30) that diffraction offers.

It is important to note that I am not arguing that reflection and reflexivity are without important contributions to research methods. Each have complex meanings that are, in actuality, not limited to the language of optical metaphors and discourses. However, in ways in which they are often used in teacher education programs, both reflection and reflexivity connote a self referentiality, a turning inward and they do not seem to diffractively attend to and respond fully to the effects of difference. In other words the individual is maintained as the reference for knowledge thereby missing what matters, what the world, has to offer.
3.3.2 Interview to the Double (ITTD)

In searching for a few already-established practices to use in my research project which involve both indeterminacy and exceptional attention to detail, I discovered the work of Davide Nicolini and Bridget Roe (2014) who engaged an interview process called Interview to the Double (ITTD). This is an interview method designed initially by an Italian philosopher and his colleagues, to offer opportunity for workers to sense new possibilities of action that might be available to them. Nicolini and Roe (2014) work with midwifery students, who in similarity to teachers and teacher education students, are practitioners that must perform specific actions. Nicolini and Roe argue that their students cannot, in fact, escape performing specific actions and in the process, adopting certain ways of doing things that lead to the deferral and suspension of all other alternatives.

Because practice seems inherently singular at the point of accomplishment and practical knowledge seems determinate by nature, the ideal of a profession or a field of practice becomes part of the process of normalization. Understanding, instead, that submitting to a profession limits what is doable, and recognizing the need to feel capacity for expanding possibilities of action, is a practical problem for research. While Nicolini & Roe observe that reflection has been an integral part of midwifery teaching since the 1980s, it is also an implicit requirement for supervisory meetings, an observation that resonates with teacher education field experience teaching and supervisory practice as well.
Nicolini & Roe found that using ITTD was helpful for practitioners to come up with a rich description of their own practice as well as for generating the support of expanding practical understandings and options for action. ITTD involves a one-hour interview in which the practitioner (teacher, student teacher, coach) explains to the researcher, how to take the practitioner’s place at work the next day. The practitioner wants to make sure that nobody will (hypothetically) notice that the researcher has taken their place because everything they do will be so much in similarity to what the practitioner will do. This yields a monologue but it is interspersed with clarification questions from the researcher who wants to make sure they know every little detail of this doubling experience to avoid being found out the next day.

In a second, approximately 40-minute interview, the instructions from the first interview were discussed again for further clarification as well as for generating more possibilities of action. Participants, according to Nicolini & Roe, are often surprised when they review their first responses and then make further adjustments or clarifications. These interviews are video and audio recorded and analyzed for themes; sub themes are seen as an extension to the analysis. Later, in reading their own transcripts and listening to themselves, Nicolini & Roe describe much practitioner self confrontation occurring, such as, “Oh, is that what I do?” The practitioner then has opportunity to revisit her practice and clarify further, with subtle adjustments, or reposition entirely.

The ITTD process as a diffractive methodology is useful as it draws attention to difference in what might be conceived as a homogenous practice. Both midwives and teachers are expected to project a very specific professional self that complies with the
image of their work “carefully nurtured by their professional association” (Nicolini & Roe, 2014, p. 73). Nicolini and Roe claim that ITTD was effective at “surfacing normative dimensions of practice” (p.72). “Rather than offering insight into a presumed inner self, it brings to the fore the main normative and technical regimes of conduct regulating the production of selves” (p. 72.). In the process of giving, re-giving and revisiting their necessarily detailed instruction, normative constraints of professional thinking are lifted so that “new possibilities of action and new ways of being a competent practitioner can emerge” (p. 72). Most exciting is Nicolini and Roe’s claim that their ITTD participants were not only thinking ‘outside the box’ but also able “to appreciate the nature of the box” (p. 72) as normative constraints were part of the resulting pattern of details.

In my research, I use the ITTD method with both student teachers, cooperating teachers. In so doing, I focus on how this process might move beyond an individual’s discretionary decision-making, and how it might serve to multiply the production of the teacher education field experience subjects rather than how it might try to reveal isolated inner cores. In addition, ITTD involves a commitment to trying to know the world well without needing to distance people from what they know and instead, noticing that people are part of what allows the world to continually emerge in particular ways. Nicolini & Roe offer some caveats in regards to the use of ITTD, which include a need to build trust in relationships before engaging it, as well as a caution to avoid interpreting the phenomena from an outsider’s view. Furthermore, they recommend that it is not a standalone technique and in my project, this certainly was not the case. My research included weekly meetings with field experience participants
as well as participation in a number of other diffractive practices, another of which is

*Currere*, which I will explain in the following section.

### 3.4 Agential realism and autobiographical representation

To introduce my second method, *Currere*, I first revisit another longstanding practice in teacher education which involves asking students to write autobiographically, to research themselves, in preparation for their field experience. Much reflective practice for pre-service teachers begins with narrating formative experiences and then examining how and why they were formative (Sharkey, 2004). Maxine Greene (1978) wrote that one needs an awareness of personal landscapes as a way of becoming aware of the landscapes of others. Autobiographical work in teacher education is conducted for a number of reasons, sometimes to enhance student transition and engagement by exploring and transferring social justice understandings, and sometimes in an effort to have students begin to “situate” themselves in the ‘container’ of time/space, from which to write reflectively. Although Janet Miller (2005) writes that autobiographical writing encourages “all kinds of closet doors to open” (p. 219), she also addresses the gaps and silences that are created in uses of autobiography that replicate the self as “rational, coherent, autonomous, unified, fixed and given” (p. 219). Used with teachers, autobiographical writing can perpetuate categories of ‘good’ and ‘bad’ teachers. In hopes of sensitizing students to issues of social justice, student autobiographical work sometimes receives feedback about missing issues such as sexual orientation, privilege, race and class and students are asked to add the ‘missing’ information. This stands at a distance from diffraction’s work of agential realism that is “attuned to the entanglement of apparatuses of the apparatuses of production, one that
enables genealogical analyses of how boundaries are produced rather than presuming sets of well-worn binaries in advance” (Barad, 2007, pp. 29-30). Rather than using autobiographical writing as a form of inquiry that evokes issues of sexual orientation, privilege, race and class, these are often imposed as already captured knowledge to be added on to current student understanding.

Barad argues that the boundaries that allow us to tell one body from another, or one group of bodies from another group, are determined in the intra-actions of such bodies rather than pre-existing them. (Barad, 2007, p. 71-94). Barad writes that because she wants to avoid the realm of representationalism, and its associate, “reflection,” she explains quantum theories of diffraction that offer a way to escape from the object/subject division, allowing for an alternative understanding of the discursive and the material and helping to construct a better understanding of agency as not residing in either subject or object of knowledge. In these ways, agential realism provides a possible alternative which does not rely on classificatory processes, to the representationalism that is present in much epistemological work (Barad, 2007).

Autobiographical work often falls too easily into already anticipated storylines where the narrative is not so much about coming out as it is about at last making everything match up with what is said about oneself. As mentioned earlier, diffraction offers a kind of realism where the agentiality of matter (method/apparatus) has real effects. It is not representational realism, the representation of something substantialized or something that is already present as the difference between subject and object, between materiality
and discourse which maintains a gap between subjects and experience. Realism is about real effects of intra-activity involving connections within phenomena instead of separate things that pre-exist their coming together. Agency in this sense is the doing of intra-activity and about the realities of “changing possibilities of change” (Barad, 2007, p. 178). The effects of intra-activity become elements in further and ongoing intra-activities and possibilities are changed with literally every intra-action.

A method that uses this framework might allow a way to escape from the object/subject division in traditional autobiography and may provide an understanding of agency as not residing in either the subject or the object of knowledge. Furthermore, each intra-action enacts a resolution within the phenomenon that includes the larger material arrangement of practices that effect the distinction. In other words, the autobiographical responses invited as a linear account, or as an account that falls into already determined categories, articulated or not, do not consider what emerges as inseparable from its apparatus of distinction. Yet, it is only through our biographic lived and felt engagements that meaningful educational practice is undertaken.

To engage Barad’s ideas in research with teacher education field participants in an autobiographic way requires a method that embraces the material, social, and subject worlds simultaneously and which must be practiced in order to feel its own self-division. The purpose of this method or practice needs to offer ways to elaborate or take into account the concepts of intra-action, agential realism, diffraction and entanglement and how they enable co-constitutional thinking that does not take up the construction of the subject as attributed by material practices or for properties as individually ascribed. I
offer Pinar’s (1975) method of *Currere* as meeting the conceptual needs of my methodology.

3.5 Currere

*Currere*, the Latin root of curriculum, meaning to run the course, is the central method of the autobiographical theory that was devised by Pinar (1974) and later elaborated by Pinar and Grumet (1996). The method of *Currere* abandons a static view of the subject as that which is acted upon by people in authority so that teachers and students may implement the former with as little subjective interference as possible. On the contrary, *Currere* perceives curriculum to be a dynamic and subjective process whereby students and teacher, the real players in the educational process, can “study the relations between academic knowledge and life history in the interest of self understanding and social reconstruction” (Pinar 2012, p. 44). In other words, *Currere* seeks to understand the contribution academic studies make to one’s understanding of his or her life (and vice versa), and how both are imbricated in the society, politics, and culture (Pinar, 2012).

Pinar (1975) wrote that we should engage the word *Currere* in the infinitive form of curriculum and turn our attention from what contributes to a course of education, towards recognizing education as something that courses. To ‘course’, for Pinar signals an indeterminate outcome for the self through the writing of *Currere*; an indeterminacy that offers an expanded understanding of the self in becoming, in movement, always in process. *Currere* reminds us that there is both a partiality and a temporality, and they come together. Diffraction, as is evidenced most profoundly in the data generated by *Currere*, delves into the materiality and physicality of partially
forgotten histories, making them partially visible as well as making partially visible some of their associated causes: it exposes the world in its complexity.

The method of *Currere* consists of four steps or movements—regressive, progressive, analytical, and synthetical. Spatiality, temporality, and causality do not follow a linear progression of cause and effect in this process; present, past, and future are conflated. Calling *Currere* an apparatus helps to understand that what emerges from each stage of the practice is an agential cut. Each step invites a diffraction pattern as well as contributes to an overall diffraction pattern.

In the regressive phase, one’s past lived experiences are considered ‘data,’ which are generated through free association in revisiting the past and thereby reexperiencing and transforming one’s memory. One re-enters the past and feels some inklings of its remaking of the present. *Currere* asserts that at any given moment one is “located in historical time and cultural place” (2004, p.36). This makes it possible to abandon the idea of looking for one causal point for the production of the subject in any one type of materiality, discourse, culture, the social, the subject, or anything else.

Causality itself is interrogated in Currere’s process. Barad (2007) reconceptualizes causality by underlining that we cannot understand causal relations within a new materialist framework as specific relations between isolated objects. Causal relations demand a specification of the material-discursive apparatuses that enact an agential cut between intra-actively produced entities. This involves thinking of the world not as a collection of individual, self-identical bodies interacting with each other, but as an entangled network of material-discursive phenomena, where bodies are produced differently in different contexts. In the regressive phase of *Currere*, matter is
not considered as something passive and identity/identities are realized as already active. This is not a search for a real or authentic self-expression but rather a generating of cultural and social meshing.

In the progressive step of Currere, one looks at what is not yet and “imagines possible futures” (Pinar, 2004, p. 36). Here one’s practice weaves together a heightened awareness of one’s self in relation to its reactivated past and its feel for the future (in other words, to the effects of what happens). In this phase, autobiographical writing includes the fictive, poetic and mythic. Barad suggests that we are responsible for the cuts that we help enact not because we do the choosing (neither do we escape responsibility because “we” are “chosen” by them), but because we are an agential part of the material becoming of the universe. Cuts are agentially enacted not by willful individuals but by the larger material arrangement of which “we” are a “part” (Barad, 2007, pp. 178-79). Important in Currere’s diffraction pattern are the agential realist terms intra-action and entanglement. As noted in the previous chapter, intra-action denotes that phenomena never exist in themselves but must always be seen in relation to one another/other. Currere provokes this aspect in the sense that it does not only refer to being intertwined with one another but rather “to lack an independent, self-contained existence” (Barad 2007, p. ix).

In the analytical stage, one examines the past and the future. Rather than the teacher being the interpreting authority through which the student “learns to tell the stories others will listen to” (Sharkey, 2004, p. 499) a subjective space of freedom in the present is created. The present, the past, and the future are looked at as one movement. This diffractive pattern reminds us that light can be directed otherwise than
back at oneself, that knowing the self can be something other than self-referential. In the analytical stage, one feels the world addressing oneself as one who is turning to greet the changing world’s new greeting.

In the fourth, the synthetical moment, a person revisits the present. Pinar (2004) describes the experience of this moment: “conscious of one’s breathing, one asks, who is that? Listening carefully to one’s own inner voice in the historical and natural world, one asks: what is the meaning of the present? The moment of synthesis Pinar (2004) feels, “is one of intense interiority” (p. 37). In this phase of the practice, there is an attunement to nuances and details of self in world with new possibilities, new awarenesses. Although Pinar describes this moment as one of intense interiority, I make some translations in terms of agential realism and this final step, which I will explain in the following paragraphs.

In this dissertation I considered *Currere* as a diffractive apparatus not only because it makes explicit diffractive patterns of entangled selves and is a practice of mattering which involves stabilizing and destabilizing intra-activity (Barad, 2007), but because it also situates agential cuts not as taking place in space and time but in the making of space time itself, through which differential agential possibilities are realized. There is possibility for realizing agency not as an attribute but as the ongoing reconfiguring of the world. Rather than being asked to name things, it offers opportunity to practice one’s feeling an embodied capacity to differ. And, rather than attempting to determine which slot in Bohr’s two-slit experiment one might shove their experience through, as particle or as wave, rendering other possibilities more profoundly unknowable, it acknowledges various patterns emerging together.
An apparatus is not to be understood as a passive instrument of observation, but as a material-discursive practice that creates differences and delimitations and thereby phenomena. At the same time, apparatuses are themselves phenomena, but phenomena in the form of open intra-active practices without immanent boundaries. Its forces are enfolded into itself which is perhaps why Pinar describes this moment of synthesis as one of “intense interiority” (2004, p. 37). It is the embodied happening of the physical sensation of new possibilities, the body awakening to new sensations of entangled relations. Diffractive practice helps with understanding the indefinite nature of boundaries as enactments that emerge from within. Barad (2007) argues that the relationship between the natural and cultural is a diffractive wave pattern of what she calls the exteriority within, which means that what is separated out as outside is done by means of diffractive interferences from different material, natural, linguistic, or bodily forces that combine in a material constitutive relationship whereby the world, and it boundaries, are enacted through what Barad calls agential cuts. The exteriority within mechanism allows material-discursive forces to become meaningful as agential realism. Diffraction and the exteriority within this dynamic is what accounts for the intra-dynamic aspects of intra-action.

The process in Barad's notion of the apparatus is directly linked to agential realism and "non-deterministic causality" (Barad, 2003, p. 76), by which she means a causality that is intra-connected with "space" and "time" that intra-relate in a multidirectional way. The apparatus unites the different forces intra-acting on it, making its becoming (or its materialization as a corporeal body in a determined moment) possible.
These differing forces intra-relating are what Barad (2007) calls the enfoldings of the apparatus and it is the intra-relation of these enfoldings, or parts, of the apparatus that turns it into an event, turning this object of knowledge into an analytical tool. Such a movement is significant because it is necessary to stop looking at matter as something passive and identity/identities as always already active (Barad, 2007).

The apparatus enfolds time in immanent ways (multiple and unpredictable). When a case in a concrete spatio-temporality is studied, we are immersed in the apparatus. The exclusions within the apparatus that is being analyzed are beyond the researcher at a specific time; they become excluded realities (Barad, 2007) to them at the present time. The enfoldings of the apparatus do not have a closed end, but for example, since my limits as a researcher facing deadlines are also a part of the boundary that materializes the phenomena, at some point these "ends" are going to be present, and that is what makes meaning not only as an end but as an embodied act that continues to mean.

*Currere*, as practiced by Pinar (1994), can be seen as an attempt to break with a view of autobiography which views the subject as stable, fixed and knowable as opposed to a diffraction of their autobiography. *Currere* is a diffractive practice that carries the past into new contexts, without offering a predetermined self or the conclusion of a life. Although *Currere* has been described as reflexive practice (Pinar, 2004), and although Grumet (1976) described it in classical physics terms as: “a cycle in which thought bends back on itself and thus recovers volition” (pp. 130-131), Haraway (1997) argues that as a critical practice, “reflexivity, like reflections only displaces the same everywhere” (p. 16) and I argue that this is not only what *Currere*
can do. “Diffractive patterns”, she writes, “record the history of interaction, interference, reinforcement, difference” (p. 273) and this seems evident in Currere’s various movements. Clough (2000) as well, writes that diffraction offers “a composing and recomposing that cuts into and cuts away from genres, technologies, images, and scenes so that movement is never simply narrative or a life story” (pp. 184-185).

These conceptual convergences bring an interesting view to thinking about the formation of the subject. The notions of intra-action, diffraction, agential realism and the entangled understandings offered by Currere, challenge the humanist subject as being at the core of agency as they shift thinking to a view that engages material discursive simultaneity, how the conceptualization of human as well as non-human phenomena is agentic, and to a formation of the subject as relevant not only in relation to subject as phenomenon, but also to other human and in particular non-human/material phenomena. Human as well as non-human phenomena should consequently be seen as simultaneously enacted and enacting. The consequence of this is not only to conceptualize the subject as enacting along with objects as enacting, but also to conceptualize objects as enacted along with subjects as enacted.

This means, for instance, that a classroom in which an intern finds oneself should not merely be seen as space to practice how to teach. Instead, it should also be seen as enacted by other objects, by subjects, discourses, etc. New materialist conceptualizations invite awareness and sensitivity to all sorts of complexities in the interacting processes/enacting practices and ways to talk and to understand how multiple realities, multiple selves and matters, multiple relationships and intra-actions
among varying entities across what we have formerly known as subjects and objects actually, make a life.

In conclusion, the central principles of diffraction and agential realism in new materialism are significant in making normative constraints part of the resulting patterns of details as well as opening and reworking agential conditions of possibility. Ethics is paramount in this process that addresses difference through the effects (nuances and details, rather than broad, rational categories) that are generated in phenomena that is in the midst of becoming what it is not. New materialism’s central concern is in fact, ethics and justice: “Ethics is not a concern we add to the questions of matter, but rather is the very nature of what it means to matter” (Barad, in Dolphijn & van der Tuin, 2012, n.p.). I have sought methods such as ITTD and Currere that practice the diffraction patterns of differences “that our knowledge making practices make and the effects they have on the world” (Barad, 2007, p. 72). Researchers have more responsibility in the apparatuses they assemble with in their work as they ask themselves questions such as where do these practices appear to be moving? What differed from the expected? What impact might this practice have on participants with whom we are entangled and finally, what does this real moment, this added reality, now make possible? New materialism understands research as a force that alters or creates reality in both symbolic and material terms (2007, p. 75-81).

This chapter has argued that diffraction is a viable methodology that has potential for assuming a substantive place in the field philosophy of education. The focus on a more creative critique is about making an affirmative pragmatic reading instead of merely classifying to determine generalities or to search for what might be
missing. Diffraction is often performed in a transdisciplinary way and since the focus is on creating new ideas, causality is disentangled from inspiration. One analysis might be developed with theories from an unexpected source. Even if theories do not share common ontological or epistemological starting points, they can still affirmatively contribute to each other’s development.

3.6 Participant Details

3.6.1 Recruitment

In order to obtain research participants, I sent a recruitment letter to cooperating teachers and pre-service teachers with whom I had worked before becoming a doctoral student at the University of Regina. I knew them in my capacity as either a faculty advisor for pre-service teachers during their field experiences or as an instructor in the University of Regina’s Faculty of Education, Teacher Education Program. From this recruitment process I received interest and eventually a commitment to be part of the study from three cooperating teachers and three pre-service teachers. The cooperating and pre-service teachers had been paired by the Field Experience Office at the University of Regina. I worked as each student’s faculty advisor and any potential conflict of interest was addressed in consent letters to both the practicing teachers and pre-service teachers. Of the teachers recruited for the study, one is a practicing teacher who has been in the field for over fifteen years, who has been a cooperating teacher for a number of years and who is active in the high performance coaching world; a second practicing teacher who has been teaching in the field for almost 10 years, has been a former high performance athlete and is currently involved in high performance
coaching provincially; a third practicing teacher who has been in the field of teaching for just over four years, is a high performance coach, who did not identify himself as a former or current high performance athlete. Participants 4-6 were pre-service teachers in the midst of the four-month internship placement, and each identified themselves as high performance athletes.

3.6.2 Recruitment of the Coaches

Participants seven and eight are currently high performance coaches employed by Tennis Canada. Prior to the study I had met each of the coaches while living in British Columbia and working for Tennis Canada. For this research, I contacted each of the coaches by email, outlining the purpose of the study and via email each coach agreed to be part of the study. The rationale for including the coaches is that coaching is also a field of practice focused on expanding body understanding and in which developing a “feel” for situational options for interaction or intra-action is considered valuable. Prior to commencing the ITTD with the coaches, I sent a letter of consent (see Appendix E) to each coach for consideration. Consent from the coaches was obtained verbally at the start of our first Skype meeting. I met, via Skype, with the each of the coaches three times. Both coaches engaged in the actual ITTD interview data collection: each completing an ITTD interview and then a second time when their interviews were returned to them with my jottings and the request to see what might have surprised them and finally, we met to review their doubled responses.

The remaining six participants who were located in Regina, Saskatchewan participated in the ITTD method as well as the method of Currere. As it happened with the research process that emerged, the six field experience participants became
prominent characters in my analysis because the two coaches had schedules that proved too full to complete the *ITTD* and the *Currere*. I found that the particular methods involving the other six participants provided a rich range of data and subsequently became the focus of my analysis in this particular research experience. In light of the fact that their schedules prohibited the two Tennis Canada coaches from participating in both diffractive methods, I made the decision to have their data act more as supportive background in this research, and their data will be addressed in the concluding chapter. As part of my future research agenda I intend to make these coaches and others assume a more central role.

<table>
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<tr>
<th>Participant</th>
<th>Teaching Experience (years)</th>
<th>High Performance Coaching Experience</th>
<th>High Performance Player Experience</th>
<th>ITTD</th>
<th>Currere</th>
</tr>
</thead>
<tbody>
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<td>X</td>
<td>X</td>
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<td>X</td>
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<td>X</td>
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<tr>
<td>Tony</td>
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<td>X</td>
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<td>X</td>
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<tr>
<td>Angie</td>
<td>In Practicum Experience</td>
<td>X</td>
<td>X</td>
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<td>X</td>
</tr>
<tr>
<td>Cindy</td>
<td>In Practicum Experience</td>
<td>X</td>
<td>X</td>
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<td>X</td>
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<tr>
<td>Sam</td>
<td>In Practicum Experience</td>
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<td>X</td>
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</tr>
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</table>
### Figure 3. Participant Chart

<table>
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<th></th>
</tr>
</thead>
<tbody>
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<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Charles</td>
<td>N/A</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

3.7 Ethics Approval

Research ethics applications were submitted to both the Regina Catholic School Board the University of Regina’s Research Ethics Board. Once approval (see Appendices A & B) from both boards was received the study commenced. Written consent was obtained on the day the Interviews were completed. Verbal consents for the professional tennis coaches was obtained via Skype. The ITTD took place in the school where the teachers and pre-service teachers were engaged in the field experience component of their teacher education program.

3.8 ITTD/Currere – Meeting with participants

There were a total of eighteen, one-on-one, face-to-face meetings with the six school based participants - each of these interviews/meetings took place at the school where the participants were undertaking a four-month internship experience as either cooperating teachers or teacher education students. Following the initial interview meeting, I returned to the school to meet with the participants. I met separately and privately with each participant and returned the transcripts to them for further consideration. I asked them to review their transcripts and to notice things that might have surprised them about what they said and if, by reading through their instructions to the double, what if anything they might change. The participants were asked to
complete this portion of the research and send their comments to me within three weeks. Once they had completed this step, I meet with each of them again and transcribed, into the original interview transcript, their responses.

*Currere*

Once the *ITTD* data had been collected, I met with each of the six participants at their school to explain the method of *Currere* and to set a time frame for them to send their writing to me. I provided each of the participants with written information regarding the method of *Currere* which included information about the intention and focus of each stage of the method. Due to their busy schedules while at school, each participant agreed that they would complete their *Currere* writing while at home. In the case of the Tennis Canada coaches, we arranged to have the *ITTD* and the two follow up discussion via Skype. Soon after the study began, the coaches told me that due to hectic travelling and coaching schedules, they would not be able to complete the method of *Currere*. Each coach agreed to have the *ITTD* data remain as part of the study. The results of their data will be discussed in Chapter 7.

I tried to have the *ITTD* transcribed as soon as the final interview was complete so that I did not remove myself too far from the interview and double events. I transcribed, myself, all of the *ITTD* interviews and doubled responses for participants 1-6. For the *ITTD* interviews with participants 7-8 (the coaches), I hired the transcription service, Transcription Heroes, to complete them. In adherence with the University of Regina Research Ethics Board requirement, I submitted this information to the REB.
CHAPTER FOUR: Review of Literature addressing Technical/Rational/Discursive Curriculum for Field Experience: Ramifications and a Few Useful Alternatives

_The same intelligence is at work in all acts of the human mind. But this is the most difficult leap. This method is practiced of necessity by everyone, but no one wants to recognize it, no one wants to cope with the intellectual revolution it signifies._


_Beyond calculation the subject moves from reflexive knowledge to immanent embeddedness given “an insufficiency of calculus caught in a swarm of becomings”._

(Claire Coolbrook, 2014, p. 59).

In previous chapters, Barad’s work in new materialism, and in particular, her theory of matter, of agential realism and of diffraction provided a framework for considering the functions of particular apparatuses/methods in this thesis. In this chapter, I review literature regarding the purpose, and value of the field experience, as well as its humanist roots which appear to stipulate a reliance on the technical rational underpinnings of this experience, along with some new materialist additions to reconceptualizing educational practice. New materialist theorizing contributes to moves away from anthropocentric understandings that focus on human rational thinking and logocentric perspectives which position the knower and the known as distinct technical entities in a pedagogical context. In this chapter, the technical, in relation to the technical rational approach, is considered in terms of something that continues to evolve but only within the bounds of its definition, where the rational in
the technical rational approach refers to human conscious awareness and its capacity for certainty.

4.1 Technical Rationality in Teacher Education

A review of the literature related to the imbrication of the technical rational in teacher education suggests an understanding that instrumentally rational actions are goal-directed, feedback-controlled interventions in a presumed objective world. Bullough and Goldstein, (1984) have argued that the end result of this approach is the reduction of "moral, aesthetic, educational and political issues to technical problems: why and what are reduced to how" (p. 144). Applying an instrumental rationality, underlying an empirical-analytic perspective, treats education as the means to a given conclusion. Within this approach, teaching and learning behaviors are elements in a system that can, in principle, be controlled as the means to a given end (Carr & Kemmis, 1986).

An extension of this form of rationality is to view teaching as a skilled craft based on technical expertise. The constraints to students' learning—located in physical, psychological, socioeconomic factors as causes of inadequacy—supposedly can be dealt with by the application of the appropriate technique. The instrumental view of education leads to the idea that education can be improved by gaining a more complete mapping of the cause and effect relationships in education. The application of instrumental rationality in education is demonstrated by: behavior modification and competency based education (Bowers, 1977); emphasis on control, conformity, and standardized curriculum packages (Baldwin, 1987); and, the dependency on standardized test scores as proof of educational success or failure (Broadfoot, 1985).
This latter application proceeds without questioning whether or not the tests represent the aims that society wants schools to pursue. As a consequence, educational issues become defined as simple technical problems, and educational reforms are directed towards surpassing the national norm. From the instrumental perspective, “teaching becomes the management of standardized ends and means; learning becomes the consumption of prepackaged bits of information and parts of skills; and success becomes teachers and students doing as directed” (Bullough & Goldstein, 1984, p. 146).

4.2 The Field Experience: Some background

As far back as the mid-nineteenth century, literature relating to the field experience indicates that pre-service teachers learned to teach in large part by teaching. In fact, in 1839 a principal of the first public normal school in Massachusetts wrote that people became teachers by “requiring them to teach each other in my presence and by means of the Model Schools where the normal pupils had an opportunity, both to prove and improve their skill in teaching and managing schools” (Borrowman, 1956, p. 71). In Illinois, during the same time period a normal school leader, Richard Edwards noted that:

Another essential requisite of a normal school is that it gives pupils an opportunity of some kind of practice in teaching, under the supervision and subject to the criticism of experienced and skillful instructors. This is accomplished in various ways; by exercises in conducting the regular class of the normal school; by classes of normal pupils assuming for the time the character of children and receiving instructions and discussing questions as
they think children would; and by a separate school of children in which the
novice is entrusted with the charge of a class, either permanently of for a stated
period, as a week or two weeks (Borrowman, 1956, p. 71).

In 1948 the American Association of Teachers Colleges published the Flowers
Report that recommend that the number, length and variety of field experiences be extended. James Conant (1963) wrote:

It seems clear that the future teacher has much to learn that can be learned only
in the classroom. I would argue that all education courses be accompanied by
‘laboratory experiences” providing for the observation and teaching of children
(p. 161).

Soon after, James B. Conant, Othaniel Smith, Saul Cohen and Arthur Pearl (1969)
argued that:

The current situation of remoteness of the prospective teacher from the realities
of the classroom practice must be reformed. Prospective teachers must be
brought into contact with reality through various training experiences and
actual encounters with children in the classroom (p. 9).

While Conant (1963) argued that certain features of teaching can only be learned by
being in the classroom he did not elaborate what they were. Smith et al. (1969)
promoted actual encounters with children in classrooms as a means to make the
experience of preservice education more realistic. Edward Merrill (1967) suggested
that these experiences were useful in assisting pre-service teachers to consider their
desire to teach, to explore how much they had mastered curriculum content, to gain experience in planning and handling classroom routines, to discover how to create positive student teacher relationships and to receive appraisal regarding classroom performance.

Other purposes of the field experience include providing an opportunity to consider, reflect upon and study teaching; to combine theoretical knowledge about teaching with classroom practice; to have experience with K-12 pupils from diverse socio-economic backgrounds; to have encounters with classroom problems (e.g. behavioural and learning); to gain experience with classroom artifacts such as instructional materials and equipment; and to have opportunities for reflection on the social and political components of teaching (Goodman, 1983; Zeichner & Teitelbaum, 1982; Ginsburg & Newman, 1985; Erdman, 1983; Beyer, 1984; Tabachnick & Zeichner, 1983).

This commitment to practice teaching has continued in teacher education. There is ongoing agreement in the research literature that the field experience is a major component in the education of teachers (Smith & Lev-Ari, 2007). Barbara Graham (2006) claims that it is an important rite of passage in a teacher’s career and Harm Tillema (2007) calls it the core of teacher education programs. In fact, the field experience in teacher education has been the subject of discussion among teacher educators internationally for more than a century. Issues that have been addressed in these discussions include the appropriate and optimum length of experience (Carpenter and Blance, 2001; Kosnick and Beck, 2003); the quality of supervision and assessment provided by school-based cooperating teachers, and faculty advisors from universities
(Beck & Kosnick, 2002a, 2002b; Clarke, 2001); the extent of the links between the school and the university (Long, 1997); and the increasing focus on the teacher as reflective practitioner rather than as a competent technician (Clarke, 2006; Coolahan, 2003; Green & Harris, 2002; Zeichner, 1990).

The purpose of the field experience continues to be seen as a way to enable preservice teachers to put into practice the theoretical components of their university course work in relation to specified issues such as teaching and learning approaches and classroom management (Grossman, 2009, p. 13). Considerable emphasis is placed on reflective practice: “One does not learn through experience but through reflection on experience and through interaction with others” (Korthagen, Loughran, & Russell, 2006, p. 1025). During the field experience, opportunities are created for pre-service teachers to begin to research their teacher, “to begin to see things differently” (Korthagen, Loughran, & Russell, 2006, p. 1030) and also to critique the teaching of their teacher educators (Berry & Loughran, 2002). The role of the university faculty advisor is to “share with school supervising teachers the responsibility for shaping the progress of each pre-service teachers” (Kostogritz & Plunkett, 2006, p. 15).

4.3 Technical Rational

To articulate more fully the technical rational approach in the field of education I draw first on John Dewey, a well-known proponent of educational experience that is free from rigid frames of preconceptions and as someone who advocates for immediate experience with both the human and the more than human world. I also draw on Donald Schön, and Joseph Dunne, who have been credited with critical responses intended to highlight the untenability of technical rational approaches in education. I then move on
to Pinar’s reconceptualization of curriculum studies broadly and specifically his thinking against the technical rational subject in education as well as his call to *complicated conversations*. I also draw on the work of Elizabeth Ellsworth who offers multiple openings to work beyond notions of a subject that might be considered only in terms of the rational human.

According to Dewey (1929/2004), traditional curriculum anchors students to the purely mechanical aspects of educational activity that “leads to methods, which reduce much instruction to an unimaginative acquiring of specialized skills and amassing of a load of information” (p. 226). Dewey believed that an inquiry approach to learning offered a reconstruction of experience and was central to one’s capacity for discernment. Anne Phelan (2005) claims that the reconstruction that happens in the learning process of the inquiry of prospective teachers requires discernment: “to first learn how to make intelligent reports of what happens to them as they prepare for and engage in teaching” (p. 343). While Dewey might not have meant for the processes to be partitioned in the way that Phelan prescribes, both consider that learning is an event that becomes part of and changes, the subject, and as such needs to involve more than listening to information or performing certain skills.

Dewey writes that education involves not merely the procedures for pouring knowledge into learners to fill the gaps in their behaviour or for leading a learner directly, in step-by-step fashion, from what they do not know to what they know. For Dewey, learning or knowing is an active, moving, creative practice in which the student must “wrestle with a problem first hand” (1929, p. 43) without all the trappings that are offered by a technical rational approach. In the 1980’s, Schön identified a technical
rational approach as inappropriate for the field of education and became one of its most notable critics. He defines technical rationality as, “instrumental problem solving made rigorous by the application of scientific theory and technique” (Schön, 1987, p. 3).

Dewey recognized, very early in the twentieth century, that a technical rational approach could only result in unimaginative and unsustainable sameness.

4.4 Cuts that separate

What Schön illuminates is the futility in education of looking to technique or science as the only way to resolve issues of practice dilemmas in the field because predetermined methods or organization based on observation limit the complexity of practitioner interactions. Central to Schön’s epistemology of practice is the idea that there are indeterminate zones of practice that practitioners must negotiate. According to Schön (1983) “The situations of practice are not problems to be solved but problematic situations characterized by uncertainty, disorder, and indeterminacy” (pp. 15-16). Furthermore, he suggests that the majority of practice can only be characterized by such indeterminate zones that are not “in the book” (p. 16), and which do not respond in clear-cut ways to the application of technical or scientific evidence.

Schön argues instead, that teachers’ knowledge is created in the teaching context, and therefore is attained through knowing and reflecting while in action. From this view, teaching practice is not derived from a body of expert knowledge, but is based on knowledge that is subjectively derived from teaching practice. Schön’s contributions have been enormous in shifting teaching practice towards contextual subjective experience. His contributions towards thinking in action acknowledge
movement in practice and are therefore in opposition to technical rational practice; a practice content only with keeping things fixed, static and unmoving. Schön highlights the significance of practitioner experience and of the practitioner’s active construction of a conversation with, the situations of practice.

Implicit in this understanding, however, is a refusal to liberate thought from metaphysical prejudices, continuing to secure distinctions between the individual and the environment. Reflexive thinking in action is a focus on practitioner interpretation which assumes empirical reality as meaningful only through interpretive processes which are obtained through naturalistic observation. Such observation presumes the independence of the empirical world from the interpretation. This perspective implies unobtrusive methods: that things can be observed without any manipulation by the observer and their apparatus, and I will address this notion of a neutral apparatus later in this chapter.

Additionally, implicit in reflexive thinking is an elicitation of behavior that does not require prying open existing practices in variational ways that unsettle and mingle modes of becoming. Schön does, however, emphasize that practitioners test out and experiment with various approaches. While he does not go so far as to imagine the subject as emerging from intra-action, nor does his use of reflection notice the realities of what escapes this apparatus, there does seem to be possibility here, for feeling that the practice itself gives feedback to the engaged practitioner, which they must respond to, in moving into the situations that emerge in practice.

In similarity to Schön, Joseph Dunne argues that the field of education has been:

Lured into a technical rational orientation that promises objectivity away from
the subjective; transparency of its procedures; replicability of its operations; generalizability of its findings; predictability which we can use to control; and the provision of unambiguous criteria for establishing accountability (Dunne, 2005, p. 377).

Dunne’s observations are resonant with much current mainstream educational discourse.

Dunne’s solutions promote that it is in, “real engagement with, and in practice [where] a person’s powers are released, directed and enlarged” (1993, pp. 72-73). New materialism extends this by considering bodies’ (or phenomenon) not only productive but as also produced through the very practices of subject formation. While Dunne (2005) argues that “knowing and learning requires an ability to stand outside their subject and in the shoes of the learner” (p. 267), Barad (2007) counters that material/discursive practices are “inextricable from the bodies that are produced and through which power works its productive effects” (p. 7).

4.5 Manifestations of Humanism in Field Experience

Humanism

The concept of humanism is constructed from the Latin word for being human, humanus. In ancient Rome, where the concept seems to have been originally used, humanus prescribed a particular type of human. Humanus was what distinguished, and separated, the civilized human beings from animals, nature and the uncivilized human who in ancient Rome was anyone who lived outside of the Roman Empire. Humanistic ideas and ideals place humans at the center, as they set up a dualism whereby they are defined in opposition to nonhumans. The civilized human in this thinking was also the
rational animal, that is, a human who took up a privileged position as a specific kind of animal, separating it from all other animals (Biesta, 2006).

Humanism is a common Western concept that has historically been used in a wide range of ways to describe a variety of ideas: the flourishing of rational individuals, the common values of all human beings, the engagement of human emotions, civilized human beings in contrast to the uncivilized, the renaissance era, an educational ideal based on canonical material, a contrast to the natural sciences, or simply secularism (Biesta, 2010). In contemporary debates, humanism is often reduced to meaning only one particular thing, namely the rational, individualist Enlightenment concept of humanism, since the Enlightenment period successfully formulated a vision of the modern human being\(^8\). Enlightenment humanism is probably the humanist perspective that has had the largest impact on educational theory, at least when it comes to ideas about educational relations\(^9\). Classifications of humanistic history are performed in different ways but perhaps in equally problematic ways.

Enlightenment humanism argued that man [sic] could educate and create by himself [sic]. The central tenets of this perspective are rationality, education, liberty, and individualism. The purpose of man [sic] was to flourish, grow, succeed, and develop. Enlightenment humanism is probably the humanist perspective that has had the largest impact on educational theory, at least when it comes to ideas about educational relations. Much educational criticism is currently aimed at instrumentally rational actions for minimizing the “significance of experience to its effect on a

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\(^8\) This section is informed by Davies (2008), Liedman (1997), and Hansson (1999).

particular situation” (Pinar, 2005, p. 68). With achievement as the objective, the instrumental approaches focus on tools, resources, environments, techniques, teachers and students as the means to that given end. Ewart argues, “education systems are viewed as an input-output system, where resources and raw materials enter at one end and the finished product, an achieving educated student issues from the other. Within this delivery system, educational problems are viewed as blockages, caused by inappropriate teacher behaviours, student inadequacies or inefficient resource uses” (Ewart in Wright, 2004, p. 643).

The term technical that is often included in the critique of rational addresses to educational practice may need a bit more explanation. When the term technical is included, it is in reference to learning, according to Dwayne Huebner (1975) to apply a variety of techniques to the curriculum and to the teaching-learning process. Huebner explains that a technical value system is one in which activities are designed that become the means to predetermined ends. Jurgen Habermas (1974) argues that the relationship between theory and practice is made up of a generic stock of insights in the form of “principle-governed techniques and ‘know-hows’ derived from research and propositional theory (p. 82). Using the term technical alongside instrumental and rational critiques of educational practice is different from understanding the technical as intertwined with all human movement such as our reliance on pots, baskets, roads, pencils, etc. This intertwining of the technical with humans equates strongly with how the apparatus is described in Chapter Four. The apparatus, as Peters (2015) argues, is the basis of our world; our technical know-how and our bodily forms have coevolved. Our educational practices need to appreciate our literal embodiment of technique
without being governed by technical “quick-fixes” and without forfeiting the capacity to periodically be shaken up, caught off guard or be surprised.

4.6 Rational Human Control

Enlightenment thinkers argued for an idea of the individual and society as things that were bound to develop, or in other words, continually improve, as a means of the individual fulfilling their true potential. This thinking continues to be dominant in the modern educational project where knowledge is seen as consisting of passive representations for the active teacher to transfer to passive students – or passive content for the active student to learn for herself. Gert Biesta (2006) argues that the problem with humanism is that it “posits a norm of humanness, a norm of what it means to be human” (p. 6). The rational Enlightenment human is, to a high degree, something created historically as a typified being. Although the rational aspects are enhanced, there is also room for sensibility and passion. For example, Wollstonecraft (1996) argues that sensibility and passion are part of reason, “For what purpose were the passions implanted? That man [sic] by struggling with them might attain a degree of knowledge denied to the brutes” (p. 11). Hence, the passions were given to humans in order to create a dynamic struggle with reason.

A similar approach is proposed by David Hume (in Barad, 2007). He argues that passions are the driving force of human nature. Hence, it appears that even emotions are caught up in rational humanism through its use of causal efficacy, referring to something’s ability to cause something. Using anger as an example of a powerful apparatus that we often use as causal efficacy, Massumi describes anger’s defining qualities as staccato and unconnected: “What is actually said and done from
one moment to the next is discontinuous by nature” (Massumi, 2011, p. 65). What does continue is not actual contents of our experience but rather the “micro-climate that is life at this moment” (p. 66). Every situation is sundered in actuality by the climate of micro-intervals and this discontinuity gets smoothed over; anger is a carry-over bridging by interaction the actual discontinuity between moments. What appears as actual connection is anger as an abstract continuity to two moments. The openings in every moment are reasoned away in use-oriented or behavioral focus on the flow of action, or continual improvement.

To label contemporary humanism as individualistic rational Enlightenment humanism may be an oversimplified model. At the same time, however, reason is the main aspect that is generally recalled from this period, making it relevant to talk more specifically about it, although, it is important also to remember not to consider periods or theoretical directions as entities with fixed properties, but as tools to solve particular problems. For the field of education, rationality and the flourishing of the individual have certainly been ideas that have helped to develop educational practice that remains familiar today.

Ideas similar to Enlightenment humanism can be traced in other humanistic schools of thought. In liberal humanism, Nimrod Aloni (2007) argues for the use of similar arguments in order to separate humans from animals, placing more value in human-exclusive properties and less in qualities shared with animals. Instead of trying to identify the border between humans and animals, Johann Gottfried Herder (2012) uses another strategy, namely he completely avoids such identification. In fact, not only does he avoid the border, he argues that straying too close to it could be dangerous. The
risk is that human beings could ‘slip’ into animal behavior, disrupting the cultivated life and society humans created through, among other things, dominating the animals. Herder (2012) notes that humans are born rational and linguistic, and that they never act entirely out of instinct (as animals do). Herder saw the qualities that supposedly distinguish humans from animals as dichotomous and oppositional: man[sic]/animal and reason/instinct are the distinction between pure and abject (Oliver, 2006).

Accordingly, what he saw as the “unbroken human” was only characterized by human exclusive properties, not the ones humans might share with animals. Anthropocentrism is fundamental to humanism. Cary Wolfe (2010) argues that “humanist discourse will always be available for use by some humans against other humans” and therefore conserving it even partly “has the effect of ensuring that at least some forms of oppression are inevitable” (p. 241). Anthropocentrism will be discussed more fully in Chapter 6.

The humanist framing of essence of humanness is based on exclusively human qualities such as a developed cognitive capacity for language and rationality (Biesta, 2010). Biesta (2004, 2010, 2014) argues that the humanistic starting point for education is already fixed when the question of what the human is, is resolved. The assumption of resolution is limiting. Traditional understandings of epistemology in which an “independent agent comes to a knowledge project fully formed (Barad, 2007, p. 341) or in which knowing is just a play of ideas, continues dualisms that separate humans out from the world. Knowing is instead, part of being. Knowledge (and hence the subject) is
a “distributed practice that includes the larger material arrangement” (p. 342), ranging across traditional boundaries such as those between “human and nonhumans and between self and other (p. 342). Other critics of the technical-rational note its “strong tendency to dis-embed knowledge from the immediacy and idiosyncrasy of particular teaching situations and from the experience of teachers” (2005, p. 341).

Through this disembedding, it is supposed that what is essential in the knowledge and skill can be encapsulated in explicit, generalizable formulae, procedures or rules. The latter are then to be applied to the various situations and circumstances that arise in practice so as to meet the problems that they present. These problems are supposed to have nothing in them that has not been anticipated in the analysis that yielded the general formulae, and hence to be solvable by a straightforward application of the latter, without need for insight or discernment in the actual situation itself (Dunne & Pendlebury, 2002, p. 197). In other words, the negotiation and learning of the practicum experience is often withdrawn at its conclusion in favour of activity directed towards certain ends. Problems can be problematic but always solvable because of generalized rational knowledge and skilled technique.

4.7 Neutral Apparatus

Dunne (2005), elaborating on Schön’s work, identifies technical rationality as the mainstream of rationalist humanist thinking (p. 375). Securing validity of any knowledge as its claim to rationality (p. 373). He argues that this technical orientation is offered as neutral, because of the ways it follows principles of rationality that can
be applied objectively to any context, and therefore come with unacknowledged bias and distortion based on assumptions of the universality of rationality (Dunne, 1993, p. 7). Currently, the technical rational approach can be seen in demands for evidence based practice and identification with best practices. Robert Slavin (2002) suggests this rational and evidence-based thinking has its hold in theories of education which continue to consider it as an applied field; and by those who argue that research in education should ultimately have something to do with improving measurable, curricular outcomes via particular techniques. Biesta (2007) argues that the continued prominence of the technical rational in the field of education is grounded in the still persistent concepts of measurement tied to their correlation with educational outcomes. Proponents of the idea that education should advance as an evidence-based profession argue that it is only through the conduct of large-scale experimental studies—the randomized controlled field trial being the “gold standard”- and careful measurement of the correlation between input and output, that education will be able to witness “the kind of progressive, systematic improvement over time that has characterized successful parts of our society throughout the twentieth century, in fields such as medicine and education” (Slavin 2002, p.16).

Further, Dunne argues that once a mode of rationality has been hegemonically inscribed, only certain activities which relate directly to that knowledge are seen as reliable and possible because they are easily traced back to other rigors of knowledge production. This thinking places great importance on concepts like ‘objectivity and detachment’ and puts emphasis not on first-person experience but on a third-person
perspective that offers findings which can be generalized in accordance with clearly formulated, publically agreed upon procedures (Dunne, 2005). These are procedures that feed into particular kinds of observation and measurement, kinds of testing and in ways that Dunne suggests are “freed from possibilities of misinterpretation by being maximally purged from the need for interpretation itself” (p. 374). Dunne is highlighting the problematic nature of representationalism that believes in the power of words, ideas or images to mirror pre-existing phenomena. Dunne suggests that interpretation is necessary but does not address the difficulties that interpretation presumes in distancing the empirical world from itself.

Sharon Todd (2010) argues that education ought not to be concerned with “the mere achievement of being educated into pre-defined roles or abilities, no matter how well intentioned they may be” (pp. 4-5); rather it ought to be concerned with becoming in relation through remaining present – in place, body and time. In fact, for Todd, the uncertainty in what she calls the asymmetry in education is thought to create learning and teaching. Todd (2003) writes:

Teaching and learning seesaw between the “bringing more than I contain” that teaching aspires to and the “receiving beyond the capacity of the “I” that learning strives to achieve. Within this movement, of course, there are many surprises and shifts, and the roles marked out for teachers and students are not so rigid as perhaps they first appear. (p. 30)

For Todd, the asymmetry does not necessarily concern just the roles of the student and the teacher, but rather a more essential difference between subjects. In other words, Todd argues, that the teacher and student roles in the field experience are not so rigid
after all.

Britzman asserts that learning how to be a teacher “concerns coming to terms with one’s intentions and values, as well as one’s view of knowing, being and acting in a setting characterized by contradictory realities, negotiations, dependency and struggles” (p. 31). She proposes the teacher as an incomplete project, as unfinished and as in the process of becoming a teacher with others, which is in contrast to technical-rational understanding. If the teacher chooses to become a critical subject, she supposes that what is critical only emerges when the teacher understands herself or himself as subject to uncertainty. For Britzman, then, “uncertainty resides within the acts of a self committed to becoming” (Barad, 2007, p. 3). Those scholars who hold the teacher as already in the midst of assemblages, view emergence as an open rather than fore-closed possibility.

4.8 Discursive

In accordance with others, Michel Foucault cautions that knowledge cannot be understood simply as technical expertise or the knowledge of common sense (Foucault, 1972). Rather, the culture, history, gender, language, beliefs, and practices in a community construct knowledge. For Foucault, knowledge is neither neutral nor objective. Rather it is local, partial, and situated (Foucault, 1972). Knowledge makes possible what can be thought, said, or written. Knowledge can be thought of as an understanding that is specific to a particular time in history or to a particular group of people, and is used for interpreting the world. This means that knowledge is always in a state of construction. It is never seen as a whole, and it is understood as an
interpretation rather than an objective fact or truth (Hacking, 1999). If knowledge is seen as incomplete, it cannot be generalized, applied, or replicated. In other words, there are no universal truths from which standards or norms can be generated to measure them.

The notion of the partiality of knowledge is useful in acknowledging one’s inability to experience all, for example, of light’s totality. In the move to new materialism, Barad considers a more broadly considered social construction of everything and also conceives of bodies as having not incomplete, but rather complete experiences (with light and being), yet existing only in openness to next experience. This puts forward a compelling argument for the necessity of teaching practice in the field experience where one experiments with considering more than what actualizes as well as what is now possible that was not possible before. Barad notes that in his work Foucault; “eschews …humanist accounts that make reference to the intentionality of a unified subject” (in Barad, p. 63). Foucault writes:

Humanism is . . . a theme or rather set of themes that have reappeared on several occasions over time, in European societies; these themes, always tied to value judgments, have obviously varied greatly in their content, as well as in the values they have preserved. . . .From this we must not conclude that everything that has ever been linked with humanism is to be rejected, but that the humanistic thematic is in itself too supple, too diverse, too inconsistent to serve as an axis for reflection. And it is a fact that, at least since the seventeenth century, what is called humanism has always been obliged to lean on certain conceptions of man borrowed from religion, science, or politics. Humanism
serves to color and to justify the conceptions of man to which it is, after all, obliged to take recourse (in Rabinow, 1984, pp. 32-50)

Foucault strongly asserts that knowledge and power are not identical, but inseparable and intertwined. He writes that “knowledge and power are integrated with one another and there is no point in dreaming of a time when knowledge will cease to depend on power” (Foucault, 1980, p. 52). The question of analysis for Foucault is not “What is knowledge?” but “How is knowledge created and maintained?” (Foucault, 1980, p. 53). The central question in analyzing knowledge is how it is produced, spread, changed and used. Foucault was interested in discourse, not as a study of language, but rather for what discourse does. Foucault (1972) asserts that discourses are made possible not only by objective reality but by the existence of particular social and historical conditions, which is in contrast to technical-rational to language and reality.

In Archaeology of Knowledge, Foucault (1972) describes discourse as “the general domain of all statements, sometimes as an individualizable group of statements, sometimes as a regulated practice that accounts for a certain number of statements” (p. 80). Discourse produces knowledge in that it governs the way in which we can not only talk and think about something, but also how we can act or practice in relation to something. Yet, while discourse for Foucault (1990), was a vehicle of control, it was also an instrument for resistance: “Discourse transmits and produces power; it reinforces it, but also undermines and exposes it, renders it fragile and makes it possible to thwart it” (p. 101). Foucault argues that truth is socially constructed; therefore, the point of analysis is to reveal the complex and varied strategies in place that support and
reinforce truth and those that exclude or challenge alternate versions of events. Within the analysis, those practices that bring to life and maintain particular regimes of truth can be exposed.

For Britzman (1998, 2003), both the identity and the role of the teacher are constructed through discourses and discursive practices in education. Discourses are the metaphors, images, rules, practices, and languages that construct an understanding of a concept or object; they direct the ways we think and talk about an idea or concept (Foucault, in Barad, 2008). Equally important to the understanding of discourses is that they create the conditions that allow particular practices, voices, and ideas to be silenced or excluded (Foucault, 1972, in Barad, 2007). In this way discourses make it possible to talk about an object in one way and not another.

Foucault explained how discourses as apparatuses attach to bodies and limit possibilities. As a result of the effects of new technologies increasing human capacity for recognizing the real energies of the ways we take up places, promises, decisions, and assessments, including those of rational thinking, and enculturated by other interactions, go on into the future. New materialism is realizing the necessity of a move away from a sole focus on skills of preparedness in education, towards opportunities for developing a sense of capacity in terms of where to go from here (Kruse & Ellsworth, 2012).

4.9 Discourse and matter

Barad (2007) explains that while Foucault’s thinking as outlined above “cuts through the agency-structure dualism” (p. 63) he is not “clear about the material nature
of discursive practices and how they continue to maintain the tenets of humanism. Therefore, while appreciating the work of Foucault, Barad (2007) explains that her interests have led her to consider the ways in which his ideas of regulatory power and discursive practices remain limited only to the human domain and do not address the language/reality dichotomy, due to his skepticism of modernity’s claim of access to the real and material (p. 2). Barad conceives discourse as dynamic and productive with no fixed boundary between human and non-human and with matter an active participant (Barad, 2007, p. 66). In other words, matter is active and ‘speaks’ in contribution to discourses that also involve ideas.

Without acknowledging discourse as entangled with matter, the effect is that the focus on representation, ideology, and discourse excludes or evades the “lived experience and corporeal practice and biological substance” of knowing (Barad, 2007, p. 4). Although becoming a subject is generally thought of as only involving human enculturation, new materiality argues for a co-substantiality of all kinds of bodies. As noted earlier, Mazzei and Youngblood (2013) argue that maintaining humanism even partly has the effect of ensuring that at least some form of oppression is inevitable and humanist discourse available for use by some humans against other humans.

Barad (2007) asserts that matter exists as a performative agent: materiality and discursivity must be rethought in terms of intra-activity “Discursive practices are boundary-making practices that have no finality in the ongoing dynamics of agential intra-activity” (Barad, 2003, p. 823). This premises a reality that does not exist independently of bodies, but rather, the energy produced by and through them. Barad writes that agency should not be understood as limited to the discursive nor only the
human, and calls for a “robust account of the materialization of all bodies – ‘human and non-human’ – including the agential contributions of all material forces (both the ‘social’ and the ‘natural’) (p. 66). Extending agency beyond the realm of what we usually consider as human, changes the teacher education field experience’s relation to theory and practice. When reality only comes into existence through intra-acting bodies, it becomes much less useful to presume to know in advance and then apply that normalized knowledge to a new situation. Furthermore, when one believes that it is possible to separate human from non-human, it becomes easier to determine and categorize ‘human’ traits against those that render someone less than human.

4.10 Into a Moving Field: Agential realism

Thinking through the scholarship taken up in this chapter which describes how the field experience has been imbricated in technical rational discursive approaches regarding how one becomes a teacher as well as those ideas which challenge this approach, one further feels becoming a teacher as a complex practice that is marked by a context of uncertainty. “Uncertainty” may be understood in a number of academic disciplines as an undesired state of limited knowledge that makes prediction impossible, and thus reflects a misguided modernist intellectual position in which certainty is a possible and desired state from which to know. Uncertainty, however, is not the opposite of the technical rational. Barad prefers the term indeterminacy rather than uncertainty (Barad, 2012). In her view, indeterminacy is integral to what matter is and how it is understood. It is not human generosity or openness that allows difference to be indeterminate; it is actually what matter is. For Barad (2007), agential realism asserts that there is a “there”, but that it does not pre-exist. Rather, it exists in intra-action with
the material discursive. The notion of entanglement is used here in the specific sense given by Barad, for whom, “existence is not an individual affair” (p.ix). According to Barad, “Individuals do not pre-exist their interactions; rather, individuals emerge through and a part of their entangled intra-relating” (p. ix). Bringing these thoughts back to the educational context of the field experience, a familiar tension remains between that desire for certainty, and the recognition that uncertainty is inherent within the shifting and dynamics of human activity. I argue that the technical rational approach is a continued from of rationalist foundationalism that is a recurrent feature of Western philosophy. Its approach, and the intellectual positions that underlie it, is a futile response to the indeterminate nature of dynamic contexts.

Within a technical rational perspective, Phelan (2005) notes: “teachers often struggle to let go of knowledge as generalizable formulae that can be readily applied in practice” (p. 341). With such a narrow assessment of what teaching entails, alternative possibilities become even more unimaginable. Within an agential realism perspective, Barad (2007) extends and challenges the technical rational and its human-centered understanding of agency. Barad writes that, “agency is cut loose from its traditional humanist orbit. Agency is not aligned with human intentionality or subjectivity” (p. 177). Agency, for Barad, “is a “doing” or “being” in its intra-activity. It is the enactment of iterative changes to particular practices” (p. 178). This understanding of agency has been significant in my thesis in the ways it compelled me to attend to the agentic force of matter/discourse circulating in the practice of pedagogical undertakings in the field experience. During the field research for this thesis, one of the things that I came to appreciate more is that focus of the field experience need not be solely on helping
students adjust to particular situations but rather to remind them to attune or re-attune to what particular situations make possible.

Barad also encourages a change of perspective from the universal to the quantum, in order to try to see otherwise, without losing sight of the complex entanglements of matter, of the fact that we are not really able to “see” much at either end of the physical spectrum. From this perspective, the notion of scale cannot be seen as an external measurement that can be objectively applied to time and space but its rather part of the phenomena it attempts to measure: “Time and space, like matter and meaning come into existence, are iteratively reconfigured through each intra-action, thereby making it impossible to differentiate in any absolute sense between creation and renewal, beginning and returning, continuity and discontinuity” (Barad, 2007, p. ix). The ontology of the world is therefore that of entanglement. It entails the constant unfolding of matter across time, but also a temporary stabilization of matter into entities (or rather, things “we” and other nonhuman “beings” recognize as entities) in order to execute certain acts and perform certain tasks. As a result, we begin to see that only very few of these acts will be pre-planned and conscious, which limit the notion of the technical rational discursive approaches in the field experience.

4.11 Examples of Alternative Educational Ideas that seem Useful

Modes of Address: Who does the Field Experience Think You Are?

In Ellsworth’s (1989) book, Teaching positions: Difference, pedagogy and the Power of Address, she asserts the impossibility of predicting and controlling the learning process. As a way of setting the course for the book, Ellsworth suggest modes of
address in relation to the way a film addresses its audience as it proposes the following questions: “Who does the film want you to be?” (p. 22). It is in the midst of this interdisciplinary proposition that Ellsworth elaborates her idea of modes of address in relation to the field of education. Drawing parallels and intersections between film and curriculum, Ellsworth describe modes of address as being about the need to address any communication, text, or action to someone and the desire to control, in as much as is possible, how and from where the person reads the text. She proposes that films, like curriculum, have intended, imagined and desired audiences and are designed to evoke predetermined responses from audiences that have already been located by both filmmakers and curriculum makers, within assumptions of who they already are. “It’s about enticing the viewer/student into a particular position of knowledge towards the text, a position of coherence from which the film/curriculum works” (1989, p. 28).

What Ellsworth suggests is that there is an educational imperative to achieve an exact fit between a film or curriculum’s mode of address and the response of the viewer/student.

Ellsworth continues with a need for a pedagogy “of the unknowable” (p. 38). For Ellsworth, genuine understanding occurs not by appealing to a dialogue to fill in space that emerges between the learner and the text but by recognizing this space as a “space of difference” (p. 38) between the learner and the text, a space in which potential emerges. It is here that Ellsworth proposes a significant challenge to the still pervasive technical rational framework where every thing exists at the edge of its capacity to differ, just at the edge of coming undone from what it was before.
In addition, and of particular significance for the work of this thesis, Ellsworth, explains that the viewer/pre-service teacher is never exactly whom the film/curriculum predicts they are in advance of experience. She argues that what filmmakers and curriculum makers are doing is akin to thinking in the third person, therefore ignoring the ideas that the bodies with which film/curriculum intra-act are always moving, always passing through uncontrollable other bodies (film/curriculum) making film/preservice teacher bodies unpredictable phenomenon in which differences in meanings, experiences, conscious and unconscious desire, and subject positionings always interfere with the goal of achieving exact fits or full understanding between a film’s/curriculum’s mode of address and the viewer’s/pre-service teacher’s response. Ellsworth points to the diffractive nature of how a subject is constituted as she writes: “for not only are subjects always only ever problematically occupied but they also pass through the unconscious and many dynamics of history, desire, fantasy and transgression” (p. 43).

In more recent work of Jamie Kruse and Elizabeth Ellsworth (2012) they add a new layer of meaning and sensation to an expanded understanding of the world’s sociality and the mutual constitution of entangled agencies including:

Not only the energies of colors, textures, and substances that existed millions of years ago as a contemporary force of everyday living”, but also, “the real energies of how the ways in which we take up places, promises, decisions, and assessments made in the past, enculturated by other interaction, go on into the future” (in Triggs, 2012, p. 5)
Barad differentiates this similar description of intra-action in contrast to the usual term interaction, that assumes separate individual agencies which precede their interaction with the world. Agential intra-action is a challenge to rational claims of considering human-centric culture, the measure and meaning of all things.

4.12 Reconceptualising curriculum

It is my sense that a review of contemporary curriculum studies’ response to the technical rational approach and the ways it has framed what it means to become a teacher must inevitably include the scholarship of Pinar and Grumet who propose a reconceptualising of the curriculum field whereby curriculum theorists hope to move away from the widely accepted technical rational approach which suggests that theory exists only to serve the practical effectiveness of classroom teachers. They argue instead, that curriculum theorists have a responsibility to inform everyone engaging in education (students, practitioners, and administrators) that the practices traditionally associated with efficiently implementing bureaucratically determined educational objectives and activities are not the only possible curriculum practices.

In doing so, these curriculum theorists are attempting to restore thoughtful inquiry to classroom activities and they ask educators to question not only the activities in which teachers engage, but the very nature of knowledge as discrete objectives, outcomes, and purposes ordered for the effective transmission of the school curriculum. They argue that it is by questioning the accepted practices and beliefs of those engaging in education, teachers and students are no longer compelled to succumb to the evident demands of schoolings’ institutional situation. Rather than leaving us to wonder how
one goes about this questioning with one’s own mode of address, they offer the method of *Currere* in which there is provocation for sensitizing oneself to new possibilities while feeling the effects of others. It appears that this method of revisiting the past, present and future in an analytical/fictive creation, actually offers what Barad might describe as a diffractive pattern where one is able to register both indeterminacy and the possibilities of small but consequential differences.

Finally, while often thought of in similar terms to the space a container theory mentioned in Chapter Two, is an understanding often associated with the experience of the field. The field is what is common in every field experience but it is seen more often as a technical object, rather than a substantial reality – a phenomenon that changes change. While it would seem that the student teacher, the cooperating teacher or even teaching are often the subject of the teacher education field experience, without a technical/rational approach the subject of the field experience might be considered to be the displacements of teaching and the continual modifications of field experience of possibilities that those displacements effect. While it will be attended to in greater detail in the next chapter, it is worth noting here that perhaps the most meaningful challenge to a technical rational approach for me was working with field experience participants, as we engaged in methods that did not require quick and definite responses, where we witnessed the transgressions of our own limits as well as dwelt for awhile in places where we had not lingered before allowing waves of intensity to propagate in free space. I felt that attending to the details of experience, my own and those of that of the participants created a diffraction pattern that attended to how the variegated renderings
intersected and influenced one another, as well as how this ensemble of intra-actions did not form a unified or self-sufficient whole.
CHAPTER FIVE: Data analysis: Beyond methodological singularity

More is at risk than 'the results; intra-actions reconfigure both what will be and will be possible; they change the very possibilities for change and the nature of change (Barad, 2007, p. x).

Much of the work of this dissertation is positioned, theoretically, in contrast to many conventional propositions about how one conceives of and carries out research in the field of education. This contrast is also enlivened in this chapter in the way I take up new materialist thinking in relation to practices of data analysis as I attempt a move away from conventional practices of qualitative data analysis (i.e. coding).

Barad (2007) challenges researchers to rethink scientific processes, data analysis, representation, the role of the researcher, and research ethics. Using the philosophical writings of Niels Bohr as her point of entry, Barad outlines her onto-epistemological understanding of the research process, which she calls agential realism (explained in Chapter 2), in direct challenge to Western metaphysical epistemological practices of research. As a result of the refusal of agential realism to disentangle phenomenon without questioning the things that are taken-for-granted that allow education practices to sustain themselves in stable categories, Barad offers opportunity to extend her discussion directly into data analysis.

In this chapter, I provide an argument against traditional coding in data analysis and then offer instead, a diffractive analysis along with alternative understandings of onto-epistemological becomings of teaching bodies in the field experience. To accomplish this, I provide a review of some ideas which are positioned in opposition to conventional qualitative research practices; next, I return briefly to a discussion of
humanism and how it continues to guide the way we think and consider data that emerges from study.

Within the field of education, the concept of post-qualitative research data analysis is developing (Lather & St. Pierre, 2013). St. Pierre (2013) explains that the original efforts of qualitative research was to establish an alternative to quantitative social science methodology, "ironically, by relying chiefly on positivist markers such as systematicity, linear processes, technique, clarity and transparency of language, accurate observation, representation, and so on" (p. 654). The problem with qualitative research for new materialists, therefore, is found in its continued reliance on quantitative positivist epistemology and ontology and in its lack of wider consideration of methodological consequences that other theoretical frameworks bring to bear (Lather & St. Pierre, 2013). There is an emergent body of research using post-qualitative approaches which rely on theoretical frameworks that are working beyond the realm of humanism in data analysis: new materialism (Lenz Taguchi, 2010; MacLure, 2013), posthumanism (Blaise, 2013, Jackson, 2013; Pedersen, 2010, 2013), Deleuze (Mazzei & McCoy, 2010; Lenz Taguchi, 2012; Mazzei, 2013), and actor-network theory (Fenwick & Edwards, 2010; Latour, 2004). Further, post-qualitative researchers are exploring new ways to do research non-hierarchically, non-representatively, and from non-essential grounds (Lather & St. Pierre, 2013). Methodologically, we are beginning to experience the effects of the post-qualitative research which has been used with various kinds of data generating methods such as interviews and autobiographical work. In the following chapter, a post-qualitative take on data analysis is undertaken using the methodology of diffraction as explained in Chapter 3.
5.1 Conventional qualitative data analysis

St. Pierre & Jackson (2013) claim that the qualitative tradition of coding is a difficulty for new materialist researchers to give up because it is so teachable and so understandable. Offered as work in contrast to this, Lisa Mazzei and Alicia Youngblood (2013) have engaged in data analysis by “plugging” theories and empirical data into each other. To do so, they explore data and theory as intra-related, not separated where theory is applied onto the data. To do so they deliberate about showing how each constitute and affect one another. In addition, Maria Wallace (2017) explains that Mazzei & Youngblood (2013) engage ideas from Foucault to work the “same data chunks repeatedly to deform [them], to make [them] groan and protest with an overabundance of meaning, which in turn not only creates new knowledge but also shows the suppleness of each when plugged in. Affrica Taylor and Mindy Blaise (2014) attend to the “more-than-rational” aspects of the analysis process, in order to decenter the idea of the autonomous student and offer a theory of living beyond developmental views. The more-than-rational aspects they address include among other things, snow, mittens and dark nights. Karin Hultman and Lenz Taguchi (2010) use a relational materialist methodological approach to analyze how nonhuman things co-create the becoming of children in relation to their relations to things and spaces in schools which might have been otherwise overlooked Hultman and Taguchi, as well as other studies have adapted diffraction to the analysis of empirical data (Mazzei, 2013, 2014; Lenz Taguchi, 2012; Juelskjær, 2013; Davies, 2014).
5.2 Humanism in data analysis

As has been explored elsewhere (Davies, 2008; M. A. Peters, 2006; Hansson, 1999; Liedman), humanism draws from Rationalist philosophers of the seventeenth century who claimed that knowledge of the world is mediated by innate structures of large social systems and human activity (e.g. language and/or culture) and that these abstract systems lead to a universal, unchanging structure of reality (Davies, 1997). Descartes (1998/1637), for example, set out to formulate clear, rational principles that could be organized into a system of truths from which accurate information about the world could be deduced. Descartes’s emphasis was on the rational faculty of the human mind, which he considered an innate structure with a capacity for discovering outside truths. His method, based on mathematics, consists of following certain rules for thinking (i.e. deduction) in an orderly way so that we can know something with absolute clarity.

Descartes’s famous statement – indeed, his assertion of this theory, “I think, therefore I am” affirms the existence of reality in the mind and therefore the thinker’s existence outside the realm of the material.

The Cartesian proposition of one clear Truth (i.e. one way of thinking about and hence being in the world) and of things/people having “their own true and immutable nature, essence, or form which is unchangeable and eternal” (Descartes, 1998/1637, p. 88) fueled various aspects of humanism that have flourished in the last three centuries. For example, Enlightenment humanism of the eighteenth century defined the essence of human as a rational, reasoning individual and the center, creator, and master of meaning, truth, freedom, and reality (e.g. Davies, 1997; Foucault, 1999, Audi, 1999).
Both the word and the concept of humanism, adopted by and proliferated across Western countries and continents, were fully articulated in the nineteenth century and remain a powerful shaper of how we think about ontological concepts today, particularly that of essence, which I describe in the next paragraphs.

Ontologically, humanism refers to ways of thinking about humanness that are essential and universal, with a single defining quality that is shared by everyone. As Davies (1997) explains, “Humanism signifies something that is everywhere and always the same … it is a condition, timeless and localized” (pp. 24 & 32). Accordingly, it follows that the persistent idea of essentialism can be used as a “precondition, even a definition, of humanism” (Davies, 1997, p. 124). In other words, a humanist view of identity, or humanness, points to an essential nature that stabilizes meaning about people who belong to a particular identity category, such as woman, and lesbian (Weedon, 1997). Taking a cue from Davies (1997), if essentialism is an indispensable characteristic of humanism’s human, then we can put to use this concept for critique of humanist (i.e. essentialist) practices in qualitative data analysis. Essentialism locates itself onto qualitative methodology by assuming that people (authentic, stable subjects of research) who speak (from a conscious center) give us (the researchers, also authentic) rational, coherent truths that serve as data for analysis and interpretation. As well, traditional data analysis in qualitative research tends toward humanistic, essentialist practices of sorting and grouping data that appear to be similar and building themes from similar data based on coherence and patterns.

This desire to stabilize essence is a move intended to produce order and regularity under the guise of categories that erase difference and privilege identity among
seemingly similar things (St. Pierre, 2000). That is, in the practice of coding data, categories are created during data analysis, categories that supposedly possess reliable essences and consistent traits for theme-building and subsequent meaning-making. The codes, the themes, and the meanings become stabilized structures on which to ground an unchanging truth about the real – a knowledge claim. Thus, the practice of coding data that essentializes people and their experiences leading to representations of the real and true knowledge, is an epistemology intertwined with humanism.

As has been alluded to, St. Pierre is a prominent voice in this discussion regarding data analysis beyond coding. For St. Pierre, humanism “works against the interests of inquiry and its motivations for immanence and action, and hinders the ethical potential of the research process” (in Hinton & Treusch, 2015, p. 5). On the one hand, humanist interpretations seem to solidify the concepts that are fundamental to our research and teaching (e.g. knowledge and the subject) while on the other hand, we notice inquiry committed to epistemologies that “rely on humanism’s representational logic” (St. Pierre, 2014, p. 17). In St. Pierre’s view, new materialism marks a departure from rigid designations, instead working with onto-epistemology in terms that, she believes, can successfully help avoid the pitfalls of humanism because this new materialist ontology “rethinks the nature of being itself” (p. 18). In this way, St. Pierre argues for an emphasize on the ethical responsibility inherent in the dissolution of the object/subject binary that this ontology proposes as she writes, “If we see ourselves as always already entangled with, not separate from or superior to matter, our responsibility to being becomes urgent and constant” (p. 17).
Adding to this view against traditional coding, Lenz Taguchi (2012b) argues that a diffractive analysis “is not about uncovering the essence or truth of the data. This is an uncovering of a reality that already exists among the multiple realities being enacted in an event, but which has not been previously ‘disclosed’” (p. 275). A wide range of human and nonhuman intra-acting factors contribute to the “uncovering” of a reality through an agential cut. In many ways this is a deeper form of critique than one in which one category is defined against another. Knowledge in this view cannot be created from an outside position looking at the world, but from being entangled with the world. John Durham Peters (2015) argues that this mode of “uncovering” works to make what seems obvious, not obvious at all and rather creates an opportunity for emergence of the “deepest kind of idealism about the hidden constancy of perceived things” (p. 41). This argument stands in direct contradiction to many of the central ideas in traditional philosophy of science and simultaneously it connects to other kinds of science, such as native science and indigenous worldviews (Cajete, 2000). But what does this mean for the role of the researcher if s/he is not seen as separate and objective?

5.3 The Role of the Researcher

Barad (2008a) discusses the importance of taking her notion of objectivity into account. Whereas positivist objectivity seeks to create a distance between the research and researcher, Barad’s version of objectivity, is once again built on a Bohr’s philosophical physics position, and attends to the idea of ethical accountability. For
Barad (2008) “objectivity cannot be about producing undistorted representations from afar; but rather, objectivity is about being accountable to the specific materializations of which we are apart” (p. 91). These same sentiments are suggested by the work of Patti Lather and Elizabeth St. Pierre (2013), Jackson (2013), and Mazzei (2013) who deal specifically with what we as researchers do. According to Barad, the researcher is not representing, nor is she simply “making facts” (Barad, 2008, p. 91). Rather, as researchers, we are “making specific worldly configurations – not in the sense of making them up en nihilo, or out of language, beliefs, or ideas, but in the sense of materially engaging as part of the world in giving it specific material form” (Barad, 2008, p. 91.) Therefore, ethical researchers cannot leave out their own becoming through the process of research.

Lenz Taguchi (2013) speaks to the inherent difficulty in all of this. She argues that it is easy to get “caught up in the taken-for-granted images of thinking and doing analysis” (p. 706), and that to avoid being lulled into this “we need to distort assumed practices of thinking, analyzing, and interpreting and produce a researcher ontology of multiplicity” (714). Instead of working with taken-for-granted images, the analyses must provide habitats for diverse forms of life (Peters, 2015). That is, what is determined from the research must not only seek the truth of social relations but rather, encourage new ones.

In understanding that as researchers “we too are part of the world’s differential becoming” (Barad, 2008, p. 91). Lenz Taguchi asserts that we need to acknowledge that we are part of the research itself. In other words, I am being produced, I am becoming, through this research, through the intra-actions in the ITTD’s and the Currere writing of the participants. I am also accounting my own differential becoming
by the inclusion of my own *Currere*. This decision increased the intra-action between the participants and me, continuing to indicate the entanglement “between subject and object, and knower and known” (Barad, 2008, p. 138).

In order to adhere to Barad’s (2008) notion of ethical objectivity, as a researcher engaged in analysis, I must be a part of the analysis, not as a separate entity but as part of the intra-active becoming of the research and the world. This will require “an accounting of the constitutive practices in the fullness of their materialities, including the enactments of boundaries and exclusions, the production of phenomena in all their sedimenting historality, and the ongoing reconfiguration of the space of possibilities for future enactments” (Barad, 2008, p. 379). Or as Lather and St. Pierre (2014) state: “How might we become in becoming?” (p. 631).

**The Entanglement of the Research Process**

The research process involves a wide range of intra-acting multiplicities/phenomena/subjects. Therefore, the notion of an individual researcher actively working with passive research objects/subjects becomes less viable. In other words, as Edwards (2012) suggests, “the theory question in education is not only about which theories we mobilize, but also about which approach of theory mobilizes us” (p. 525). As such, research is a relational project where the researcher body is one of several parts. Each part plays its own role in the research. Edwards (2012) claims that it is the role of theories to mobilize or affect the researcher. In their research, Taylor and Blaise (2014) argue that their process involves accessing the “more-than rational apprehensions of the ways in which the world acts on us and affects us—
beyond our endless meaning-making about it” (p. 385). Accordingly, more-than rational aspects such as body, affect, impulse, materiality, sensations, and experience should also play a part in the research process.

Despite the fact that this thesis is an intricate entanglement with all eight collaborator participants, it is also my own self, my own Currere, which has been constitutive. All ideas proposed in this work are produced in relation to texts, individuals, nature, students, classrooms, things, feelings, difficult days, stray thoughts about the current Grand Slam on television, my hunching over my newly-built desk, visits with my daughter, laughter, a cup of forgotten coffee beside me…. The diffractive analysis is both vulnerable and unpredictable with respect to this relationality in that it values the unexpected partners and acknowledges the role of the agential nonhumans in the research process. This means acknowledging that the researcher is not the only self at stake, and that all aspects of the research are co-constructing the agential process intra-actively. Mazzei (2013) argues that “a diffractive strategy takes into account that knowing is never done in isolation, but is always effected by different forces coming together” (p. 778). These forces are continuously intra-relational. When analyzing and constructing new concepts, openness to what the theories and data do to the research process is emphasized. In this openness, I studied how the various texts (interviews, Currere) engaged intra-actively with each other, with the researcher, and with other unexpected aspects, for example, how one seemed to pull something new out of the other. When attuning to more-than-rational aspects in the research process, other kind of data can also appear.
Barad instructs that a productive diffractive pattern can appear when texts interact “under the right experimental circumstances” (Barad, 2007, p. 83). In diffractive methodology, this means that a critical perspective is accompanied with a focus on the creation of concepts and development of new ideas (Braidotti, 2006). For instance, Barad proposes a focus on research as being “suggestive, creative and visionary” (as cited in Dolphijn & van der Tuin, 2012, p. 50). This kind of research stirs things together so that for example, we cannot think about coaching, without thinking of how various players, contexts and situations caught us up in ways that we had not anticipated.

Diffraction as a pragmatic and creative alternative renders research as a generative and productive means of creating new thought rather than for the purpose of dissecting errors in what has been previously done. For example, when Iris van der Tuin (2011) reads Henri Bergson and Barad diffractively through each other, each philosopher’s work is strengthened as opposed to primarily serving as the subject of a critique. Hence, following van der Tuin (who relies on Barad), the purpose of this analysis is to pay attention to the fine details of the arguments and to find productive connections and possibilities for development. Rather than sociocultural critique which Barad argues “is over-rated, over-emphasized, and over-utilized” (as cited in Dolphijn & van der Tuin, p. 49) this work demands a more critical critique where focus is also given to a sensibility regarding how we are conditioned by the conditions we condition.
5.4 Diffractive analysis

As explained in a previous chapter, central to Barad’s (2007) new materialism is the notion of ‘diffraction’, which is contrasted to the traditional qualitative research methodology of ‘reflection’. Barad takes her cue from physics, explaining diffraction as what happens when waves pass through an obstruction or opening and are spread differently than how they might otherwise be spread. Reflection, on the other hand, connotes “themes of mirroring or sameness”, whereas diffraction “is marked by patterns of difference” (Barad, 2007, pp. 71-72). As a methodological practice, diffraction allows us to read “insights through one another”, moving us “away from habitual normative readings and accounts grounded in discursive readings that often fail to account for intra-actions” (Jackson & Mazzei, 2012, p. 115). For example, in describing their process of ‘diffractive analysis’, Alecia Jackson and Lisa Mazzei (2012), explain how they ‘plug Barad’ into their own data to read their interviews as enactments or performances, rather than as descriptions or representations. Jackson and Mazzei (2012) view the notion of ‘plug’ as a process of arranging, organizing and/or experimenting.

The purpose of ‘plugging in’ is to make something new, to engage in a continuous process of making and then making again, differently. This helps to explain why coding as an analytic process is problematic for a new material analysis because taking words at face value does not account for how discursive constructions intra-act with material conditions.

From this perspective, "We cannot separate the discursive practice from its production in the material. Nor can we fail to take into account its material effects"
(Jackson & Mazzei, 2012, pp. 127-128). Therefore, a diffractive analysis is not simply about what is told, or experienced, but “about the ways in which what is experienced is formed in the intra-action between the material and discursive” (p. 130). What this means for research practice is that we need to look beyond words and their meanings to what is possible beyond current captures of reality as well as to create data that is not entirely captured in either description or analysis. Reading data diffractively means Jackson & Mazzei (2012) suggest, that “we try to fold these texts into one another, in a move that 'flattens out' our relationship to the material" (p. 131). One of the meanings that I gather from this is that the methods of *ITTD* and *Currere* considered through a diffractive reading helps with understanding how the participants and researcher emerge on the same plane.

Hillevi Lenz Taguchi (2012) describes diffractive analysis not only as an alternative to conventional reflective analysis, but as a ‘transgressive methodology’, that is both feminist and political. She describes it as a process in which the researcher is 'installed in' the data, rather than positioned outside at a distance from it, thus violating the norms/boundaries of interpretive qualitative analysis. This opening up of data to "imagine what newness might be incited from it" (Lenz Taguchi, 2012, p. 270) entails seeing difference as it “emerges as an effect of connections and relations within and between different bodies, affecting and being affected by each other” (Lenz Taguchi, 2012, p. 269). Therefore, as a researcher, my analysis becomes an emergent effect of untangling these tangled connections. ‘Plugging in’ feminist materialist theory to data, Lenz Taguchi & Palmer (2013) suggest, enables a focus on the entanglement
of multiple performative agents (including themselves as researchers) in various material discursive practices.

How might these new insights help to reconfigure the agential cuts we make in relation to the field experience? What implications might they have for researching work and learning? I suggest that a diffractive methodological analysis adds to our understanding of the inherent complexity of this work in (at least) three ways. First, a ‘diffractive’ analysis demonstrates that nothing exists in stable isolation and that connections which are always in a state of flux have material effects, even if these are not immediately visible. The implication of this is that in the development of the field experience we need to attend to the effects of introducing new elements, and of making changes to components of systems and frameworks. A change enacted here will effect a change over there.

Second, reading data through a diffractive methodology enables one to understand how crucially matter is implicated in practice, showing that non-human participants are not mere tools, passive things in the background, but that they play an active part and their participation needs to be taken seriously. The implication of this is that we need to pay attention not only to the design of things such as the field experience for pre-service teachers, but also to how practitioners engage with the nonhuman (including the feeling of one’s own potential) and the effects of these engagements.

Third, analyzing data in this way opens up for scrutiny the implementation of integrated approaches, showing that practice rarely happens as planned or intended. The implication of this is that the translations that will inevitably occur cannot be
predicted and so systems need to be agile and flexible enough to respond to such unanticipated consequences as well as to augment the flourishing of the ongoing assemblage process. Using the non-conventional/traditional methodology of diffractive analysis enables one to consider instability and not knowing in advance as unproblematic, and rather as inevitable, necessary and indeed useful in terms of considering next steps in conceiving of the field experience differently. This type of enhanced understanding of how one becomes intra-actively with matter in the field experience may point the way to alternate modes of address and modifications. Knowing that nothing is fixed or “immutable” (Barad, 2007) means reconsidering the role of the researcher in her intra-action with data in order to notice the entanglements and agential cuts in order to consider what is happening and to imagine what might, and how something might, happen differently in next moments, phenomena and enactments.
I want to encourage doubt about [the] presumption that representations (that is, their meaning or content) are more accessible to us than the things they supposedly represent. If there is no magic language through which we can unerringly reach out directly to its referents, why should we think there is nevertheless a language that magically enables us to reach out directly to its sense or representational content? The presumption that we can know what we mean, or what our verbal performances say, more readily that we can know the objects those sayings are about is a Cartesian legacy, a linguistic variation on Descartes’ insistence that we have a direct and privileged access to the contents of our thoughts that we lack towards the “external” world. (Rouse, 1996, p. 209).

In this chapter, after explaining the participants and methods in my research, I engage in some diffractive analyses of selected responses and in so doing, I explain my ongoing inquiry in what new materialism offers to a research process as well as to understanding the production of the subject in teacher education practicum experience. This chapter is itself experimental in the way it breaks with much of qualitative analytic traditions mentioned in previous chapters. New materialist thinking has not been addressed in field experience research in teacher education where there continues to be a preoccupation with what it means to be a teacher, mentor or coach and certainly what these selves ought to look like and how they should act.

The chapter will explain my research activities that investigate the entanglement of ideas and other materialities to promote a reality beyond those produced by “processes of recognition and identification in reflexive interpretations or discursive perspectives or positionings” (Lenz Taguchi, 2012, p. 265). This research is an experiment that
offers skepticism in the persistent faith that educational practice maintains in our access to representations over things. Rather than a logical necessity, the belief in the working of representations rather than acknowledging its continual material rebirth, is an ongoing Cartesian habit of mind as noted by Joseph Rouse (1996) at the start of this chapter. Little has been done previously in educational research on teacher education practica experience to investigate possibilities of considering the agency of the material in the production of knowledge. Neither has much been done in trying to read matter’s intelligibility in new ways and imagining other possible realities presented in research data.

My aim in this chapter is to use the data collected for the research study as an attempt to reconfigure ways in which we might think about how the self comes into being within field experience in teacher education including insights from those with experience in the field of coaching. Many references have been made to coaching in research about the work of the cooperating teacher in the field experience. For example, in their extensive literature review Clarke, Triggs & Nielsen (2014) explain: This conception [the role of the cooperating teacher] is likened to that of a coach, that is, someone who works closely with the learner in the immediacy of the action setting (Russell, 1997), encouraging and eliciting the meaning that the learner is making of his or her practice (MacKinnon & Erickson, 1988), and judiciously providing guidance to facilitate the development of her or his repertoire (Clarke, 1997; Hatch, 1993; Kettle & Sellars, 1996).

Other comparisons to coaching in teacher education practicum research include those of Bullough & Draper, (2004), and Clinard, Ariav, Beeson, Minor & Dwyer, (1995).
Because of my own experience with high performance coaches and the learning that I gained from these coaches, I have chosen research participants who are not only teachers, but also coaches or who have had experiences of being coached in high performance sports, hoping that they might be more interested in situations where things like position and momentum are only meaningful when actualized in particular research apparatuses (or in particular game plans) as indicated in Chapter Two, and in which a non-deterministic causality is at play as explained in Chapter Four.

In the last chapter, it became evident that much of the existing research in the field of teacher education and the field experience has exhibited an anthropocentric focus. The legacy of the ‘linguistic turn’ (MacLure 2013) featured significantly in poststructuralism has been to encourage an understanding of the production of the self as discursively constituted by teacher education programs and perhaps most significantly in the field experience portions of teacher education. The linguistic turn considered bodies as discursive: bodies that indicated their positioning through their movements. Their movements revealed who they were and if properly performed, their movements could also reveal who they were not. The subject was constructed by already determined external mechanisms, Massumi (2002) argues, rather than by the qualities of its moving experience. An emphasis on the discursive constitution of the self in the field is also evident in the examinations of teacher education’s field experience history, classroom pedagogy and teacher’s work (Hilton, 2003). In many studies, the focus has been on what the self is, rather than how the self comes into being (beyond its discursive constitution) and with what degree of felt potential, or said differently, with what degrees of feelings of capacities for being affected and for
affecting. While it is impossible and perhaps not useful to aim to de-anthropocentrize, it is possible to practice making and noticing shifts in practice that shift presumptions in convenient habituated ways of engagement. These practices begin with me in this chapter. I share a lengthy description of my own struggles in shifting from an anthropocentric and humanist approach to the data. I feel that this is important to include because it shares the difficulty that I realize must be inherent in analyzing any data while realizing that whatever one makes of it, contributes to what it is that emerges. Rather than discounting reality, I am practicing noticing details that may perhaps be taken in previously unexplored directions for participants, myself, and for educational practice and research.

The focus of the rest of this chapter involves an analysis of data that aims to render matter and meaning as mutually constituted in the production of the self in field experience (Barad, 2007). Additionally, while this investigation is situated in field experience, its implications for thinking about onto-epistemology in teacher education broadly may also be felt through the work of this chapter and will be elaborated in the conclusion of this dissertation.

6.1 Beginning my analysis

For many months the completed transcripts became an unwieldy and impenetrable block for me. Even though I could feel the process of reading the data as intra-active, and that there were many moments when completing the process changed my relationship to the data, I was not sure what to make of it. I found myself wishing to return to well-worn habits in qualitative research that include coding or looking for patterns and similarities. I resisted, and there were times when the resistance felt like
failure. Eventually, I allowed myself to use the data as a guide to a diffractive way to proceed. I read and read again, I listened and listened again. I thought. My own experiences ran interferences through the texts of my research. I tried to let my own texts and the texts of my participants lift one another out of their time to make visible how each is conditioned by conditions that I was part of conditioning. I retreated from the data again and at some points, I felt that I was coming to terms with how I might work to see the ‘selves’, including my own, along with my past experiences, emerging from and in intra-connection with data. Barad argues that the data itself is agentic and transformation depends on the multiple connections made in specific environments. If I were to assist in stirring things together, I felt that I might come to resolutions that matter. As I struggled to engage with the block of transcribed ITTD data and Currere writing that confronted me and at times confounded me, I tried to cut through the data, connecting pieces of data to theory in ways that resonated with my own understanding. Sometimes these ‘cuts’ were a way to help me begin to simplify such as by grouping words together. I had to remind myself that simplification was not my only goal and I needed to be attentive to the interferences with the self that were beginning to emerge ever so slowly. The blocks returned.

Barad’s (2007) examples were helpful to me. Her example of the Brittle Star was useful as I searched for a way to begin my analysis. I describe the relation between analysis and the Brittle Star more fully later in another chapter but for now, it might be sufficient to say that this example was particularly helpful as a way of understanding that new problems to be solved emerge literally and materially as effects of mutual engagement. Barad describes the Brittle Star as an example of diffraction whose body
bears witness of the worlds they have evolved to live in and the Brittle Star body both reveals and enables its techniques and knowledge for movement. Brittle Stars have coevolved in concert with their technical practices and environments.

Most often Barad theorizes diffraction through understandings of physics, often calling attention to encounters of light with material structures, and the encounter creates what Barad (2007) refers to as “diffraction patterns”. I found returning to images of thought about diffraction in water and light helpful, as well as to diagrams of diffractive patterns. Thinking about diffraction requires shifting habits of seeing and perceiving. For example, what was especially helpful was to read Barad’s (2007) ideas about interference patterns that are tied to the notion of diffraction and how one might look for them only by looking diffractively oneself, in other words, alongside and across my own experiences.

Another example that Barad (2007) provides is one of waves encountering rock structures. She pays attention to the point of diffraction at which the wave (upon its contact with the rock) becomes a smaller version of itself. Consider again the image of simultaneously dropping two stones in a pond. Barad explains that the “overlapping concentric circles” or mini-waves that emerge are diffraction patterns (in van der Tuin & Dolphijn, 2012, p. 60). Diffraction patterns are not read as reflective images. Each diffraction pattern carries with it unique traces of relations that constitute material objects (Kirksey, Shapiro, & Brondine, 2013) as they intra-act in new relations. This means that each felt relational trace carries potential for further diversity.
Reading again diffraction’s invitation to seek out patterns of interference, and drawing my own understanding of interference, I continue to work with the data. While I believed that my tennis playing and coaching skills might have made me more sensitive to how each change or interference resonates in other interferences, I needed more practice.

Again, I read, beginning with participant one through to eight. Then I read again and I began to write participant’s words, separating them out to consider them anew. I wrote down phrases and exclamations, explanations and impressions that participants had shared. I wrote them close to others that seemed to connect so I could see them close together and consider them in intra-action to see if they sparked something new of the other.
I tried to consider every word that I wrote in connection to the moment of sharing by the participant and I tuned in to memories of the particulars of my encounters with the participants: the knowing, the tension, the release, the certainty and the uncertainty. As I have written elsewhere in this research, Barad’s diffraction involves reading different insights side by side, without giving greater value to any one (Barad, 2007). Through close intra-active reading, interference patterns as well as the differences they produce, are illuminated, emerging to make apparent how things get excluded and new differences get made (Barad, 2007). It became most apparent to me that I was deeply entrenched in looking for what I thought was missing in the participant data as well as trying to overlay generalizations that seemed reasonable. Arguing for the use of materialist approaches in research, Alldred and Fox (2015), explain that by working diffractively the researcher can be made aware of and acknowledge exclusions and constraints that they are making in the analysis as they arise and respond to them (2015, p. 6.4).

Using a diffractive analysis methodology, I understand my knowledge making practices to be ‘social-material enactments’ that ‘contribute to and are part of phenomena’ I describe (Barad, 2007, p. 26). Finally, my own blocks and my own resistance towards the data dissipated somewhat and I began to attune to the Interview to the Double and Currere as agential apparatuses that are in relation with material phenomenon or knowledge, reminding me that knowledge is not a direct action of the human. The Interview to the Double and Currere are experiments in documenting the “entangled structure of the changing and contingent ontology of the world, including what Barad describes as “the ontology of knowing” (Barad, 2007, p. 73).
In this struggling analysis phase of my research I began to realize that I would need to come up with a way to attend to interferences (experiences) from each participant’s ITTD in ways that looked for diffraction analysis already underway. In order to engage with and find form for my response to participant’s experiences, I began to look for how each participant’s second encounter with the methods interfered with the first and how each stage of the method of Currere revealed the ways that each self interfered with the other after each first encounter of writing. Here, in the midst of the research struggle, three of the most significant findings of my research emerged. The first major realization was that neither I, nor Karen Barad, had invented diffraction. It was already happening and I could look for and assemble with its tools of phenomenon, agential cuts, apparatus and intra-action to consider its interferences. Secondly, the participants were already engaged in a diffractive analysis through their participation in the ITTD and Currere and I needed to sensitize myself to finding something of it. As a result, this analysis chapter might be more accurately described as a Double Analysis. Thirdly, rather than trying to minimize interference, I now needed to move the data that I had collected through my perceptions, through my own sensations. To do this, it was important that I read the participants’ interferences, use them to push my current understandings of diffractive analysis and then also write my own interfering narratives, part of which I have shared in other writing (see Sorensen & Triggs, 2017) as well as in various portions of this dissertation.

For the purposes of writing this chapter, then, I cannot simply reflect on my analytic practice as if it were an observable entity. It is a series of movements, sometimes imperceptible, affected already by the choice to think about them diffractively. And if analysis is a set of encounters among meaning, matter, and ethics, those encounters are
always already affecting and being affected and my added meanings are part of what materializes. Recalling early experiments with light described in Chapter 3, the more imagined precision of a measure, the greater the degree of unknowability that slips away. This should not be read as a weakness of a diffractive analysis, but rather, in Barad’s terms, a means of getting closer to the indeterminacy of the “fundamental constituents that make up the world” (Barad, 2007, p. 72).

My analysis of the data then, will be an entanglement of intra-acting encounters. The very act of trying to document them here in this chapter will be one further element in a complex array of entangled movements. The analysis is emergent and unpredictable, a series of encounters with the new. It is demanding work, requiring the capacity to let go of the already-known, and of explanations, of already anticipated categories and coding. It involves difficult and sensitive epistemological, ontological, and ethical work to be sensitive to the not-yet-known emerging in the spaces of the research encounter and to feel one’s imagined boundaries shifting and reconnecting. Barad (2007) claims (on page 4 of this dissertation) that data analysis includes an attentiveness to the tools phenomenon, agential cuts, apparatus and intra-action. I will engage these tools to guide the creation and sharing of my data analysis. The data will be presented in the following ways: The ITTD data analysis and Currere will be combined, followed by a discussion of what emerged using the apparatus of diffraction. This will be followed by an entangled consideration of what the data might mean in relation to the Pinar quote at the start of the dissertation.
6.2. Analysis of Response Data: Phenomenon, Agential cuts, Apparatus & Intra-action

6.3 Phenomenon

Phenomenon, according to Barad tells us much about the indistinguishability of object and subject, of agencies of observation and what is observed. Phenomenon begins with a primary ontological unit rather than with independent participants with inherent properties and impermeable boundaries. Timothy Morton (2012) explains a primary ontological unit as being what confronts our inner potential and is an equal and opposite outer “infinite variety of infinities” (p. 31). From a coaching perspective, the primary ontological unit might be the assemblage of the court, the time, the opponent, the game, one’s own sensations, in addition to the player. There is also a Double Analysis going on in coaching that involves attending to the player’s sensitivity for example, to varying consistencies of bounce, the player’s attentiveness to the degree of textural “grab” of a court’s resurfacing, the player’s reactions to their own reactions to their responses to their opponents or playing partners. Contexts do not play out separately from phenomenon; instead, they are in-folded. This makes a complex analysis for a coach and even includes sensitivities regarding how the coach is responding to how the player is responding to the coach’s responses. Each coaching response adds to the ontological unit that makes new reality with new potential. However we intra-act, we are in a unit incapable of further subdivision. We can only ever, move into another phenomenon generated in part through our movement into it.

I was initially concerned that sharing the transcripts with participants with my comments embedded would be problematic because I feared participants would lose
confidence in my competence as a researcher if I were to make myself vulnerable, include myself as part of the phenomenon. However, through reading other accounts of those using this methodology, I became aware of the value of my own vulnerability, the ways it opened me to connection with others in order that we might evolve, change, differentiate and become different. Most of the participants seemed to enjoy the sharing process of revisiting their ITTD data. Participant 3, Deborah, experienced the more detailed version of my notes and commented on how impressed she was that I had elaborated ideas all about her. She indicated that she wasn’t talking about what was on the page but rather the discussion that my notes had inspired when she reconsidered what she had shared in the interview. Wayne, however, alerted me to some problems he had with seeing the transcript with parts of my self included but later indicated that because he feels like a private person it just felt unusual at first to have a part of me there with him.

Having Wayne direct my attention to our entangled phenomena reminded me that a motivating force for my work is my desire to explore the production of the teacher education subject in practica experiences in ways that do not consider participants as isolated, discrete, and static bits and pieces of the world to be apprehended by practicum students and educational researchers. Because phenomena are lively \textit{\textit{intra-}}actions of matter and discourse, this work seeks what more we might think about the production of the self in the field experience and what might de-center but not diminish the human subject so that its participation in lively \textit{\textit{intra-}}actions of matter and discourse are acknowledged and its powers of emergence re-accessed for more effect and becoming.
As this process of responding to the data continued it felt at times as though I was indeed working and writing in intra-action with participant’s interviews, and able to focus on ‘what a body can do’, rather than focusing on the representational notion of what it means to be a teacher, student teacher or a coach. The analysis process emphasized for me, how much is potentially missed when we hold out certainty. None of the remaining participants commented on the inclusion of my ‘self’ into their data.

6.4 Apparatus

6.5 Agential Cuts

If I consider the subject as emerging from its co-existence with the world, then I must provide opportunity for my analysis to be a habitat for diverse forms of living. This must be an opportunity for both myself and the participant to relate to things or spaces that are often overlooked or held too tightly to a certain time and place and then to engage our sensations to look for alternative potential in each detail.

Wayne

Wayne has been a teacher for almost twenty years and intends to begin PhD studies at some point in the future. Wayne comes from an extensive background as a high performance athlete in various team sports.

**Currere (Excerpt from the Regressive moment)**

*I entered school a bit younger than some of my classmates because of when my birthday falls and was still very much vulnerable and was comfortless without the presence or touch of my mother. When she walked me to school, we just lived down the block, I remember looking intently for her, I failed to locate her anywhere until I noticed her walking down the road to our house. I was sad. My father was the vice principal of the*
school and is a no-nonsense and meticulous man. It was his way, period. I recall being afraid of failing and remember that when I could not stand being at school I would just walk home to find my mother. My mother was my fortress and when I was feeling empty and alone I would always find her. She would never make me feel bad about my choice to return home – she never questioned my decision she always let me be a part of deciding. Sometimes after lunch she would suggest that I return to school – sometimes I did, and other times I just stayed home. My father on the other hand, did not always approve of my choice and let me know.

Wayne discussed the centrality of paternal and maternal relationships in what he sees as a difficult negotiation between the two and how they are intermingled with his sense of self. The flow of this entry is also filled with the intensity of a young boy’s feelings of wanting to be included in choices that made him feel safe.

Excerpt from Wayne’s ITTD:

Despite being a physical education teacher, I see the value in integrating more of the things and the values of the students; so when they are coming into the gym, I talk with them about sports and other things that I know they are involved in like band and drama and things like that. I want to pass on to my students the message that I am interested in what they are doing so that they can see that I value them. I mean we do have tasks to do for sure, but at the same time we need something more.

Along with what I see as a caring side of me, I can also be a hard ass about things. There is definitely a time to get things done- I really believe that; and I recognize that dealing with this side of me is not always easy. This comes from the notion that there are times to interact with students and colleagues but ultimately we are here to get things done. I never play games with students or other teachers; I’m never manipulative.
Also, at this school we are never really included in any decision making around things that ultimately affect our jobs and you need to know that I will never agree with any decision that I have not been a part of.

While diffractive methods seek to enlarge agency within any phenomenon to include the more than human, it also connects, for human bodies, to an intensified responsibility where one’s response is never completed. Each movement generates more potential response with which one can only reposition in the midst of a new response.

[Doubled Response]: I believe in the things that I said here because I really do think that there are ways to do things as a teacher that will mean that your students know what to expect and what they can count on. Otherwise there is a lot that can go wrong – a lot of things that you cannot be certain of. By keeping things predictable you avoid, at least mostly, any chance of chaos breaking out. I can’t see changing these things because I have used them for most of my teaching career and they have served me well.

What I notice in reviewing is how much I need this place and how much I really need to leave it and pursue places where my style is appreciated.

While I felt that the apparatus of the ITTD resolved ambiguity it also provided an opportunity for Wayne to shift the material reconfiguration of the world that came to matter to him and thereby sense new potential as an integral part of the phenomena through which he lives. Instead, I observed that the event was also an opportunity to validate and provide explanation for his current teaching style. I realized that I had anticipated something that would register for me as more transformational, yet I am reminded that it is not only a measure readable by a human observer this is meaningful. An apparatus is affirmative; it is an opportunity to consider my own humanist practice
and the persistence with which I am drawn to thinking that I can remove myself and pronounce judgment on another. Barad explains that apparatuses are not tools to be used to satisfy knowledge projects but are rather, methods of relation. Furthermore, not all meaning is knowable to language and neither does it fall in line with human time expectations. Even the nonhuman world carries meaning; our limited lifespan and attention may not be adequate to much of the world’s knowledge. In my analysis of Wayne’s response, I shifted my focus to ponder how this shift for him will also resonate further for me in this analysis, how familiar I am with acting as though anger belongs to me because of my humanist beliefs in traditional causality. In the analysis, I am part of the apparatus and each propagating wave of the resulting pattern changes roughly in comparison to my own response. I revisit this additional analysis of my own anger in the concluding portion of this chapter.

The text responses of the next participant seem to provide more evidence of the potential in the apparatuses of the ITTD and Currere for promoting the ongoing flourishing of the making of the subject which, in alignment with the research aims of the study, leads to increased attunement to feeling more of the complexity and potential in terms what more a self can become. With this participant I was able to notice the forces of the methods bringing something more into being.

Deborah

Participant two has been a physical educator for almost a decade. Prior to entering the field of education this teacher played women’s hockey at the national level and continues to coach a local high performance hockey team. At the time of the study, Deborah was feeling strongly a need for something new, something different than teaching.
**Currere (Excerpt-Response to the Synthetical)**

I feel like this project of writing the Currere not only opens up doors that may have never really seen inside before, but it has at the same time opened me up. It has actually helped as a way to unlock certain emotional gates in my mind. I may not be a totally new person because of this and the insights from the ITTD interview but I do have new understandings about why I often feel stuck and maybe that can help me make some changes now that might make what happens in the future not so stagnating as it feels now – my job and life I mean.

During my engagement with Deborah’s regressive and analytical phases of *Currere*, Deborah was caught in a mode of thinking about herself and an anger that divided her from the potential to become something more. In the process of writing, she located what she saw as the problem—the cause of her misery — all hinging on a choice that was made in the past. In turn she excluded herself. She blamed others. In the progressive phase of *Currere* she begins to ask what if, in an imagined future she was able to walk away from situations that incited anger, what if she was able to intra-act with her anger differently? Could she engage in a practice that could lead more useful outcomes for her? In other words, what else might she hear if she listened to her anger differently and in the way that she listens when her students are addressing her in ways that show signs of needing the help of a teacher, of her? Could she look at herself with compassion, the same compassion that she currently shows the students in her class, students who excel because of the care and generosity that she offers in order to help them feel cared about?
To regain life energy, *Currere*, for example, encourages participants to confront difficulty in order to loosen its grip (Pinar, 2004) and I argue that the *ITTD* offers similar encouragement. With these new materialities emerging, might Deborah be able to use the exclusion that anxiety currently offers as a way not to reiterate judgments and exclusions but instead invent or feel a new way to receptivity and to thought about a self in ways that allow her to listen with compassion to her own fears, remorse and anger.

A diffractive analysis of the *ITTD* for Deborah involved “question[ing] how basic categories and standards are formed and how they are formed as ordinary” (Peters, 2015, p. 35). Deborah’s initial reactions to her circumstances had seemed justified and as expected. The *ITTD* and *Currere*, however, appeared to be an opportunity for her to examine the rational explanations that she had been using to create a sense of continuity for her anger from one moment to the next. Perhaps the most significant aspect of her analysis is a recognition of the flexibility or, more accurately, the indeterminacy of the apparatus. Whatever boundary making practices we are engaged in to resolve ambiguity, they are not permanent nor separate and each brings new potential.

*Deborah’s ITTD Excerpt*

*So if kids are having issues in my class. Sometimes they will tell me that what I am teaching is stupid or something like that. And I tell them that they signed up for the course, that it is an elective and they don’t have to remain in the class. It is their choice. I tell them that they have the option of not participating and that this kind of behavior will reflect in the kind of mark they get for participation.*
We just have an honest conversation about it. I mean I don’t kick kids out. I don’t send them to the office, but, we all have bad days, so if you are having a bad day and you act out, then I will let you do it unless what you’re doing is going to hurt someone – but I won’t engage in a word battle with them; I tell them that they are not going to upset me with what they say but that they can stay after class to talk about it so that they can figure out how to return to class the next day with a better attitude or maybe they need to stay away from class for a day – and then I always am happy to see them when they return.

In Deborah’s ITTD she was able to see that the many ways she engaged pedagogically with students in her classes where she was almost always delivering ‘second chances to my students because you never know at what point another chance might be the very thing they need to make better choices the next time’. As she read both her Currere and ITTD alongside one another, she could see the ways she was offering a way forward into difference for her students but not for herself. The apparatus she used to resolve ambiguity not only provided a new realization, the agencies of observation she had been practicing began to be visible as part of her experience.

This was also the case for Tony. In another section of the ITTD Tony suggested that there were times when he wondered if he had had enough teaching experience to be a cooperating teacher. In addition, he talked about concerns he had in relation to how effectively he was mentoring his pre-service teacher intern. At one point in the interview, before offering me instructions for the next day, Tony told me that he likes to think of himself as a laid back person and teacher and that it was these qualities that
he wanted to offer his intern – despite this he said that he also felt pressure from the more senior teachers at the school to be more attentive to details in his own practice.

_Tomorrow we are going to run a volleyball clinic, and you will have to set up the gym, you will find that all the equipment is in the storage room. You, and not the grade 9’s, will have to arrange the equipment so that it is not done in a way that allows the students to bunch up. Now [intern] can help you with this but you need to remind her to do the set up and not the grade 9’s. And she will need to be reminded, in case she forgets because sometimes despite being a hard worker, she gets the students to do a bit too much work in the setting up. Part of the reason you need to do this is because there have been a couple of times when the grade 9’s set up the gym and things got a bit out of hand. One kid got tangled in a net and fell and another time kids were jumping over a net, before it was in place, and one of them fell and sprained their ankle. Even though I still jump in and play sports with the student, I think I told you, but I was told by our head that I needed to be in a bit more control of the set up and now I just do it because..._

In this portion of the _ITTD_ Tony showed insight into his practice of both teaching and mentoring and in turn how he was influencing his intern’s practice. His instructions appeared to be linked to authoritative knowledge and indeed, the technical rational. For example, the following excerpt, despite him telling me at times throughout the interview he is laid back, reveals the concerns with following procedure:

_I am meticulous about writing records correctly, that’s always been a point that other teachers in my department have made. Once, at the very beginning of my time here, a parent complained about their kid’s mark and because I had not recorded_
enough daily marks for that student the administrator had a talk with me, and since then I never back off the daily marks. I shared this story with my intern and have told her that she needs to keep very good records because I don’t want that to happen to her.

This portion of ITTD is characterized by what Tony would later called the normative or expected version of what a cooperating teacher and pre-service teacher should be.

[Doubled Response] As soon as read the transcript, my head was spinning about what I had spoken about. I was quite shocked actually, yes, yeah, because I was amazed how much I talked, and then it got me thinking, I was thinking about what did I say and I didn’t say this and I didn’t say that…[laugh]what I left out and wish I had said, [laugh]because I sound so formal and hard when that is not who I am – I really don’t want [intern’s name]to think that teaching is so serious, I mean it is serious but it can still be fun. I also feel a bit angry that I let these senior teachers push my buttons about how to be a teacher. I went through school way after most of them did and I am younger and really have a different view of being a teacher. I think that [Intern]knows this about me because we are also friends – but I have to be doing things closer to who I am. Lots of teachers here, not maybe in this department, like to have fun with their students.

Tony found the ITTD useful and enlightening in the way it allowed him to see the effects of what a previous error in providing enough marks had produced in terms of practical knowledge and solution. He also recognized how difficult it is to speak
about his own job and how much of what he does at work becomes invisible to him. It is in this example where Tony is sensing and feeling more of the complexity of the materiality of practice and how he is in tension with what he considers traditional modes of teaching and mentoring and the struggle of what more he would like to bring both to his own practice:

[Doubled Response] I see that with some of the people I work with that when you’ve been doing a job for a long time you do it almost with your eyes closed and you have your own way of doing things. For me it showed me that as long as I am teaching here I will always have pre-interns and interns - it is sometimes good to have students; students challenge you and you have to explain what you are doing and I always like having a student for that reason.

Mentioning the interference to practice that having pre-service teacher offers, is significant as it indicates the way the form of self-confrontation offered by the diffractive method of ITTD allows deeper understanding of the forces beyond the self that affect an understanding of who the subject is and can decide to be. Tony’s ITTD seems to align with Nicolini and Roe’s (2014) claim that their ITTD participants were not only thinking ‘outside the box’ but also able “to appreciate the nature of the box” (p. 72) as normative constraints were part of the resulting pattern of details.

6.6 Agential Cuts

Tony is a student of the diverse shapes and changes that bodies can assume. He is enthusiastic about his understanding that practice reorders things and that through detailed attention to the body and available equipment there is an opportunity to reinvent everything about oneself.
Tony

ITTD (Excerpt)

Just so you will know on the day you are here: when we are playing a particular sport like basketball or whatever, I usually jump on a team that is not doing so well in order to make things more fair or more even or to instill a sense of competition. It is a kind of modelling—it is also about showing kids that you don’t have to be boastful if you are really good – that it is good to be competitive but you don’t have to take it too far. I try to find ways to make them feel comfortable and by doing this [jumping in] I think that it makes it easier for them to make themselves vulnerable and to ask questions about something that they don’t understand; I show them that I don’t know everything in advance and I think that this helps them not have to always know something – this is something I hope to continue to work on and to build on in my own teaching. One of the other PE staff does not think that I should do this – that I should not play on teams with the students and that I should not make myself vulnerable because I might lose credibility with the students. But for me, even if I mess up it is okay and I don’t think that I lose their respect. I think that it makes me more approachable and in these ways we learn together.

ITTD (continued)

It might be important to know that when I went to university to become a teacher I did not look athletic – I was really skinny and small, not as big as I am now because of working out so much – and it is embarrassing to say that I did not have the first idea about going to the gym and working out and when I looked around the room in my first year PE classes at university, I was unsure if I could make it because as I looked around the room and I did not know anyone and was so hesitant – as I saw people who, quite
naturally, looked like athletes. While things seem a bit easier these days it was hard to start as a PE teacher because I did not come by it naturally. My experience of going to university and being so small and feeling bad about myself for this – like I did not fit in, has given me many things to talk about with students in my classes who are struggling with the same feelings. And, not just about having an athletic build – though this is hard for many students- but about other issues that are related to being in high school and even outside of school. I can talk with students about these things – the things that I have gone through and because I am honest and authentic I know that it really helps. When they hear me talking about their goals and see that I am achieving those goals they don’t just respect me they also come to me for ways to move forward in their own lives – they see that it is possible to change.

Tony [Currere – analytical]

As I consider the difference between this project and reflection activities I have been involved in . . . I have to say that I am somewhat amazed at the changes that are taking place within me. Not in any particular way that someone could see immediately, but in a subtle more intimate way . . . I find that I can make intentional changes in myself.

Barad explains that in agential cuts, agency is actually cut loose from its traditional humanist orbit and is not aligned with human intentionality or subjectivity. Within education’s humanist moorings it is difficult to sense that there are more deciders than just the human in the phenomenon that emerges. Despite not always having precise language for them, it is these moments of finding oneself in the middle of things, somewhat undone, realizing that our movement is governed by variation,
selection or retention of options, that impresses upon us in ways that we remember and want to share.

Agential cuts are enacted by an apparatus and Angie’s shifts in her ITTD offer an example of this:

Angie

Angie is currently a high performance athlete on a collegiate track and field team as a long-distance runner. She has experienced many successes and accolades as an athlete as well as in her role as an assistant coach for this same team. At the time of the study she was in the midst of completing her field experience and was actively entertaining the exciting prospect of finding a job as a teacher. She was able to engage to her love of all physical education programming at the school with her cooperating teacher.

Angie: ITTD excerpt

She is describing what she does during her prep period:

I don’t usually feel stressed out at that point about my lesson and so I use that time just to hang with the students. I greet them with a “hi and hello” and “how’s it going?” and there is one girl who runs cross-country and there are 2 grade 10 girls that I taught during pre-internship and so I feel that I kind of have a relationship with them already. Maybe I will throw in comments about appearance and there is a student who is usually late and we make a comment that he is late again and then they say that the dog ate my homework or whatever and I think that is on purpose to miss the warm up and then there is lunch...

Angie: [Doubled response]

(in relation to her description of commenting on appearance)
Here I think when I read this I wonder about the idea of talking about appearance. I mean it is a reality in sport and the comments I make are never mean or anything. I mean I am telling them that they look good but I wonder if by saying this to them and not to others, they might feel bad and be sad or something so I will have to think more about this one.

Barad explains that agential cuts enact a resolution and produce determinacy from indeterminacy producing difference out of phenomena. Here, for Angie, the resolution she is enacting in diffractive ITTD method produces difference that has new relations and opens what was previously taken for granted into pure potential. Knowing in an agential cut involves “a part of our world making itself intelligible to another part” (Barad, 2007, p. 185) and in this case, part of Angie’s world was making itself intelligible to another part.

6.7 Intra-action

Angie

In Angie’s ITTD she explains that she is exhausted, nervous and afraid. She cited that some of her fear was the result of being paired with a cooperating teacher who she considered “cool”, competent, and someone all the students love and could relate to. This participant engaged comparison of how the students regarded and treated her cooperating teacher and how they regarded and treated her. Any opposition and/or anger she felt coming from the students intensified her anxiety which she notices she turns into becoming more severe with the way that she treats the students she teaching. She notices how when the exciting flow of boys together was interrupted by another student’s angry withdrawals, her need to control this student’s behavior intensified. She
recognizes that she did not allow for alternate intra-actions to emerge and instead felt that the best action was to call the student to account in front of his peers and to tell him to behave in ways she believed a respectful student should behave toward a teacher. In these ways she managed the flow of intra-actions around her by excluding and rejecting the student.

She recalls that she thinks that the students did not notice that it was difficult to manage her anxiety because she is so skilled at putting on a ‘game face’ so that opponents do not sense or feel her anxiety. For Angie, students are considered opponents from whom she must distance herself for protection rather than for whom she will elicit new ways for them to reveal their capacities for noticing potential movement. She indicates that while she could do this well at the beginning of the field experience, there were ongoing feelings of insecurity and often anger and frustration when considering how the students frequently responded to her with ‘tests’ and challenges that they did not exhibit with her cooperating teacher. She ended her ITTD by indicating that there were perhaps too many times when at the end of the school day she would ruminate on what happened in class and that sometimes she would break down and cry.

In the synthetical phase of her Currere, Angie suggests that by engaging with the past and discovering the things that she had buried "because it really was too painful to think about", she was able to release some of the bitter feelings she “was holding inside and could start to think about ways to move forward with a more confident, more positive outlook”. She adds, “I think I believed that in track I came close to reaching my full potential as a person. Writing this Currere has made me feel unsure about that”.

The
method’s event seemed to offer Angie an opportunity to feel alternatives to her involvement in the field experience.

**Cindy**

*Synthetical – Excerpt*

By using the regressive stage, I was able to remember some things I did not even think I knew. For example, going back to remember that my first grade teacher chastised me for talking too much, (something that I have been accused of even today) and tried to make me sit silently in my seat had slipped my mind, it slipped my mind that I felt frozen which lead to me noticing that I often ‘freeze’ when someone criticizes me – what I sense now is that when this happens I become angry and turn the anger inward. For Cindy when the pain of chastisement returned, its impact was revealed and relieved to a certain degree. She further explained that she had never given these experiences a second thought until she engaged in writing her *Currere* and at moments in the *ITTD*. For both Angie and Cindy, diffractive practice seems to reveal the ways in which exclusions do not disappear quietly. Rather, they continue on, materializing with forces that are difficult to ignore and which can instigate further change (Barad, 2007, p.30). Arguing for the use of materialist approaches in research Alldred and Fox (2015) explain that by working diffractively the researcher can be made aware of and acknowledge exclusions and constraints that they are making in the analysis as they arise. These then, compel a response.

Through remembering, Cindy felt her sense of potential was expanded. Cindy’s regressive writing indicates her noticing of the need to be released from this frozen state. She first tried to avoid the memory of sadness and hurt; and then in her
progressive writing in opposition to turning her anger inward, she imagined a bright future filled with humour and laughter as her coping skills. As she moved to her analytical phase, she saw that the avoidance of difficult emotions had become cyclical and something she wanted to move beyond in order to be released from what she began to identify as a cycle of hopelessness.

Intra-action involves opportunity for next phenomenon to be a habitat for more diverse forms of life (Peters, 2015), rather than an iteration of what already exists. What is on the other side of the agential cut is the continuing of intra-action. Barad explains that agential separability in the agential cut is not individuation. This challenges education’s ongoing relationship with humanist individualist metaphysics. Cindy’s analyses are cuts between what is included and excluded from what she is considering. Of major significance in intra-action is that the human does not have full control over these cuts and instead the universe “kicks back” (Barad, 2007, p. 215).

With what recourse however, does this leave Cindy? I suggest that the diffractive methods of ITTD and Currere provided an event in which Cindy moved alongside her own practice in the midst of shifting with her movement. Cindy was able to start considering how habits of thought make some things visible and other things easier to ignore or never see, things like the feeling of the infinity of potential in the midst of every phenomenon. Through an intra-action with these methods Cindy was able to appreciate and begin to understand how her habituated ways of moving through the world were limiting potential for different, more affirmative responses both to herself and students. Neither the ITTD nor Currere asked what she could or should have done.
Neither held Cindy to what she has made of reality or looked for reasons why. Rather, each offers a place for picking up and for being picked up in the threshold of a new trajectory, however slight. Confronting one’s potential for alternative responsiveness is a radical contribution to teacher education field experience. The alternative world into which Currere carries its writer is filled with the same entities of ordinary life but now they are experienced anew and “revealed in all their complex, lively and enlivening glory” (Bennett, 2002, p. xxii). By bringing something new into imagination and intra-action, this mode of self-intimacy in the making of the subject may be a powerful lure to challenging the dominant story of a world controlled by forces of regulative authority. Becoming a teacher has the possibility of being inspired by feelings of the potential in things that rational undertakings may currently be replacing.

_Sam_

_Regressive (excerpt):_

_I remember being fifteen years old and moving to the north to play hockey. At the time I recall not feeling sad about leaving home because being a hockey player was all I wanted to be – eventually all of this would lead to something bigger, something better. I recall missing my parents a lot and how they would support me by driving to my games to watch me and it was good to see their faces. I eventually played in the junior hockey league and I loved the feeling of moving up of skating fast and how it felt to be recognized as one of the best and going as far as I could in the Western Hockey League. But this also causes me to remember when I was 18 years old- I was diagnosed with Hodgkin’s Lymphoma. So once that happened I could not play hockey for a year. I still could skate at that time but I could not play contact sports. So after a year of not playing_
high performance sports, I remember the feeling of losing that one component that makes you who you are in that sport – the recognition, the pay, doing something that you absolutely love at a higher level than most – once I returned to playing I was on a high dose of chemotherapy and at that time they put a lot of young people on steroids to kind of counteract the nausea and things like that and to keep your strength up enough so you can participate in life outside of your illness. I gained a lot of weight when I returned to the sport and I had lost that foot speed that is so important and that I built my hockey career around. From there I played Junior B, which is a little lower caliber and eventually I quit and decided to go to university to become a teacher. I had to make a new plan with new goals.

Excerpt from the ITTD

My health decided that I had to leave high performance hockey. Once I lost that foot speed I needed for hockey I knew that my time in the sport would not be as long as it had before getting sick. So once I knew I could not play anymore I quit and then had to set a new goal. So you will need to understand and I think you do because of your own high performance sport experience, that my athletic experiences inform how I teach. I still want to be the best I can be. When you play a high-performance sport or are a high-performance athlete, you have a drive that you build on, and I bring that drive to teaching. I still want to be the best that I can be. If I could I would be the best teacher in the school but it takes time to build – so my goal is to do this over time, to be the best teacher for me and for my students. So, I feel that when you are a high-performance athlete you are always training. Training to get better, and now that has shifted from hockey to teaching.

I learn every day, trying to learn more and more so that I can give everything I have to my students. What happened regarding my health, rather than altering my drive, it changed my
perspective on how I should be driven, now I am driven to see what I might be able to inspire in my students. Same drive, different focus. I think that I have changed what driven means to me – for my cooperating teacher it seems to be more about learning and working hard; for me, I have transferred some of the ways I would drive and motivate myself-from the hockey days-and now see it more as how can I use my time and energy in ways that offer more to others and not so much about my own personal victories.

Following the completion of *Currere* and in the review of his *ITTD* transcript, Sam indicated that experiencing the pain in the past for a second and third time, he wondered if some of the negative emotions would be relieved. However, what had been painful remained painful. Sam appreciated that the burden of the past needs to be revisited so that alterative paths can be envisioned, yet the ache of the past resurfaces in this effort of return. Here lies a state of paradox without a final solution – of the present, stretching back to the past and extending to the future: contradictions and the ambiguity of life remain while new meanings are generated along the process. It is neither the heaviness of the past nor the lightness of the future that can enable us to be fully present in lived moments, but our responses to both the past and the future in life-affirming ways may lead to a creative relationship with the present.

The return to the past in *Currere* allows for working through emotional blocks to reposition oneself and the world (Pinar, 1994). The surfacing of difficult emotions and the process of seeing them through the apparatuses of *Currere* and *ITTD* holds the potential to provoke new insights and to bring about movement. Here the working diffractively leads to an increased ability to envision the hope, the something more for
the future. Both of these methods strengthened the link between life experience and imaginable futures.

This unlocking of rational control over the mind seems to allow what is forgotten, to return in new ways, though perhaps with no less intensity. It introduces the internal experiencing of time that is not chronological. All participants reported that the flow of time in memory was not linear and instead the one memory jumped to another which many felt allowed them to suspend categorical thinking and judgment, making room for what many thought were forgotten to return in ways that did not seem chronological. Although not addressed fully in this research practicing diffractive methods may also have the potential for new sensivities to the fleetingness and spaciousness of time, the actuality of its field of non-simultaneity (Peters, 2015), the impossibility of its capture by all of our efforts in probability through calendars and standardized time (see Peters, 2015; Kruse & Ellsworth, 2012). For the purposes of this research, the stirring together of time seems part of practice in feeling the indeterminacy of the apparatus in a move away from traditional conceptions of cause and effect.

Pinar argues, “Work with the past, release from it, allows loosened identification with fear of the future, and allows heightened intuitive sense of where one may go” (1994, p. 59). Deborah revealed such a dynamic in her analytical step: “Having done the regressive stage, I was better able to write about my future. I don’t think I could have done that if I had not looked back at my past first”. However, such a work does not happen automatically. In contrast with the articulation of the pain in the past, sometimes participants’ progressive writings were filled with scenes that were bright, exciting or peaceful, and free from conflicts. While unburdening of the past leads to
more pleasant writings in the progressive step, an idealistic flight into the future without moving through difficulty is not the same as embracing the future with all its possibilities. Wayne was able, in responding to my written feedback in the ITTD, to analyze this contrast and consider the potential that he felt in ways he might reconstruct the present. Below is an excerpt from his original ITTD interview as well as his doubled response:

Wayne ITTD excerpt:

Most often in my day I don’t stop for a break between classes, in between and if possible you could maybe take 2 minute or so here in the office to sit and relax. I know that it is not ideal but I always do this. For me efficiency is key. As you know, I share this office with another teacher and while her intern has her own office in another part of the school, she is always in here. Chatting and it gets on my nerves. One time I came in here and the intern was sitting at my desk and when I came in the intern did not get up. So, I just stood there looking at her until she got up. You may have to ask her to move if she is there on the day you come.

[Doubled Response]-As I read this portion of the interview I guess I was a little surprised because it doesn’t make me sound too nice but the thing is, these interns are here to learn how to become a teacher and when we have other spaces for them to be, then I think that out of respect they should use them and not be in my and the other teacher’s office all the time. Also as I read this, I was just really aware that you know, that some things I thought about saying I did not say... [laugh] ...I thought of what I could have said that and I didn’t say it. Also in some cases I was not aware of what I had said. Part of why I teach as I do is, part of it was maybe that that was how I was mentored.
I don’t want [Intern] to think that I believe that I have all the information or the answers .... because I have been out of the teacher education program a very long time. I do learn things from [Intern] and in some ways [Intern] lets me in on the new things that he learns from university.... what I try to do with the student, is to work so they can see the importance of my knowledge base. So the intern can see it is alright to learn from me, that I have something to offer and that I am open to discussing things on a professional level with the interns; you know, about what they are learning at university, from their point of view, that’s something I have always done.

As with some of the other participants, as Wayne became aware of what he had spoken during the ITTD interview, he was able to begin to articulate different and alternative options open to him, and to the interns.

All of the participants acknowledged in their writings or in interviews that “reentering” the past brought insights into their lives that they would not have gained otherwise. Most participants believed that regressive writing was the most important step in bringing about past events that they felt they could appreciate differently. Relationality was a particularly important theme underlying many participants’ memories. The first thing Deborah named when thinking about her early childhood experiences was the interconnection, even when there were missing links in her life. Understanding their own childhood made participants aware that the impact of teachers with children stays with them through adulthood. As a result, both Sam and Tony renewed their commitment to finding ways to increase their students’ potential for more than what might happen on any given day. All of the participants noticed how their own experiences of the past continued to resonate as influential in their
pedagogical relationships with their students, their devotion to improving the quality of life for children, and their vision of creating a sense of belonging in their gyms and classrooms. Their *Currere* writings strengthened the link between their life histories and their educational outlooks. For example:

*I see how I've internalized an agenda about what it means to teach. And that I have also, in comparing myself with my cooperating teacher, I'm starting to internalize her agenda. I am doing what I think I am supposed to do or what she will think will make me a good teacher. I am forgetting myself. I am a leader in my sport and on my team, but I seem to forget that when I walk in here [school]. My experiences in sports have made me resilient and I need to find ways to incorporate these experiences into my teaching. Habits of pleasing are getting in the way of me doing that. Something I should seriously think about.*

(Angie, Synthetical excerpt from *Currere*).

The return to the past in *Currere* allows for working through intellectual and emotional blocks to reconstruct one’s relationship with oneself and the world (Pinar, 1994). The surfacing of difficult emotions and the process of working through them promise to provoke new insights and to bring about movement. Working through difficulty leads to increased ability to envision the future anew. This ability involves seeing that there is potential to escape dominant discourse and habituated patterns of moving and this escape happens in the midst of disintegrating the subject and its methods, by which they are accustomed to responding. One crafts a new center of gravity, literally, and not as a hypothetical point. It is the interruption of the body’s necessary relation to the grounding force of human action that transforms the invisibility of gravity to the visibility of its effects and this is the self-renewing
condition (Massumi, 2002). In the midst of diffractive methods, opportunity is provided for amplifying this feeling of being off balance which according to Massumi (2002) triggers a new self ordering, and makes visible the infinity of the mutability and connectivity of one’s body. Cindy stated that by revitalizing her past and recovering what she had tried to bury because it was too painful to really think about, she was able to, “release some of the “bitter” feelings she had embedded inside and move forward with a more positive outlook which brought forth more self-confidence in myself”. (Currere – Analytical).

Diffraction reveals the ways that exclusions do not disappear quietly, rather they continue on, materializing with a force that is difficult to ignore and can instigate further change (Barad, 2007, p. 30). In articulating those painful memories connecting affects with words, the attachment to those emotions is loosened, not so that she can move beyond them, but so she can participate in making them into other reality. Cindy said that there were times when her life felt like it was flat and that any openness to new possibilities was blocked. All the participants articulated the benefit of discovering and addressing an internalization of rigidity as well as the feeling of loosening their imagination about what might come next. In terms of educational practice, it seems readily apparent that opportunities for re-formation of the self should not be lost at the expense of seeking change in social institutions. This is important in regards to imagining institutions and subjectivities that do less violence to the world’s requirement for diversity and variety.

In neglecting, ignoring or repressing dark periods of life, the participants all seemed to sense a loss of vitality. They had somewhat unconsciously registered
themselves as fixed. They all suggested that the *Currere* method encouraged them to think about their current practices (*ITTD* responses) and allowed them to confront difficulties in order to sense ways in which the grip of those difficulties loosened. After discovering that loss and sadness were the part of his regressive writing, Sam also saw the substantial shift that followed. He wrote about making a conscious choice to learn from loss so that he could “apply the wisdom obtained from these poignant life experiences to my future” (*Currere* – Analytical). Some of that wisdom included the body drive that he had experienced in his time as a high performance athlete. It now seemed to resonate with a different focus-towards being the best teacher he can be. Feeling a “drive” in its movement that does not go directly from one party to a second party in a direct causal effect, often augmented in teacher education pedagogy and research analysis, highlights a body’s diffractive movement.

Aspects of our selves, or the subjects we intra-act with in educational practice are qualities or ways of expression that we tend to think of as fixed. Instead, expressions are not fundamentally ownable. Massumi (2002, p. xxxii) writes that the language of expression overspills phenomenon and is not directly reactive. The opportunity to practice a method that invites working alongside something that is currently underway, was also an opportunity for Sam to sense the familiarity of the drive that emerged in his athletics, emerging also in another situation as well as how this emergence was part of his current practice. Sam felt that the research methods were part of a new capacity to revisit hidden passages to loss and difficulty, enabling him to respond to new landscapes—both inner and outer landscapes.
Practicing diffractive methods provides an opportunity for feeling a part of arrangements that organize lives which are often followed without sensitivity to alternatives. In contrast with the articulation of the pain during the past, sometimes participants’ progressive writings were filled with scenes that were bright, exciting or peaceful, and free from conflicts. While unburdening of past experience leads to more pleasant writings in the progressive step, an idealistic flight into the future without moving through difficulty is not the same as embracing the future with all its possibilities. Sam was able, in responding to my written feedback, to analyze this contrast and reconstruct the present. He explained that his definition of inner drive had shifted and now involved offering more to others and thinking more relationally.

Vivid descriptions of senses were abundant in many of the Currere writings. Smell, sounds, colours and images were among the first things that appeared in their memories. When I asked how they began to remember the past, all but one of the participants responded that images or fragments came to mind first before any actual writing of the phase began. It seems that the work starts with the body, its sensations of scrambled, randomly accessible pasts, and its preservation of unknowable pasts in DNA, our immersion in the “leavings of those who’ve gone before” (Peters, 2015, p. 91). From this view, the body’s feelings of capacity for affecting and being affected respond to external impingements on it that have not yet or perhaps never will, register consciously for us.
6.8 Conclusion of analysis

This diffractive analysis has been based on Barad’s notions that different material-discursive agential cuts will facilitate the emergence of determinate entities differently from the entangled matter that constitute a phenomenon. In Barad’s agential realist account, she explores that apparatuses are not tools to be used to satisfy knowledge projects, that an apparatus such as analysis is instead, a method of relation. Rather than being concerned with scrutinizing what an apparatus is, she is more interested in what an apparatus does and how it does it. In her view, the apparatus is not simply a material object but rather a part of a material-discursive process of materialization that is in relation to material phenomenon.

Considering Barad’s new materialist take on the position of the human and her theory of agential realism, as discussed in Chapter Two, which include concepts such as phenomena, which are entanglements of intra-acting agencies, agential cuts, apparatuses and material-discursive intra-actions, and co-constitutions of object and subject, I approached my analysis with the understanding that the research study consisted of an entanglement of intra-active agencies. As such, this analysis was in no way linear. It leads in many different directions, the result of which is multiplicity and ambiguity, which keep analysis and knowledge production “on the move” (Mazzei 2014, p. 743).

The diffractive methods of ITTD and Currere do not innocently go back in time and space searching for origins, reasons or tracings of a past and history that really happened, nor of a future that should happen. Instead this method intra-actively
reconfigures the self that is produced at each phase of writing. The diffractive qualities of *Currere* are underpinned by the ontological assumption that neither the selves that are engaged, nor the selves that are generated are ontologically given in advance of intra-actions (Barad, 2007, p. 246).

For the research participants the *ITTD* process provided opportunity not only for being surprised by their own shifting responses but also for feeling themselves as malleable and connectible bodies in new networks of relation. Wayne, for example, was surprised that his words sounded harsher than he had thought they had; he was surprised at some of the things he had verbalized but had not realized he had done so. He also realized in the doubled response, that in the initial interview, he had actually thought of much more that he could say but refrained from doing so. He had forgotten these thoughts and now they were made present to him again. He repositioned his initial response by noting that he does not want to come across to student teachers as knowing everything and he admits that he learns from the student teacher as well. In relation to other responses, he re-articulates and reaffirms his initial position and as he does so, he begins to realize a distance between who he wants to be and his current place of employment.

Angie’s doubled response in the *ITTD* process highlights other contributions to her awareness of the means by which her subjectivity is structured and this includes the ways in which she reads her student teaching through the expectations that she has of herself through sports.

Deborah, for example, was able to feel herself as part of the reality that she was describing with choosing to have interns in the class despite the difficulties that have
been involved for her. The diffractive ITTD apparatus assisted her in making less of a
definite cut between herself and the student teachers.

Deborah (ITTD) Excerpt:

Some of the reason I have interns is because I did not have a very good internship
experience, I did not have a great cooperating teacher and so my teaching experience,
or trying out teaching was not very good. My co-op was very young, in fact I think he
was just two years older than me and so it was really hard for both of us. And when I
graduated and working for only two years I was asked by the university to take an
intern and I did– he was not a good teacher and I was not ready to mentor someone,
and I likely should not have mentored but the school felt pressure to take someone and
so I did. I was reluctant to give up my class, probably because I did not know what I
was doing. I was not into confrontation by this time and so I did not give good feedback
– in a way I was going through all the things he was. Learning to teach, learning to
manage students it was not good. It was awhile after he finished that I took any more
interns. I mean if you get a bad one then you have double the work – you have to teach
all of the classes because they can’t and then you have to teach them stuff because they
don’t have a clue.

[Doubled-Response]

Reading this I felt that I had been harbouring some resentment about my own
experience in the internship I had and that when I got my first intern, even though I
said I was doing it to give back it was little bit more of just doing it to do it and did
not reflect how I am today which I could have said more of as a contrast. When I was
a high performance athlete I never gave up and when I read this I see some of that
missing in what I told you about why I take interns. In my coaching, even locally, I focus on the importance of relationships, and building relationships and so when I have an intern like the one I have right now, I can say to her ‘just go’ and she takes that and does her own thing. So it lightens my workload [laughs] but it also allows me to sit back and think about how I might help her. The other thing is that I would have liked to tell you that I have had hard interns since that first bad one and I use my coaching skills and my relationship skills to find a way in with them. Because I am more confident because I am not harbouring a grudge about my co-op I can give in ways that reflect who I am.

In general, during the doubled responses and the self-confrontation it made possible, all but one participant looked beyond what might be considered the traditional, rational, approaches to becoming in a field of practice and openly discussed alternative professional and personal ways of doing and being. This ranged from references to other teachers who they did not wish to emulate —this included those they considered experts in their fields - to alternative models teaching. Angie, one of the pre-service teacher interns, talked about desire to incorporate some of the holistic and relational teaching practices of a former professor in the teacher education as well as her wish not to become ‘a clone’ of some of the teachers she had encountered in her K-12 education. This was voiced through her concerns regarding the spread of the traditional model of teaching that she hears in students’ language and discourse.

I suggest that the ITTD data selected for analysis in this chapter has provided different phenomenon, different selves for the participants to grapple with. The self-confrontation offered through the method of ITTD does not produce the sameness that is found in the process of reflection. Instead the diffractive potential of this method
encouraged the participants to feel more of the complexity and potential not only of materiality of their fields but what more they could offer to it. As Barad put it: “A diffractive methodology [is] a practice of reading insights through one another while paying attention to patterns of difference” (including the material effects of constitutive exclusions) (Barad 2011, p. 3).

Where reflection and reflexivity are inclined towards articulating the unexplored meanings or hidden meanings that are inherent in practice and the self. This thinking facilitates the search for new meaning through ‘digging deeper’ into what people already do and how they can improve and match a better representation of themselves. Diffraction, is ‘more attuned to differences’ (Haraway 1992, p. 299) more interested in bringing out the fundamental divergence of practices over time.

While the end of both reflexivity and diffraction is to help “participants to sense the underlying assumptions of the field in which they practice” (Cotter and Cullen 2012, p.231). Diffraction is thus attuned to widening possibilities rather than articulating meaning as is found in both reflection and reflexivity. The diffractive potential of the ITTD multiplies what a practice and subject may be rather than trying to reveal its inner core. In this sense ‘diffraction moves from identifying what was present and contained within an interaction to analyzing intra-actions as a process of producing differences’ (Haraway, 1992, p. 287). The self-confrontation triggered by the ITTD is designed to produce multiple perspectives by introducing that interferes with its original. The diffraction is thus a result of the difference between two representations that should be the same. The shift is not from one stable way of being a teacher/intern/coach to another; rather the multiplicity that is offered remains as something to consider for future
movement. Learning is obtained by noticing the multiplicity and feeling the malleability and relationality of one’s movement.

Throughout the process of analysis, I engaged in writing my own *Currere*. I stopped and started many times. Using a variety of examples from my past. I would regress and find the memory too harrowing, too hard to imagine writing through. Much of my past is too painful and despite my trying and reaching for happiness, my memory would not find me there—it always drew me to particular parts of my childhood—to the infinities of trauma of being a child. As I worked with the participant *ITTD* data as well as their *Currere* writing and the varieties of repositioning that the participants were in the midst of, I realized that this data was an apparatus through which I was co-constituting my own subjectivity as researcher, teacher, mother, daughter and partner, in new and emergent ways. I actually sensed a feeling of release. I share some excerpts of my writing below.

Michele – Analytical Excerpt, June 3, 2015

*Time Cannot Be Fixed (Barad, 2003, p. 264)*

*In the introduction of the dissertation I suggested that one of the driving forces for this work was a release from the destructiveness of the past; a past which included forms of parental mistreatment that left me feeling sometimes broken and many times angry. The anger I felt about being hurt as a child was difficult to come to address. The anger has been difficult to come to terms with because the means I took to deal with it left anger’s force to affect in ways that did not move me back into the world differently. Trying to come to terms with the anger through (therapeutic) discussions of woundedness, unfairness, guilt and sometimes notions of revenge left me, for years, suspended in reflection and the optical illusion of change that carries certain*
expectations of both self and others. I spent many years in talking (reflective/reflexive) psychotherapy to try to wriggle free from the pain, hurt, and anger but it did not abate. The method/apparatus through which I ran my life, my pain and my anger left me in stasis.

Barad (2003) argues that:

To address the past (and future), to speak with ghosts, is not to entertain or reconstruct some narrative of the way it was, but to respond, to be responsible, to take responsibility for that which we inherit (from the past and the future), for the entangled relationalities of inheritance that ‘we’ are, to acknowledge and be responsive to the noncontemporaneity of the present, to put oneself at risk, to risk oneself (which is never one or self), to open oneself up to indeterminacy in moving towards what is to-come (p. 264).

Michele [Synthetical Excerpt]

Currere writing for me, my self, has offered more than what I set out to do. The once felt moments of anger, of a self brimming with despair, documented in detail by a psychotherapist after being discussed and analyzed, demanded something more than the usual interpretive strategies. My anger does not belong to me alone. It did not originate with me. It comes into existence in the intra-action of past experience and a future I imagined I would have. It comes into being with my mother’s ghost. It does not originate in me. And while the anger is not unreasonable. ....

Like Pinar, Barad suggests that:

Time cannot be fixed. The past is never closed, never finished once and for all; but there is no taking it back, no setting time aright, putting the world back on
its axis. There is no erasure finally. The trace of all reconfigurings is written into the enfolded materializations of what was/is/to come (p. 264).

Michele – Regressive Excerpt. August 9, 2016

After the age of 22 my memory stopped being very sharp. For a short time I found my ‘self’ in the fog of the medication Lithium, and talking therapy all the while planning my comings and goings from university so that I would never be home alone with my uncle in the house where I was living with my mother’s sister. I could not tell all of the story really because as I had been told too many times, it is not the Newfoundland way. So I reclined in a therapist’s office telling half-truths about why I was anxious and depressed. As I think about this situation, the sense of fear, the smells of danger, I also see that the half-truths were actually armour against deeper, more painful memories of my time elsewhere—those early toddler days in San Francisco, California.

Michele – Synthetical, March 15, 2017

It is now 2017, seven years after my mother’s passing into the next place and I find myself re-engaging with those things that caused me to disremember in an effort to reknow myself. Now with all the dispositions of a doctoral student, I think again of my deliberate forgetting and how it demonstrates the power of subjective perception. Over these few weeks I have often felt entirely immobilized by memories and have been at war within my own mind. Thankfully mutations occur daily and it is during these divisions of self that the uncertain spaces that were created by my mother have opened opportunities for me to appreciate alternate styles of mothering and in turn allow me to honor and nurture the self in me and in my own daughter and in turn once more to consider myself as teacher.
The experience of being the actual medium for a continual process of creation takes me past all depression, past even chaos or emptiness, into the very mystery of that continual flip of non-being into being. It can be the occasion of great liberation when I momentarily make the transition from feeling there is nothing to fear, to the realization that there is nothing to fear. The idea of using Currere as a sort of nourishment has both enchanted me and given me hope when I think of myself as a mother, partner, student and as an instructor, and what I may become next.

As I felt released from the struggle with my research data, and in earnest began data analysis my memory for other phenomenon has been returning. Amongst them are happier times from my past:

Michele – Regressive 2 – May, 2017

I remember Jean Robbins, a former Rockette tap dancer from New York City, then living in Santa Barbara, California, coming to pick me up in her car. A very long white car, with sparkling chrome, soft red leather interior, and a steering wheel that was enormous and looked like it was made of glass. I felt small and important. On this steering wheel made of glass was one of Jean Robbins hands, holding a cigarette holder with a long white cigarette at the end. Her lips bright red, telling me “Okay kid I know that the shoes don’t really fit but do the best you can–we’re gonna learn a lot of steps tonight just listen to the music and try to feel the music in your body, don’t worry about your feet so much”. As we turned off State Street, onto Cabrillo Boulevard, and then into the parking lot of the community center situated just at the edge of the beach lined with palm trees, the sun about to set and that California sky like no other sky I have ever seen– we entered the community center and Jean Robbins turned the music on-Glenn Miller’s, “In the Mood”. At the age of 12 my love of jazz had begun.
My tap shoes two sizes too big began to tap, I closed my eye and imagined myself as 
one of the Nicholas brothers. Barad (2007) argues that most qualitative analysis 
approaches enact an ontology of given realities by overlooking the constitutive nature 
of methods/apparatuses. Barad (p. 53) explains that representationalism ‘marks a 
failure to take account of the practices through which representations are produced’ 
(p. 53). She suggests that a representational conceptualization of knowledge-making 
practices (methods), ‘takes the notion of separation as foundational. It separates the 
world into the ontologically disjunct domains of words and things, leaving itself with 
the dilemma of their linkage such that knowledge is possible’ (Barad, 2007, p. 137). 
Drawing on Rouse (1996), Barad further explains that representationalism underpins 
both empirical realism and postmodern philosophical practices that turn to language 
and discourse, as both share the representational belief that knowledge mediates 
access to the material world (i.e. reality).

Both the method of the Interview to the Double and Currere show that habits 
and habituated practices play an integral role in the constitution of the self and both 
show, almost simultaneously how these habits, and habituated practices have material 
agency that go on in the process of the self in renewal and in immanence sometimes 
forgetting what it was before. We can get stuck even though we are made of air, water, 
and earth, and we intra-act with the multitude of other living beings—some of those 
others in our guts, who we depend on to live. We are shaped and influenced by those 
other flows just as we shape and influence those flows inside and outside us (Barad, 
2007).
Nicolini and Roe (2014) argue that ITTD starts from the premise that all research, interviews or other, necessarily generate ‘data’ whose nature cannot be separated from their process of interpretation. Therefore, data is inextricably mixed and confused with the traces of the process of meaning making and the interactional dynamic that take place during the interview as a situated event (Atkinson and Coffey, 2002; Potter and Hepburn, 2005, Silverman, 2007). The result is that we cannot simply approach these data in terms of “truth” and “distortion” (Silverman, 2007). On the contrary, “we need to treat interviews as generating accounts and performances that have their own properties and ought to be analyzed in accordance to such characteristics” (Atkinson and Coffey, 2002, p.422).

As mentioned previously, diffractive approach to analysis is interested in patterns of interference. The research space is both experimental and it is a space of encounter. It does not set out to represent subjects that pre-exist the research. In this sense, a diffractive methodology shifts research from the concept of difference as categorical difference to difference as an emergent process, in which the subject becomes different in the encounters through which they emerge and go on emerging differently.

Diffractive research thus breaks up linear thought where one agent acts on another in a causal relationship and opens up a space of awareness in which it is possible to see those multidirectional, emergent, intra-active interferences that Barad (2007) calls the world and its possibilities of becoming.

I end the chapter with a word about the ethics to which Barad ascribes and this research has tried to emulate. Barad’s understanding of ethic requires a practice of sensitivity to assessing the possibility in each interfering intra-action and a willingness
to reposition in new openness, to consideration of what is augmented and what is
diminished in the impact of the research, the research apparatus and the researcher as
well as the intra-active impact of the research on the researcher. A diffractive approach
to analysis is thus interested in patterns of interference: a pattern that carries potential
with each new difference. Barad argues that ethics requires attention to the details of
the present moment, to “the ongoing practice of being open and alive to each meeting,
to each intra-action, so that we might use our ability to respond, our responsibility to
help awaken, to breathe life into ever new possibilities (Barad, 2007, p. x). Such
openness to potential can be rendered impossible by habitual ways of already knowing
who the subject is, rather than the subject as a matter of intra-acting intensities. Each
research action, each interpretation is an ethical matter and mattering. When something
comes to matter, when it actively changes the way things are and are perceived to be,
both the ontology of bodies (our own and others’) and the meanings made of what
happens are affected. In Barad’s (2007) words, “Mattering is simultaneously a matter
of substance and significance…” (p. 3). This understanding of entanglement affects
not just what is possible to see but what is possible to be and do, epistemologically,
ontologically and ethically.

The basis for research is both experimental and is a space of intra-action. It
does not set out to represent subjects that pre-exist the research. Einstein once wrote
about Bohr: “He utters his opinions like one perpetually groping and never like one
who believes himself to be in possession of definite truth” (Barad, 2007, p. 121). This
chapter has attempted to be less about knowing what the self is in field experience,
and more a methodological experiment in how self becomes. Within a new materialist
framework
this implies a never-ending enfold ing that will extend beyond this dissertation chapter, myself as researcher and you as reader, an open-endedness that sits uneasily with the tradition of closing comments.
CHAPTER SEVEN: Analyzing the More-than-Human in High Performance Coaching

This chapter shares some of the research data generated by my two participants who are coaches with Tennis Canada. The analysis of the chapter is grounded, particularly, in how Barad (2007) takes up and extends Haraway’s question: Why should bodies end at the skin? I enlarge this question in relation to how the ongoing subjectivity of becoming a teacher in field experience challenges the already determined individualist assumptions of boundedness. Barad’s work raises questions about how the non-human acts through the body generating a different sense of the field. Karin Hultman & Hillevi Lenz Taguchi (2010) draw from Barad to describe the field as: “An assemblage of overlapping and intra-acting forces” (p. 532). These questions about the limits of what can be known about the subject at a distance from or from outside collected data allow further questions about how we might think beyond the humanist body that we have learned to conceptualize as a bounded whole and as an entity that we possess (and master via a mind/body dualism). Barad’s work helps to think about the permeability of bodies and what is not visible in our intra-actions.

Barad (2007) argues that current humanist assumption (i.e. that certain events out in the world follow as a consequence of human actions, choices, intentions, and so on), need to be re-thought, or re-visioned, as “after the fact” understanding we make in relation to the outcomes of intra-active events. As well, she suggests that not even our bodies can “simply take their place in the world. They are not simply situated in, or located in, particular environments. Rather ‘environments’ and ‘bodies’ are intraactively co-constituted. Barad’s observations relate to one of the reasons I was interested in including high performance coaches and coaching in this dissertation which is that in coaching practices there are notable resonances between what coaches
and cooperating teacher do (see Clarke, 2006). While this connection has been well explored in previous educational research, my work attempts to engage coaching in order to push Barad’s ideas into usefulness in ways that acknowledge diffractive methods more directly. Rather than engaging coaching as a metaphor to help us understand the field experience in a different way, I have included the insights of coaches as part of a diffractive analysis in which the various intra-actants push other components to mean more than we originally might have thought they would.

In addition, as has been mentioned in Chapter Six, I included coaches because tennis is a field of practice in which expanding body understanding and feeling for increasing options for intra-action is considered valuable. Whether it is possible for them to articulate it or not, I think that coaches and athletes have a sense of the field of play as something that is not just a backdrop for actions and competence. They are already working in the realm of more situational habits of responding rather than a framework guided by liberal humanist notions that we are trying to move beyond.

Anthony Clarke (2007) suggests that:

Being a teacher educator demands, among other things, a level of engagement with student teachers that far exceeds that of a classroom placeholder and is akin that of a ‘coach’. I believe the conception of coach—one who works closely in the immediacy of the action setting, encouraging and eliciting the sense the learner makes of his or her actions and providing advice and expertise to guide the learner’s developing repertoire, embodies the nature of the relationship rendered by this conception. (p. 21).
Coaches are engaged with the physicality and feeling of intra-activity where one part of the game is making itself intelligible to another, with an interest in what emerges in these encounters. Relating to both tennis and education necessitates thinking of ‘play’ as a noun in addition to it as a verb. As a noun, play denotes a freedom of motion as in having to call into play, all of one’s teaching abilities in a difficult situation.

Additionally, I included tennis coaches in this research because tennis is my passion. At certain times in my years as a high performance player in California, I realize now that I was able to feel a way of movement where all bodies in the event are causes in relation to each other which was a freeing sensation in comparison to the heaviness of living within a constant vigilance to self-control. In the following section, I elaborate on some of my own experiences with tennis.

7.1 Tennis and Me

In the introduction of this dissertation I wrote that this work grew from many inspirational experiences and that playing high performance tennis was one of them. As a high performance tennis player between the ages 11 and 19, I learned the technical skills that are important to play the game of tennis. Not long after coming to the game, I was coached by someone who believed good tennis was played through the body. Through his coaching style, I quickly realized that playing tennis is not just a matter of swinging a racket, but also of perceiving a geometry of the court; learning angles and vectors and ways of feeling that give advantage to one player over another. The more I played and the more I competed, the more fascinated I became with the technologies that frequently go alongside high performance
playing. These technologies include the coach, the shoes I wore, the rackets I purchased and the choice of string for the rackets. What was happening, I think, was “a sensory awareness to nonhuman forces operating outside and inside”, (Bennett, 2010, xiv) my body. My body recognized the interrelatedness of what emerged but my mind did not attend to the fact that these technologies along with hours of practice, conditioning, eating just the right food combinations, and a good night’s sleep, all worked together to help me develop points in matches and this feel for the sport grew the more I practiced and the more I played. They were the apparatuses through which my body felt the next moments in a match. Eventually, I could feel the court under my shoes compelling me to move one way or the other, my arm stretching to find and return a ball that at first seemed out of reach.

Rather than feeling that I had more agency in the playing, tennis provided the opportunity to sense agency in the potential that emerged in the midst of bodies involved in mutual engagement. Later, obtaining my own coaching certification with a variety of coaches highlighted for me, again, the ways in which various coaches served to open the game to those being certified while others regulated learning to a series of “do’s” and “don’ts”, believing that their role was that of a gate-keeper to the profession. In other coaching experiences, particularly with Tennis Canada and their Le Petit Tennis program, the aim was to introduce community children to tennis through using tennis equipment that is modified to various sizes of bodies which they use while playing visual story games that teach moving patterns, balance and coordination. Helping participants succeed in surprising ways is the goal.
In previous work with Tennis Canada, I have had the privilege of working with each of the two coaches whose data I share below. It is wonderful for me to be able to include them, their practice and their insights in this study. Steven is a Tennis Canada High Performance Coach whose specialty is developing high performance wheelchair tennis players. Charles is also a Tennis Canada High Performance Coach whose primary focus is developing high performance Junior tennis players.

My view while working alongside these two coaches in previous years, was that they had completely varied coaching styles, however, I admired both of them and was aware of the high regard with which they were both held in the field of professional tennis. In the analysis of the data generated through their respective ITTD interviews, I often found myself tending to look for what I thought might be missing in the description of one style of coaching in opposition to the other, and in turn making judgments about how each coach described their methods. In other words, I found myself locking into step with the forces of humanism that compel me to choose one over another, find fault, to compare and seek out the style that was the most rational to my ways of thinking, the one that would yield particular outcomes. I felt the force of humanism and its tendings as I engaged in a reflective approach to the data, one in which I imagined I could be involved in mental activity apart from the data as the product of my isolated thoughts, where I could understand at a distance from the data. A diffractive analysis, however, opens an onto-epistemological space of encounter where a researcher’s aim is not to reveal something that exists independently of an encounter, thereby producing the appearance of truth, but rather to open up an immanent subjective truth: that which becomes true ontologically and epistemologically, in the moment of the encounter.
In this sense, the encounter itself is experimental in that the researcher does not know in advance what onto-epistemological knowledge will emerge from the configuration of bodies, ideas, emotions and affects (Hultman & Lenz Taguchi, 2010; Lenz Taguchi, 2012). This diffractive space of encounter is useful in research, coaching as well as in teacher education field experience where diffraction not only brings the reality of entanglements to light, it is itself an entangled phenomenon (Barad, 2007, p. 73). My research has had to address this doubled nature of diffraction to be about diffraction and also to incorporate diffractive methods and analysis that move diffractively.

Re-reading the previous chapters and recalling what I am learning and returning to Barad’s insight regarding diffraction, brought me to see that the transcripts of Charles and Steven revealed diffraction already underway. The apparatus of ITTD generated diffractive data and what I was invited to do by this diffraction was not an initial analysis but a doubled data analysis in which I was compelled to find traces of agential realism (i.e. using Barad’s concepts of agential cuts, intra-action, phenomenon, and apparatus). Barad (2003) highlights the nature of the relationship between discursive practices and material phenomena as ‘nonhuman’ and ‘human’ forms of agency. She terms this dynamic ‘agential realism’ (p. 816). Agential realism displaces matter as a fixed and permanently bound entity and the world as composed of individuals with “individually determinate boundaries and properties whose well-defined values can be represented by abstract universal concepts that have determinate meanings independent of the specifics of the experimental practice” (Barad, 2007, p. 195). Just as scientists’ capacities to see atoms today does not suggest that earlier
images were wrong or that we now know better or that atoms are only social constructs that change as our ideas change, Barad argues that a more interesting and accurate story to tell is that not only our image of the atom has changed but also our practices of “imaging and imagining and intra-acting with them have changed and so have we” (p. 354). During the *Currere* portion of this research, for example, images and sensations were the first to come to participants’ minds. These images and their change were not as significant to the process as their renewed capacities to imagine and intra-act with them, which was also a way of reordering their usual ways.

A relational ontology advocates a causal relationship between specific practices, embodied as material configurations of the world. The causal relationship between the apparatuses of bodily production and the phenomena produced, is not a traditional linear cause and effect relationship but rather one of ‘agential intra-action’ (p. 814). What is most significant here is the absence of transparency or neutrality about any apparatus (method or observation). Measurements of an apparatus cannot assign values of properties assigned because the knower and known cannot be separated so pre-existing values of properties of independently existing objects are not separate from measuring agencies. In the case of this research, I attended to this knowledge through addressing my own feelings of disintegration and capacity for self-ordering in new images of myself as both mutable and connective. In the materiality of pedagogic spaces, the intra-actions of bodies, objects and ideas can be read diffractively, rather than captured. Reading diffractively involves reading each through the ways in which each reading opens new possibilities in the previous one and across the intra-actions (Barad, 2007).
Therefore, in this chapter I draw on Barad’s agential realism and the accompanying notions of phenomenon, intra-action, agential cuts and apparatus to explore the role of agential matter in the ITTD of the two coaches.

As mentioned in Chapter Three, the high performance tennis coaches recruited for this study were only able to complete one part of the research project, the ITTD. Very busy coaching and travelling schedules did not make it possible for them to engage with the method of Currere. What follows is an introduction to the coaches as well as the data generated from the ITTD as well as some ways new materialism has a place of significance in high performance coaching and sports.

7.2 Doubled-Data-Analysis

7.2.1 Agential Cuts & Entanglement

In the Interview to the Double, Steven began with some background information about his life experience:

*Part of my story is that I started playing tennis at seven years old-able bodied tennis. My parents are both avid tennis players, dragging me onto the tennis court. I didn’t really like at first because they always made me come along. They did get me started playing however. I played other sports: loved soccer, loved basketball; really loved all sports. At around the age of 13 or 14 I realized that tennis would be my primary sport and I got competitive about it and played out a decent junior level.

I had just turned 15 when I was diagnosed with bone cancer osteosarcoma, which is the exact same type that Terry Fox had. Then, I went through the whole chemotherapy cycle. Eventually the doctors had to do an amputation because of the severity and the*
gravity of the cancer. That was kind of my Ground Zero where all of a sudden I thought this is it. I will never do sports again; and that was actually a tough moment.

Steven further shared:

*I went back on the tennis court literally a year after because I was fiddling with the prosthetic leg so I went with my dad and I still remember hitting those tennis balls and it was okay. But then as I tried to get more competitive I noticed that I would never be able to run as well as I did before with loss of my leg. I got frustrated about that and then didn’t really quit but just played once in a while and then by pure coincidence got involved with wheelchair basketball. I met a guy in a chair and he said “Hey you do you want to try basketball?” I loved it and got competitive about wheelchair basketball but then experienced another coincidence. I met somebody who played wheelchair tennis and that’s how I eventually found my way back to my first love which was tennis. Then it just went on and playing competitively for 14 or 15 years.*

7.2.2 Radical Shifts –New Apparatus-New Intra-Actions

By moving into the chair, Steven explains that he experienced a radical shift which made him reconsider the notion of phenomenon as he discovered the ways his body was entangled in the chair as well as he was already and continued to be entangled in his passion for tennis. With the chair as a new apparatus, Steven eventually began to feel its flexibility in a capacity to return to tennis as a high performance athlete. He recognizes that phenomenon are not simply situated in, or located in, particular environments. Rather ‘environments’ and ‘bodies’ are intra-actively co-constituted. Hultman and Lenz Taguchi’s (2010) description of the photograph of a child playing in the sand resonates well with what Steven seems to be articulating: the various
intra-action of chair and body and new possibilities “as body and matter of forces of
different intensities and speed, fold around each other and overlap, in the event of(…)
hand opening, body adjusting and balancing, eyes measuring height and distance.…”
(p. 530). Barad claims that bodies (human, environmental,’ or otherwise) are integral
‘parts’ of, or dynamic reconfigurations of, what is” (p. 170). In other words, “things”
that in the past we have taken as given, and the source of the activities of interest to us,
become themselves outcomes of new interests and abilities.

Once Steven made the decision to transition from tennis player to coach, he
began to work as the Tennis Canada National Wheelchair Tennis Coach and
continues to work in this role.

As we moved further into the ITTD and specifically in relation to how I might
replace him the following day on the court, Steven suggested that in order to enter the
court and have the high performance players not know it was not him, I should consider
the following:

There are some things that drive me crazy when I don’t see them done in a high
performance environment. This is the starting point for how to coach. Remember, we
are not talking about a recreation league where you, the coach, caters to what the
player wants to do. This is very different than what should be happening in a high
performance setting. So something that I am a stickler about is the environment. As
soon as we get on court and as soon as we start out practice there is no chit chat, there
is no talking about things that are not related to what we need to do in practice. So,
that means you have to curtail talk between the players like, “Oh, what did you do
yesterday?” “I went to the movies and we had pizza.” That does not happen when I am
coaching; in fact, it drives me nuts. When I see this it takes credibility from the training session. So it’s that performance environment, it’s we mean business. Practice starts with a physical warm up. From that moment on it’s all about tennis and there are no distractions. Now having said that I do want to keep the environment fun so yeah, there can be laughter and there can be the occasional joke or so but that’s kind of like a one off and then straight back into business and executing the tasks that I give to the players.

Steven provided some points of clarification after having time to review his interview transcript:

As an afterthought, so that you understand the motivation for being on task. Something that I find most players that I work with like is to be measured. They seem to like this and it is seen in most players who want to improve – so they ask questions like, “Okay, how’s my time?” Or “How many rallies did we do?” So that if I track this I can tell them “Well last week you had so many and this week you want to improve.” And I find that a good motivation. It does a couple of things, it tracks improvement and also keeps them focused. Because if they have that task and they want to beat the number of rallies that they’ve done last week they are less inclined to be saying, “So, I went to the movies last night and blah, blah, blah and chit chat.” That kind of takes care of that because they are keen on focusing on that task.

Steven also suggested that if on the day I was going to coach in his place that I feel free to call on other high performance coaches in the field.

I have so much respect for somebody like Larry and Jesse. To me Jesse and Larry are probably the two most knowledgeable coaches I’ve encountered in my career. Not only do they have the rare gift of being knowledgeable but also are able to convey their knowledge effectively. We just had Jesse help us with a development session where we
had a bunch of developing wheelchair tennis players. It was good for me to see how he sets the session up, take the players through them, having them totally engaged. You can see there is a pathway, he explains what he is trying to accomplish. He demonstrates it and then the players execute and you can see there is the clear sequence - he teaches the things he does. So my key to learning is moving these sequences of coaching. I am often approached by extremely good able bodied tennis players. In coaching courses, I am the only one in wheelchair asked to work alongside phenomenal former top Canadian players or even players that play the tour. It’s interesting to see how helpless they are when they have to try and convey their knowledge. I find coaching so much more complicated than I might have thought it was when I was still an active able-bodied player. It helps me think beyond the chair.

Here Steven notices that when he is called to assemble with able-bodied high performance tennis players he is sensitive to the vulnerability in these players and with this shared vulnerability the way he sees himself changes. The way he sees himself changes as he sees the complexity of the sport having less to do with being in or out of a chair and more about attuning to what might come next.

Steven suggested that when I end the training session I should:

...always give positive encouragement. Point out certain things that you liked, and show the measurements that show they have improved. It doesn’t have to be cuddles and rosy but point out “Okay you guys, I know it’s probably good for you to see if you can pick certain times that you did or certain numbers of repetitions that you were doing better than last week. Some guys won’t do quite as well as others. So tell them we will have to work on that next week.” Always be positive and say things like, “I like your commitment. I like your energy.” Don’t be afraid of pointing out negative things
but will always try to end on a positive note so they will feel good about coming back next week.

Steven explains that in his coaching practice he always offers affirmation to the players with the hope that the will imagine something more so that the can conjure something better in how they approach the game of tennis. It is this affirmative addition to his coaching where he offers something more livable, more hopeful for what lies ahead in much the same way that his review of what it means for him to coach top tiered tennis players.

Diffraction apparatuses such as coaching, are used in order to produce knowledge about both the self that is passing through the apparatus and the apparatus itself. Central to the development of quantum physics, diffraction apparatuses “measure the effects of difference, [and] even more profoundly they highlight, exhibit, and make evident the entangled structure of the changing and contingent ontology of the world” (Barad, 2007, p. 73). Steven seems to understand coaching as a diffractive practice that acknowledges its participation in world-making, or in this case game-making through contributing affirmations that he hopes will move with the players as they leave the court in order to sustain them until next practice or next game. The ITTD provided an opportunity for making visible Steven’s own interference in revisiting this practice as well as its various material effects and was an opportunity for Steven to affirm or reaffirm the significance of this aspect of his coaching.

Participant Eight: Charles

Prior to moving to Canada to become a national tennis coach, Charles was (and continues to be) regarded as the most influential figure in Israeli tennis as a national
coach. Charles is a former Davis Cup team captain and Fed Cup captain and current coach of many professional tennis players both in Israel and in Canada. Following our interview, Charles successfully coached the Canadian Junior Cup tennis team to a victory over Spain. He is currently national coach and head of Western Canada High Performance Program.

7.3 The Phenomenon of Practice

*ITTD* (excerpt):

Soon I will be forming a Junior Davis Cup team which is very different from coaching a player one-on-one. Because it’s not an individual sport, suddenly you have to put together a few individuals who will have the same goal, the same mission. I think bonding the team and figuring a way for them to work together and finding each individual a spot in that group, based on his strengths/weaknesses is key. I think it’s critical to understand the dynamics. Then after you break down the puzzle you have to put it together in a different way where the goal is to have the sum of the individuals greater than the number of individuals. And looking into Davis Cup and one single event, I think that will be your main focus. It’s not about teaching forehand, backhand. It’s not about improving any technical stuff, of course you maintain all those and you want to keep those in good shape but it’s a lot about the components of how we work as a team to exploit the strength of each individual and how that end up adding up into the sum of the whole group. I think it’s not something that you can really and exactly describe, there is no singular recipe to do that I know of. It is always shifting; it has to shift.
7.4 Noticing as Intra-active

ITTD (excerpt 2):

I have learned that when I form good relations with the players they listen to what I see when I am coaching and accept that there are things I see that they cannot see. I ask the players to rely on me and to rely on each other as we train. I tell them that there are reasons to have others around and how it can be helpful. As a coach I can see the ineffective aspects of their attempts as players; aspects that are in many ways unavailable to them. For example, I can look separately at the forehand or backhand grips, the players’ stance, alignment, backswing in a way that players, whose main intent is to hit the ball – the cannot see that and I can offer that to them and I try to encourage them to do that for the others on the team when I do not.

Charles also talked further about the selection of the team indicating that often he had to make quick decisions about who to include on the team:

I think it’s feeling people; it’s talking to people. It’s figuring it out very quickly and it’s also a little bit of a gamble to because sometimes you don’t know the players that well and one or two days of watching is not enough to understand who they are and what they are. You know you have to take some risks and gambles. But the focus would be then doing a lot of activities that are not necessarily on the court but off the court. Talking a lot about the mission and about the obstacles that are in front of us within this mission. What could be the challenges en route? Like almost like creating a simulation of what’s going to happen and different versions of how things that may happen on the way and talking about them. You know just surfacing and talking about them and not myself only. They have to talk about it. That’s part of the; we call it mental,
strategical preparation that you want to have in a group like this and you want to have a lot of fun.

Charles is attentive to the mutual implication of discursive practices and material phenomenon, seeing them as mutually implicated in one another. Barad (2007) explains that the relationship between the material and the discursive is one of mutual entailment. Neither discursive practices nor material phenomena are ontologically or epistemologically prior. Neither can be explained in terms of the other. Neither is reducible to the other. Neither has privileged status in determining the other. Neither is articulated or articulable in the absence of the other; matter and meaning are mutually articulated (p. 152).

In particular, in an agential realist account, both materiality and discursive practices are rethought in terms of intra-activity, highlighting as Barad (2003) suggests that “Humans [emphasis in original] are neither pure cause nor pure effect but part of the world in its open-ended becoming (p. 821).

Charles also instructed me in how I might manage being on court with the players. He offered the following:

On court you have to create an atmosphere that is not a judgmental atmosphere because those kids are pretty highly motivated and they judge themselves a lot.

Everybody is judging them, and of course they don’t need another coach to judge them daily, so it’s creating that non-judgemental atmosphere so that they are learning something and leaving, at least some of the practices, with things to think about before the next practice. You know like talking about what we’d like to do and how we would like to do. If you can read between the lines, it’s kind of doing the job without them
feeling the stress. That’s kind of an experience you need as a coach to be able to bring that forward. It’s not easy; it takes many years of failing and making mistakes until you find the right formulae and of course with different people that are different types of behaviors that you need to adjust. You need a soft touch and to negotiate between the requirements of the sport and everything else that it going on.

7.5 Intra-action

Charles sees coaching as a lived, entangled event that emerges over time. He appreciates that coaching and playing do not involve a simple “one-shot” implementation of an intention or desire; instead, he sees that they involve an unfolding sequence of particular intra-actions, a movement this way and that, guided by an inner sensing of a specific context’s “requirements” at each stage.

7.6 Me and Tennis (again)

During the time I played tennis and eventually moving into what is considered high performance tennis, I worked with a number of coaches. I remember trying out to move from the Junior Varsity Team to the Varsity Tennis Team in high school. The high school tennis season ran from September through November. To be on the varsity team, I played many weekly matches. By the end of the summer, I was tied with one other player for a position as a top seeded player on the team. This meant more play time and more direct coaching. My opponent arrived hung over from a night of partying. Despite my suggestion to reschedule, we played. My opponent made many unforced errors and eventually, she forfeited the match. Although my opponent’s poor performance made my own advancement possible, I felt guilty.
I began to play in the State of California’s high performance tournaments outside of high school tennis. At this point I had a coach named Nick. One day there was a tournament in Ojai, California, about forty-five-minute drive from Santa Barbara. Nick and I met at the tennis club in Ojai, two hours before the match to talk and to warm me up. When we arrived we looked for the name of my opponent. Her name was Andrea Gonzales. Andrea Gonzales is the granddaughter of the successful professional tennis player, Pancho Gonzales. Nick informed me that Andrea came from amazing tennis pedigree and I would have to fight hard. That was an understatement. Without including all the devastating details – I lost the match, 0-6, 0-6.

Jim did not say much. He told me to return to Santa Barbara and meet him at the club to review the match. Jim and I met at the Santa Barbara club and while we were standing on the court with many people around he began to yell. “You were overthinking everything. When you’re playing a match or a game you have to play without thinking. You just have to play”. He then picked up a racket and ordered me to the other side of the net. I hurried over? He began hitting ground strokes to me. While hitting the strokes to me, he simultaneously focused on his coaching which involved trying to control my shots completely: “Hit it here; hit it there; hit a passing shot there; come to a net; change your grip; hit a volley”. His voice and demeanor conveyed the coaching as punishment to me. He was on the other side of the net from me, jumping up and down, stomping his feet. The performance also indicated to everyone else at the club that I needed to be ‘taught’ a lesson.

There I was out on the court, watching my coach jump up and down like a monster. I was not thinking about just playing the game. After a few more of these experiences, I
recognized that like Mrs. Goleta, my high school coach, Nick was not helping me build confidence, but was instead engendering self-doubt. He made me feel like a failure. His coaching diminished any previous success that I had and I felt like I had to start anew. I went from thinking I was a great tennis player to thinking I would not have the chance to go further as a tennis player. I began to feel like I was the biggest failure in the world. [much like the way I felt in my own the internship experience].

When I consider my various coaching experiences, I realize that despite the influence of my coaches’ various approaches, I see now that I had another sense of the game. I realized when their methods were not helpful. When I played the hung-over player in order to make it to the Varsity Tennis Team, I sensed that this kind of tennis was not the only kind that was possible. Thinking diffractively might offer not just the field component of teacher education a different sense, it might also offer coaching a new sense of game. While I often maintain that the game of tennis is about learning how to keep an advantage over one’s opponent, I see that there was also, the potential for me to think of the game as one player working to offer to another, the opportunity to reposition in a way that might actually take them to their limit, and then the subsequent opportunity to reposition myself in order to accept the challenge the other player offered to me. The players add minute, unregulated variations (Massumi, 1995) to the electrified mix of the field, evoking provocations for the other player and perhaps for the umpire.

When my ailing counterpart was unable to respond in these ways, the game reverted to one with much less play in terms of what might have been possible. Field experiences are governed more by dynamic thresholds than by boundaries according to
Massumi (1995). He describes a field as a “bundle of potential functions…within a larger field of potential” (p. 95). In the fusion of play, he points out that there are indistinct boundaries and the playing out of the field’s potential requires an unfolding in continuous displacement of subjects and relations.

_Samsun, the next coach I had, did not bark orders about what should happen and what I was doing wrong. He was less defensive while coaching, and worked to include my previous experience and my perspective into account, providing me with a rationale for tasks. The coach-athlete relationship emerged in good ways because I felt understood and respected by him. I was more prone to develop positive and strong emotional bonds toward Samsun, though not just with him, but with tennis and competition in general. In addition, the result of this kind of coaching was beneficial to my happiness and my capacity to play._

While the intention of diffractive methods is not always to induce a more positive reality or a happier experience, the diffractive challenge responds to the imperative to acknowledge that self can only be partially empirically captured and that the whole is always part of something else. Sometimes, research, teaching, and coaching thoroughly confuse or too quickly conflate what we see as parts and wholes of what we are studying. The distinction is important because, as noted in previous chapters, the world is not composed of individuals with individually determinate boundaries and properties and in addition, each reconfiguration of reality carries potential to both diminish and augment other movement. Assigning negative or positive values to an overall change do not attend critically enough to the vital potential of all of the bodies included in a phenomenon.
7.7 New Materialism’s Contributions to the High Performance Body

Thinking through a more-than-human orientation means starting from the ontological assumption that our embodied experiences are entangled with other humans (e.g. coaches, teammates, opponents), non-humans (e.g. food) and objects (e.g. tennis rackets, shoes, clothing. Barad’s (2007) ‘agential realism’ theory has significantly contributed to an ontological understanding of the relationality of objects and humans that is premised upon co-implication, rather than an interaction of separate phenomena. Refusing the idea that our world is primarily made up of ‘human interactions’, Barad asks us to think of ourselves as of the world, part of the lively and ongoing production of possibilities and exclusions, as entangled.

The interview data offered in this chapter attest to connections between coaching and pedagogy, encompassing the intra-activity between humans and humans, and humans and the non-human agentic potential that emerges in the midst of fields of play. Through intra-actions, coaches and their players or teams are therefore, co-constituted. A diffractive understanding of coaching practice addresses the transversality and physicality of bodies, place and objects, cutting across dualistic oppositions of matter and human (van der Tuin & Dolphijn, 2010).
Pinar argues, “Work with the past, release from it, allows loosened identification with fear of the future, and allows heightened intuitive sense of where one may go” (1994, p. 59).

In what ways might the construction of the teacher education subject shift if educational field experience policy and practice endeavoured to work with diffractive apparatuses rather than with already established methods and processes of reflection and reflexivity? While this dissertation does not provide ready-to-use conclusions to
guarantee certain pre-determined changes, it provides some ideas for thought that arise out of the doubled engagement of the participants as well as the doubled analysis of the researcher. It shares the description of an experiment of working in a variety of situations with various forms of indeterminacy and an argument for the significance of diffractive apparatuses for countering education’s contributions to the excesses of humanism. This research argues with Massumi (2002) that when we choose apparatuses or methods with which to design knowledge, we are choosing potential modulations not only of the designed form, but through its apparatus, of people’s lives.

What seems to be an important consideration in addressing the question of the teacher education subject is that the subject is not a structure that is an external set of relations but rather part of relations of forces that are “immanent in the sphere in which they operate” (Barad, 2007, p. 230). These forces are not just social nor are the subjects just human and as they pass through apparatuses there is a continual generation and redistribution of potential energy.

In previous chapters, I have argued for what I consider a necessary shift away from behaviourism orientations and traditional empiricism, from educational practice that establishes comparison and identity in advance and misses the potential in particular actualities. I have claimed that intra-activity in teacher education’s initial field experience might exercise a more responsive knowledge practice that considers generative opportunity arising in the midst of the multiple intra-actions of the internship experience.

Analyzing the data of my field experience participants using Barad’s (2007) agential realist account of the apparatus not only provided an opportunity for the
participants but also for me to grasp some of the invisibility and assumed neutrality of the apparatuses with which we’d been defining ourselves. Apparatuses are not merely technological objects. Barad suggests that apparatuses (methods) are living matter that assemble with and shape knowledge through materiality, discursivity, agency and space-time relationships that are co-causal. In writing through my own experiences with tennis and coaching, I was able to get a sense of how and where something emerged that was disruptive to my habituated performance but more importantly how certain practices engendered particular sensibilities. Whether in relation to the technologies as extensions of my abilities in the game, the significance of other players’ feelings of capacity in the game or how previous knowledge worked to intimidate and restrict my movement, in each rendering, I generated another image in which I practiced my capacities to change and my capacities for re-entanglement.

This work was also helpful in realizing new potential in various other apparatuses with which we have constructed our ways of relating to others including ourselves. The high performance coaches who participated in this research provided examples of the potential they experienced at certain times when their capacities to reposition were amplified. Steve indicated how the wheelchair has provided a new image of coaching that thinks beyond the chair, an image that he did not have as an able-bodied player. Charles discussed the diffractive experience of being a coach, taking days to just watch his new players that he did not know and did not know what they might be capable of and to in essence, feel his own inability to respond. In the time taken in this opportunity, he realized that it was not only on the court that his work was to be useful, it would also involve off the court activities as well, in order to make the connections that were
needed. The apparatus in new materialism concerns embodied practices of materialization that are enacted in relation with matter because it is when something matters, literally, that subjects come undone and there is opportunity for reconfiguration. An apparatus provides alternative modes of being and makes other apparatuses navigable (Peters, 2015). This research has revealed the making of the teacher educator/education subject as a field of practice in which there is possibility for completely remaking the ways in which we interact with ourselves and others.

Barad (2007, 2014) offers the fascinating example of the Brittle Star to help in articulating an agential realist account of the apparatus and its capacity, capacity for something else and for me, a means of articulating an end for this work that might offer another way of thinking philosophically beyond the human frame. In addition, her example offers a way for me to suggest what this dissertation offers not just the field of education, but to my own haunted self that bears witness to apparatuses not of my own making, immersed but not fixed, in the leavings of those who’ve gone before.

The Brittle Star is a brainless and eyeless echinoderm that is related to other sea urchins, such as the starfish and sand dollar (Barad, 2014). What makes the Brittle Star fascinating is that its skeletal system is also its visual system, which means that the Brittle Star’s skin sees (Barad, 2014). It is as if tiny lenses are built into the Brittle Star’s body. The architecture of its body has caught the attention of scientists that are interested in the capacity of the Brittle Star to reconfigure its body and the boundaries of its environment (Barad, 2014).

Particularly interested in the Brittle Star’s capacity to see from a 360-degree view, scientists liken the species to the pixelization process of the digital camera
(Barad, 2014). The Brittle Star creates images through the absorption of light which corresponds to its nerve bundles, enabling the Brittle Star to see all around its environment and protect itself from danger (Barad, 2014). The five-segmented Brittle Star even has the capacity to shed its segments, which could be an instance of self-fertilization or a mere distraction for its predator.

Upon shedding, the Brittle star regrows its segments. Through embodied practices of intra-activity, the Brittle Star “differentially responds (not simply in the sense of responding differently to different things that are out there but) in ways that matter” (Barad, 2014, p. 233).

What Barad suggests is that the Brittle Star comes to know through its body and is differentially constituted in relation with the oceanic environment. In other words, the constitution of the Brittle Star is an indeterminate and relational practice. The Brittle Star is not only living in the ocean, but is of it in the sense that it spatiotemporally reworks its bodily boundaries (Barad, 2014).
In other words, the Brittle Star is not passive matter, but rather performs sight by altering body form. In Barad’s (2014) account: “The Brittle Star does not have a lens serving as the line of separation, the mediator between the mind of the knowing subject and the materiality of the outside world; they are mediated by their bodies. Brittle Stars do not have eyes. They are eyes” (Barad, 2007, p. 375). That is, it is not merely the case that its visual system is embodied. Its very being is a visualizing apparatus.

The Brittle Star is a living, breathing, metamorphosing optical system. (Barad, 2007, p. 227) The Brittle Star challenges humanist notions of the subject, through its diffractive capacity to see with its body. Knowing is entangled with its mode of being.
Its micro-lenses indicate that the Brittle Star body sees via diffraction, which suggests that the smaller the lens, as is the case with the Brittle Star, the greater the diffraction effect. The Brittle Star’s quality of imaging and thus its sight resolution is diminished as a result of diffraction. Its diminished sight in turn suggests that its boundary-making practices are difficult to see with certainty and herein, I suggest, lays hope. The Brittle Star is “not operating as a system of geometrical optics that has language and representation as the lens that mediates between the object world and the mind of the knowing subject” (Northfield, 2014, p. 60-61). The Brittle Star’s less than certain vision and its resilient capacity to evolve lends Barad to thinking that humans give sight too much credit. Representational practices, Barad (2014) explains, play with the “wrong optics,” which are grounded in “the wrong set of epistemological and ontological assumptions” (p. 234).

Notions of knowing the self, grounded in human-centred optical models of reflection, evoke dualist frameworks. Dualist thought includes understandings of the subject as having the capacity to see through the object of the eye, or the researcher having the capacity to see through the object of the particular research methods. These examples foreground the representational eye by evoking subject-object binaries. Barad’s (2014) insightful example of the Brittle Star, on the other hand, puts dualist thought into question and problematizes representational practices of seeing that adhere to ontological and epistemological estrangement. In particular, the Brittle Star enables an understanding of the eye as that which is in matter. The embodied eye that is the Brittle Star, therefore, marks the limits of determinacy and permanency of boundaries through its diffractive mode of being and becoming in relation with its environment. A
separation of ontological and epistemological worlds is impossible for the Brittle Star, as its way of being is simultaneously its way of knowing and becoming. What this further suggests is that uncertainty of observations cannot be separated from the apparatus of observation.

I argue that both the ITTD and Currere can be seen as derivatives of this thinking in the ways they make known potential to become something more, even if the invitation to do so is to choose to explain away these capacities and return to the

Figure 7: Brittle Star, Victoria BC. Photograph by Mackenzie Sorensen-Woods, 2017.
well-worn knowable modes of certainty and representational knowing. Barad (2014) explains that diffraction is “not about originals” (p. 221). It does not however, do away with originary conditions and instead, acknowledges that our previous assemblages are always readily available but never exhausted by what human decision has made of them. Diffraction is a performativ e dimension of an apparatus that works with the intensities of turbulent waves and in turn examines how intensities are lived out. Diffraction includes disjunction and interference, necessitating continuous displacement. The challenge in teacher education is to build for this continuing modulation. I understand Barad’s (2014) example of the Brittle Star as a matter of practices that make a qualitative difference in the world. Difference in this sense is not about othering or separating out but more about responsiveness in a felt relationality in continuous variation. While an emphasis on the technical/rational/discursive focus appears to continue to reassert its dominance, special alertness is needed to attend to the ways in which identities are indeed constructs but they are constructs that Bennett argues “have settled into habituated body movements, certain sensitivities and institutional interdependencies that resist redirection, revision or liquidation” (2002, p.xxvii). We need invitational opportunities to witness the malleability and reconnectivity of our identified limits.

Although the Brittle Star does not travel in group-formation, it is an example of a species that marks difference from itself through bodily space-time reconfigurings (i.e., matterings) (Barad, 2014). The Brittle Star is an agentive force that does not foresee its relations yet responds with its self-prosthetic apparatus to work with the constraints and conditions of the oceanic environment, and without human intervention. Simply
put, the Brittle Star unfolds future possibilities of being via its being and becoming in relation.

Diffraction apparatuses study the effects of such interference and difference. In the physics classroom, these apparatuses often shine a laser through slits onto a screen in order to make visible the diffraction patterns that the light waves and slit produce. They reveal objects in relation and in process, bringing what was considered unalterable and taken-for-granted background out into the open to reveal a process altering the object, rather than one that reflects back to itself. “Diffraction patterns record the history of interaction, interference, reinforcement, difference. Diffraction is about heterogeneous history, not originals” (Haraway & Randolf, 1997, p. 273).

Barad (2007) further elaborates the concept of diffraction as a scholarly approach, arguing for a diffractive method that makes visible the entanglements of scientific practices and the social. To translate this to social science methodology, diffraction does not assume that there is an unproblematic self that we can simply represent and instead emphasizes difference and entanglement. According to Barad (2007), “diffractive methodology is respectful of the entanglement of ideas and other materials in ways that reflexive methodologies are not” (p. 30).

I hope to have contributed to new practices in pre-service teacher education field experience by attuning to the entanglement of the apparatuses of production, in a doubled analysis of how boundaries are produced rather than presuming sets of well-worn binaries in advance. In this way, the data, the self and the methods co-produce one another; the ontology of the data; the self and methodological approach become as
important as their epistemologies. Hence, diffraction is a practice of attending to relationality, a process attending to the always-incomplete self and the always incomplete practicum experience. Imposing rationalism generates a loss of the sense of potential that remains within reality for its ongoing continual transformative modulation and threatens one’s attachment to the world and on a smaller scale, to the field. “Matter is apparently amenable to new conceptions that differ from those on which we’ve habitually relied” (Coole & Frost, p. 11).

It is time to ask how new conceptions of matter might reconfigure our model and practice of field experience. Pre-service and in-service teachers are not any more passive material than Brittle Stars. They are in a field experience, part of the field experience and of the field experience. Their methods and techniques are part of the intra-action of the important experience of the practicum. Research and research practices participate in the becoming-self that involves noticing, attending to, responding to, and experimenting with, interference patterns that continually reconfigure what we thought was possible. The Brittle Star, the coach and the researcher are subjects in a dynamic field and the quantum methods with which they leap, change the field.
Figure 8: Brittle Star #5, Victoria, BC. Photograph by Mackenzie Sorensen-Woods, 2017
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Regina Catholic Schools

THE BOARD OF EDUCATION OF THE REGINA ROMAN CATHOLIC SEPARATE SCHOOL DIVISION NO. 81

Rob Bresciani
Chair

Rob Currie
Director of Education

September 22, 2015

Michele D. Sorensen
University of Regina, Faculty of Education
1679 23 Avenue
REGINA, SK S4S 5Z9
michele.sorensen@uregina.ca

Dear Michele,

Research Approval:
RE: Meeting the Internship Halfway: Intra-activity in Practicum

I have received your request for permission to conduct research in the Regina Catholic School Division.

You indicate that the purpose of this study is to “examine how tenets of New Materialist thinking, which propose an augmented attunement to and the effects of the human, non-human and more than human, might impact the practice of both pre-service and practicing teachers in ways that move the field of teaching from paradigmatic to emergent and in ways that more education beyond ideas of knowing and fixing in advance of experience”.

You indicate the goal of the study is to examine the impact of thinking beyond anthropocentric logics, which tend to fix the human subject, to thinking about the ways in which matter is agentic and constitutive of subjectivity.

You also indicate this study may contribute to new practices in pre-service teacher education broadly and the internship experience, which continues to be foundational, to most teacher education programs in North American.

Your request to conduct this research has been granted subject to the following conditions:
1. Participation of Miller High School Administration and staff is on a voluntary basis.
2. Participants must be assured as to the confidentiality of their responses and the names of participants and the Regina Catholic School Division are not to be identified in the research.
3. The Regina Catholic School Division will not be responsible for any possible costs to the division.
4. A copy of the completed study is forwarded to my attention at the Regina Catholic School Division office.

I wish you success in your research and look forward to seeing the results.

Sincerely,

Brian Lush
Superintendent, Education Services

Dr. Xia Ji, Xia, Associate Professor, Director
Professional Development and Field Experiences Office; University of Regina; xia.ji@uregina.ca

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APPENDIX B: University of Regina Ethics Board Certificate of Approval.

Research Ethics Board
Certificate of Approval

<table>
<thead>
<tr>
<th>PRINCIPAL INVESTIGATOR</th>
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<tr>
<td>Michele D. Sorensen</td>
<td>Faculty of Education</td>
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SUPERVISOR
Dr. Jennifer Tupper

FUNDER(S)
Unfunded

TITLE
Meeting the Internship Halfway: Intra-activity in Practicum

APPROVAL OF
Application for Behavioural Research Ethics Review
Recruitment E-mail
Participant Consent Form-Students
Participant Consent Form-Teachers
School Based Research Approval Request Form-Regina Catholic School Board

APPROVED ON
September 16, 2015

RENEWAL DATE
September 16, 2016

CERTIFICATION
The University of Regina Research Ethics Board has reviewed the above-named research project. The proposal was found to be acceptable on ethical grounds. The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to this research project, and for ensuring that the authorized research is carried out according to the conditions outlined in the original protocol submitted for ethics review. This Certificate of Approval is valid for the above time period provided there is no change in experimental protocol, consent process or documents.

Any significant changes to your proposed method, or your consent and recruitment procedures should be reported to the Chair for Research Ethics Board consideration in advance of its implementation.

ONGOING REVIEW REQUIREMENTS
In order to receive annual renewal, a renewal report must be submitted to the REB Chair for Board consideration within one month of the current expiry date each year the study remains open, and upon study completion. Please refer to the following website for further instructions: http://www.uregina.ca/research/faculty-staff/ethics-compliance/human/forms1/ethics-forms.html

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