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Voices Count: Employing A Critical Narrative Research Bricolage For Insights Into Dyscalculia

Diana E. Kuhl
The University of Western Ontario

Supervisor
Dr. Wayne Martino
The University of Western Ontario

Joint Supervisor
Dr. Elizabeth Nowicki
The University of Western Ontario

Graduate Program in Education

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VOICES COUNT: EMPLOYING A CRITICAL NARRATIVE RESEARCH BRICOLAGE FOR INSIGHTS INTO DYSCALCULIA

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by

Diana Elizabeth Kuhl

Graduate Program in Educational Psychology and Special Education

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The School of Graduate and Postdoctoral Studies
The University of Western Ontario
London, Ontario, Canada

Abstract

This qualitative study involved interviewing adult participants who were identified, or who self identified as having dyscalculia (also known as a mathematical learning disorder), with the objective of obtaining depth of perspective on how this phenomenon is interpreted, responded to, and managed by these individuals and those around them. This study utilizes a theoretical and methodological framework known as bricolage (Kincheloe, 2005) which involves the synthesis of narrative, auto-ethnographic, critical, feminist, neuroscientific, and psychometric perspectives, to explicate the constitution and experience of dyscalculia. This study also explores epistemological privilege within the discipline of educational psychology, and draws on the work Billington (1996, 2013) who advocates for greater employment of critical approaches within educational psychology; particularly, drawing on the work of Foucault, to explicate how the privileging of certain modes of inquiry contributes to the marginalization of those under study. Findings suggest that cognitive approaches to understanding dyscalculia are neither in agreement, nor above scrutiny, and that social factors, co-morbid conditions and pedagogical approaches to mathematics instruction play a role in the emergence and remediation of dyscalculia. Ultimately, dyscalculia is explicated as a multidimensional phenomenon that raises important questions about how learning differences are approached and understood in educational research and practice.

Keywords

dyscalculia; math; educational psychology; bricolage; qualitative; narrative; auto-ethnographic; critical; feminist;

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Chapter 1

I am an experimenter and not a theorist. I call a theorist someone who constructs a general system, [...] and applies it to different fields in a uniform way. That isn't my case. I'm an experimenter in a sense that I write in order to change myself and in order not to think the same thing as before. (Foucault, 2001, p. 240)

1 Introduction

This thesis has indeed been an experiment, as through the process of exploring the phenomenon of dyscalculia, it became apparent that ascribing to any one theoretical position was not possible for what I hoped to achieve. The objective of this inquiry was to conduct semi-structured interviews with students who identify as having dyscalculia (either through self-identification or formal identification) in order to explore the personal, academic and professional experiences of these individuals, and to provide depth of perspective on how this phenomenon is interpreted, responded to and managed by these individuals and those around them, by presenting findings in narrative forms. As a result, my aims were grounded in an epistemological complexity that necessitated a framework outside of the traditional boundaries of educational psychology. I eventually determined that critically examining the phenomenon of dyscalculia necessitated examination through multi-perspectival lenses, which could be achieved through employing a research methodology known as bricolage (Denzin& Lincoln, 2011, p. 3). Through employing bricolage as method, I draw on the work of (Kincheloe, 2001) who asserts that "no concept better captures the possibility of the future of qualitative research" (p. 679), but who cautions that research utilizing bricolage involves complex epistemological, methodological and political negotiations (2005), and requires a commitment to deep interdisciplinary work that is wrought with academic tensions (2005). In extension, I draw on the work of Billington(2013) who employs bricolage in research, and advocates for critical and narrative approaches in educational psychology

that are informed by the works of Michel Foucault in order to explicate issues of power associated with knowledge production in the discipline, and to promote a democratically informed psychology, where those who have "historically been the recipients of, but not the owners of knowledge" (2013, p. 175) become the guiding voices of inquiry and representation.

I also draw on the work of Walkerdine (1998) whose critically informed feminist psychology incorporates the work of Foucault to illuminate inequities related to gender, class and knowledge production that permeate girls experiences in mathematics education (Walkerdine, 1998). Walkerdine, utilizes a bricolage of theory and methods to interrogate 'girls' mathematics education resulting in findings that both challenge homogenous assumption of girls learning, while recognizing that the extent of gendered attitudes towards (and myths about) girls learning has situated them historically as 'less intelligent' than their male peers, particularly in the realm of mathematics (1998). Walkerdine further illustrates how quantitative data obtained from 'objective science' that dispels notions of gender and ability is insufficient at ameliorating the inequities as even when faced with 'objective data' about ability drawn from assessment, teachers continue to interact with students in ways that involve complex gendered relations, not limited to, but including, expectations surrounding posing questions to or challenging the teacher in any way. Walkerdine (1988) argues that these acts, though considered essential in the development of intellect, are tolerated and even encouraged in boys, yet devalued and discouraged in girls, who receive the most positive feedback from both their teachers and their peers by displaying obedience. Thus in exposing the myths of intellect, amelioration of how girls are constituted as homogenously and inherently different than males, falls short in the face of gendered myths of behaviour that remain. As a result, Walkerdine's insights into the complexities of gender and mathematics illustrate how understanding dyscalculia must move beyond attempts to study it as an isolated phenomenon. Individuals who meet criteria for profound mathematical difficulties cannot be separated from the epistemological, ontological, discursive, political and experiential domains in which their 'dysfunction' is constituted.

In addition to critical and feminist approaches (and in continuing to employ them), I draw on and analyze dominant cognitive and emergent neuroscientific research on dyscalculia which paradoxically contributes to the perpetuation of essentialist perspectives on ability, but can also provide spaces for resistance in countering essentialist claims (Billington, 2013). I highlight the work of Geary (2011, 2000) and Butterworth (2011, 2010) who, in utilizing the same cognitive theory and 'objective scientific methods', have arrived at different conceptualizations of what constitutes dyscalculia. I also draw on the work of Ansari (2012, 2010) whose neuroscientific research on dyscalculia adds a new dimension of inquiry that appears to support dyscalculia as a phenomenon with observable brain based differences in mathematical processing, yet does not ascribe to the same essentialism proposed by Geary and Butterworth. Neuroscience, it seems, sits in an unexpected alliance with critical approaches to understanding learning, where the brain is not viewed as a computer-like fixed entity, but rather a malleable organism with which the experiential holds considerable influence. This intra-disciplinary divergence, combined with complex inter-disciplinary findings strengthens the assertion as to the relevance of bricolage in understanding a phenomenon as complex as dyscalculia.

Turning to the experiential, in tandem with asking participants how dyscalculia, or low math achievement, has impacted their personal, professional and academic experiences, I reflect on my own my own experiences as someone who meets the diagnostic criteria for a mathematical learning disorder. I utilize elements of two different approaches to narrative inquiry, Clandinin (2010, 2000), and Tamboukou (1999), as these scholar's distinct approaches to theory in narrative inquiry raise important issues surrounding what constitutes narrative inquiry. I also draw on the work of Ellis, Holman Jones & Chase, (in Denzin & Lincoln, 2011), who dismiss illusions of objectivity in research, instead advocating for deep reflexivity about one's role in the process of engaging in research and constructing knowledge.

Extending the analytical lens, I explore themes of oppression that emerged from the participant data, by drawing directly on the work of Foucault, whose theorization of knowledge and power emerged as the unifying thread in the works of a group of diverse interdisciplinary critical scholars and was evidenced in the experiences of the

participants. The significance of Foucault's work to any inquiry that examines how individuals are constituted as 'deficient' based on divergence from socially constructed norms is integral to any rigorous understanding of a phenomenon such as dyscalculia. I also draw on the work of Kumashiro, who like Foucault engages in excavation of the power and knowledge nexus as a site of oppression, but who also provides a framework not only for the disruption of oppressive knowledge in education, but a framework for facilitating transformation and emancipation through anti-oppressive research and practice (2000).

In addition to the scholars that I have highlighted in this introduction, and in keeping with the responsive nature of bricolage, I draw on numerous other scholars from diverse disciplines where their work supports, extends and even challenges the findings in this work. The 'structure' and scope of this work has been intentional, difficult, and not without risk as a beginning researcher, but was nonetheless necessitated by, the gaps in the literature, and my own positionality; that voices count.

1.1 The Emergence and Relevance of This Research

The basis for this thesis grew out of the completion of an independent reading and research course entitled Qualitative Research in Educational Psychology and Special Education (ED 9685). Through this course, three pivotal realizations about research in educational psychology emerged. First, that clearly symbiotic research disciplines have been positioned in tacit academic segregation, with qualitative research in educational psychology representing an extremely limited proportion of published research in the field (Miller, Billington, Lewis & DeSouza, 2008). Second, that within the limited body of qualitative research in educational psychology, research that takes a critical theoretical stance to inquiry accounts for an even smaller proportion of the literature (Billington, 2013). Third, that representation of the individuals under study in educational psychology rarely involves their voices (Billington, 2006).

Through these three realizations came an awareness of my own orientation to research and the importance of this in establishing a framework of inquiry and guiding my research methodology and questions. Laden with the language of deficits and

psychopathology, much research in educational psychology wields this language from the perspective of certified knowledge, with little consideration as to the impact this discourse of deficits has on those under study. Billington cautions that this seductive tendency towards expertise, authority and what constitutes evidence is troubling and he urges those within educational psychology to consider the implications of this governance of children as a power structure that needs to be examined (Billington, 2006). He raises important questions about how children are considered in educational psychology when he asks:

> How do we speak of children?
>
> How do we speak with children?
>
> How do we write of children? How do we listen to children?
>
> And finally,
>
> How do we listen to ourselves (when working with children)?
>
> (Billington, 2006, p. 8)

Billington's words resonated with me on a personal level, as someone who struggled immensely in education as a child, and who frames my current experience in education as having transpired in spite of rather than as a result of my experience as a child within the education system. Much of my academic difficulty can (superficially) be traced to a profound difficulty with mathematics, a difficulty which became an integral part of my identity, both in how I viewed myself, and in how others viewed me. In trying to understand my difficulties with mathematics in light of its emergence as a learning disorder (DSM, 2013), I was faced with a paradox; on one hand, I recognized the important insights that psychometric assessment and the identification of learning difficulties can play in meeting the needs of student who are struggling, yet on the other hand, my orientation to critical inquiry and alignment with the questions Billington poses positioned me as holding concerns about the language of diagnostics, pathology and how children are considered in professional practice and research. I found myself seeking common ground, where meeting the needs of students who struggle with academic domains is guided by research that does not define them, but aims to understand them as

complex multi-dimensional human beings and provides mechanisms for establishing supportive interventions.

According to Creswell, recognizing my positionality on these issues is the first step in establishing a framework for research (Creswell, 2007, p. 15), specifically, exploring five philosophical assumptions: ontology, epistemology, axiology, rhetoric and methodology (Creswell, 2007, p. 15). Examining these philosophical assumptions involves "taking a stance towards the nature of reality (ontology), how the researcher knows what she or he knows (epistemology), the role of values in the research (axiology), the language of research (rhetoric), and the methods used in the process (methodology)" (Creswell, 207, p. 16).I recognized that with respect to ontology, I see truth as subjective, contextual, multiple, and as shaped by oppressive influences. My sense of epistemology is that knowledge is co-constructed and "how we know what we know" is a multidimensional dynamic process. In terms of axiology, I believe that values do have a place in research and can play a powerful role in creating trust, respect and openness to facilitate deep and meaningful discourse (and I question the very possibility of "value free research"). In terms of rhetoric, my reflexive questions about my own experience, my use of the first person and the fact that my own experiences are a part of this inquiry, sees me positioned not as an expert, but as a contributor. In this vein, my choice of methodology (narrative auto-ethnography) and methods (semi-structured participant interviews) emerged as well.

This self-awareness coupled with an eclectic theoretical approach to research, though outside of the traditional boundaries of research in educational psychology (Billington, 2013),is essential to qualitative inquiry that seeks to explore the kinds of questions that Billington poses and follows the framework presented by Creswell for being critically self-reflexive in the research process (Creswell, 2007). I acknowledge that I came to the idea of research with admitted bias, but suggest that this bias is in fact beneficial to my research and was important in "dissolving the distance between the researcher and those with whom the research is done" (Denzin& Lincoln, 2002, p. 250), and responds to "arguments for 'strongly reflexive' accounts about the researcher's part" (Denzin& Lincoln, 2002, p. 250). It is also about ownership of knowledge, and democratic representation (Billington, 2013). I believe that understanding the lived experience of

individuals who are the subject to the discourse of deficits informs in a way that positivist and post-positivist approaches in educational psychology have not. According to Billington,

> such insider stories of experience written by those who in childhood had been considered beyond the normal boundaries of development can be markedly different from expert accounts which focus on the condition, category or psychopathology and are testifying to the limited usefulness of prevailing psychological explanations" (2013, p. 175).

I also dispense the illusion of objectivity which often serves to "other" the voices that the research claims to give pre-eminence to (Fine, 1994), and counter that being critically self-reflexive as to my role in the research (which is to explicate the subjective experience of individuals of which I am a part) positions me as having insights into how I have been spoken of, listened to, and written about, in a way that bears relevance on this phenomenon. I also believe that critically informed psychology, in conjunction with insider perspectives, can potentially right some of the systemic problems associated with how educators (and society) examine, define and approach difference (Fox, Prilleltensky, & Austin, 2009). Writing, and in this case research, as a site of transformation, occurs not by proposing a rigid framework for inquiry, instead it is a process that responds to the data, continually re-examining the imbrications of what has emerged with an end goal, not of some static truth about a phenomenon, rather it is, as Foucault proposes, about 'writing to change oneself and to not think the same as before'.

As Foucault emerged as the guiding voice for this inquiry, each chapter is prefaced by a quotation from Foucault that speaks to overall theme of the chapter, and that illustrates the relevance of interweaving theory, methods and narratives as tools for transformation.

Chapter 2

2 Research Objectives and Conceptual Framework

What, do you imagine that I would take so much trouble and so much pleasure in writing, do you think that I would keep so persistently to my task, if I were not preparing - with a rather shaky hand - a labyrinth into which I can venture, in which I can move my discourse, opening up underground passages, forcing it to go far from itself, finding overhangs that reduce and deform its itinerary, (Foucault, 1972, p. 17)

2.1 Introduction

The quote from Foucault that frames this chapter was written as a defence to a hypothetical critic of his work, knowing that in his intent to excavate not just *what* we know, but *how* we know what we know, he was disrupting established systems of thought, something that inevitably draws critics. Since Foucault was not one to shy away from critics, it is likely that the quote is for illustrative purposes only; leading the reader to conceptualize what is at hand with undertaking what Foucault coined *Archaeology of knowledge*[1].

This quote seemed particularly fitting to introduce the theoretical framework for this thesis as through the bricolage of theory and methods utilized to examine not just what we know about dyscalculia, but to examine *how* we know what we know about it, involves disrupting systems of belief and proposing new ways of thinking about a

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[1] Foucault, Michel. (1971). *The order of things: An archaeology of the human sciences*. New York: Pantheon Books. (preface, xxiv)

Note: Foucault's archaeological of knowledge in involves a complex non –linear analysis of contributories to the development of knowledge and theory (history, philosophy, language, and politics), particularly the configurations that have shaped 'empirical science'.

phenomenon that has until now been situated within the discourse of the scientific method.

In extension, I draw on the work of Kincheloe (2001) who asserts that bricolage must not be viewed as a rejection of theory, method or disciplinary boundaries; rather it is the acknowledgement of the complexity behind each, and the need for research to be reflective of such complexities by employing the tools necessary to conduct rigorous inquiry. I also outline how psychometric, feminist and critical perspectives that too often sit in segregation from one another, need to, and can, be interwoven in a research dialogue that deepens and expands our understanding of children's learning.

2.2 Bricolage

Though qualitative research utilizing a merger of theories and methods to forge new ground in research has been long been occurring, signifying this process and establishing a framework for it as a specific method is far newer. This methodologically diverse approach to research known as *bricolage* (Denzin& Lincoln, 2011, p. 3) is an emergent framework for qualitative inquiry, which defies succinct definition (Denzin& Lincoln, 2011, p.p. 3-4), but aims to explore new angles, forge new ground and facilitate change through diverse interpretive practices that engage both the participants and researcher in the process (Hays & Singh, p. 4, 2012). Though analyzing and synthesizing the research, I am proposing that research on dyscalculia positions it as a phenomenon that demonstrates the principles of *equifinality* and *multifinality* (Cicchetti & Rogosch, 1996); whereby multiple factors may lead to this condition, and whereby multiple outcomes may result. Though neurobiological origins are hypothesized, research has not arrived at a single etiology for dyscalculia (Shalev, 2004), and despite an emergent interest in dyscalculia within neuroscience, the complexities of brain development and function, combined with the interplay of complex social and environmental influences on brain development (Ansari, 2010), make finding a definitive etiology an elusive quest. It is this complex interplay of factors that contribute to the constitution of dyscalculia combined with the objective of representing the voices of those who live with it that requires the qualitative researcher to become a *bricoleur* (literally maker of quilts) (Denzin& Lincoln, 2011, p. 4). The *bricoleur* will employ whatever tools are necessary

to gain depth of understanding of the phenomenon under study (Denzin& Lincoln, 2001, p.p. 4-5). The *bricoleur* (and the resulting work a bricolage) can be *interpretive*, *narrative*, *theoretical* or *political* (and as is my intent, all *four*). Bricolage challenges traditional structured approaches to research, but within this process of approaching analysis from multiple lenses, draws on theories and insights as they *emerge* rather than beginning with a clearly delineated framework actually lends to a form of postmodern triangulation specifically suited to qualitative inquiry (Denzin & Lincoln, 2001, p.p. 4-5).

However, according to Kincheloe, employing bricolage is frequently met with resistance within academia (2001). He suggests that this in part has to do, not only with epistemological differences in how to approach research, but also with differing stances toward interdisciplinary research. He suggests that "disciplinarians maintain that interdisciplinary approaches to analysis and research result in superficiality; interdisciplinary proponents argue that disciplinarily produces naive over specialization"(2001, p. 683). Yet he illustrates that although superficiality can occur through insufficient depth of analysis of the phenomenon under study, this is not a criticism that rigid disciplinarity is free from. He adds that interdisciplinary work has revealed that any single research perspective is laden with assumptions, blindnesses, and limitations" (2001, p. 682), including the myth of 'objective science' as value free (Kincheloe, 2001). He adds that such knowledge that has emerged through interdisciplinary work means there is no going back to "disciplinary drawers" (p. 681). Academia needs to recognize that bricolage is no longer a radical methodological choice, but an essential requirement of research (2001).

However, Kincheloe (2001) also recognizes that bricolage requires rigor in employing diverse theory and methods. It requires the cultivation of relationships in academia and recognition of positive contributions of the disciplines that are often juxtaposed as adversarial. In employing the interdisciplinary theory, methods and philosophy outlined in this thesis in order to explore the phenomenon of dyscalculia, I have indeed levied disciplinary criticism towards educational psychology, but this is not a rejection of the contributions of educational psychology to understanding children's learning. Instead, it is a recognition that "the frontiers of knowledge work rest in the

liminal zones where disciplines collide" (Kincheloe, 2001, p. 689) and that rigor in research emerges through the facilitation of boundary work that “creates links that enable researchers in different domains to interact” (Kincheloe, 2001, p. 690).

2.3 Intelligence Theory and Cognitive Approaches

To examine dyscalculia and the associated influences, requires examination of Cattel-Horn-Carroll’s Theory of General Intelligence(CHC Theory), which proposes measureable domains of cognitive abilities including: fluid intelligence (Gf) , crystallized intelligence (Gc) working memory (Gsm) visual-spatial processing (Gv) auditory processing (Ga), long-term storage and retrieval (Glr), cognitive processing speed (Gs), reading and writing (Grw), and quantitative knowledge (Gq) (McGrew, 2009). CHC Theory forms the basis of psychometric assessment tools utilized in the diagnosis of dyscalculia (though other diagnostic measures may be utilized, (Posner, 2008), and is the primary basis for conceptualizing cognitive mechanisms underlying dyscalculia (Geary, 2000). Much of the historical emphasis on cognitive research on dyscalculia has emphasized the overall role of working memory (Gsm), but involves an examination of all of these domains and has led to divergent perspectives on their associated influence on dyscalculia (Butterworth, 2010; Geary, 2000), and different hypotheses about sub-categories that distinguish forms of dyscalculia (such as visual spatial based challenges versus challenges with word based mathematical problems) (Geary, 2000).

However, psychometric assessment (theory and practice) is not without detractors. Billington (2006), along with other critical psychologists (Fox, Prilleltensky & Austin, 2009), advocates a synthesis of critical and psychometric theory. Billington (2006) proposes that psychometric assessment can paradoxically both perpetuate and resist dominant paradigms, but in order to serve as a function of the latter, he asserts that it must be done via a critical lens that acknowledges the historical context of psychometric assessment as an extension of governmental power and regulation of individuals driven by economic interests (Billington, 2013, Billington, 1996). He highlights how most referrals he has received over the years to conduct psychometric assessment, are driven by schools with the aim of pathologization related to regulation, allocation of resources, and the potential for exclusion of students (Billington, 1996). Assessments are to be

completed in the shortest time possible utilizing measures of assessment which reify the aims of the schools (and in extension government and economic forces). Billington urges depth of inquiry and narrative assessment in tandem with psychometric assessment. Such an approach examines the complexity of the child in relation to environmental influences that recognizes how the child is constituted in multiple ways and not the product of biological determinism (Billington, 2004, Billington, 1996). Billington highlights how in his practice, school officials who have sought out his assistance to confirm a deficit 'within' a child, (based on observed behaviours, or academic performance on curriculum based measures of achievement), are often both surprised at his findings, and at odds with him for failing to 'confirm a deficit'. He refers to the school system's pre-determined desire to have an assessment confirm suspected pathology, (usually with the intended purpose of excluding children from mainstream programs), as 'statementing', and suggests that this process prioritizes administrative concerns, and comes in conflict with the goal of educational psychology; which is to understand and support children. He adds that these children frequently perform at, or above, the expected range on psychometric tests. In these instances, to both the surprise and opposition of school officials, the child has been 'signified' as capable, but not functioning as well as they could be; opening the discourse for considering the complex environmental influences that may be contributing to the child's difficulties. When the lens is turned outwards; the pathology does not rest within the child, rather experiences become implicated, and illuminate complex factors. This holistic approach to understanding learning, in turn provides potential for amelioration as opposed to exclusion (Billington, 1996, p. 51).

Psychometric assessment may provide helpful insights into areas that pose challenges to how people learn (as in the case of difficulty processing visual spatial information), but psychometric based concepts of intelligence have for far too long been presented as indicators of the extent to which one can learn. Though IQ may be the "great predictor of academic achievement"(Kaufman, Kaufman, Liu, & Johnson, 2009), it is a conceptual framework that has forgotten itself to some degree; it measures socially constructed concepts and assesses performance, not etiology, and fails to explicate the experiential contributories that lead to success on psychometric measures.

With divisions in cognitive research on dyscalculia being divided as to etiology, and the homo and heterogeneity of what constitutes it (see Butterworth and Geary), the prevalence of communities of practice (educators, psychologists, individuals themselves) embracing biological determinism as de facto (Posner, 2008) is overarching; something emergent neuroscience is illuminating as well, (Ansari, 2012, 2010).

2.4 Feminist Inquiry

A feminist perspective also plays a role in any discussion of mathematical proficiency, because it "presumes the importance of gender in human relationships and orients the study in that direction (Patton, 2002, p. 129). Research presented in books such as Male, female: The evolution of human sex differences (1998) (written by the same David Geary that now focuses on dyscalculia), that espoused biologically based sex differences in mathematical ability, has been countered by "neuroscience that has examined brain-sex differences [which] has found an overwhelming absence of evidence for such claims" (Eliot, 2009, p. 5), yet the gender myths surrounding mathematical ability continue to proliferate in society. To examine mathematics difficulty in the absence of a critical feminist perspective would fail to address important considerations in what influences learning; the student, the teacher, peers, society, attitudes about gender performativity, essentialist perspectives about ability, and the underpinnings of a societal reverence for math itself. Similar to Billington, Walkerdine (1998) draws on the historical as necessary to understanding the complexity of gendered discourses of mathematics achievement; femininity was positioned as counter to reason and logic and science. She argues that women have historically been presented as emotional and irrational and in extension lacking the inherent faculties to excel in maths. Despite a preponderance of evidence to counter the gendered essentialist perspectives on math, Walkerdine (1998) highlights how in one particular study of ten year olds, not one female student was characterized' by their teacher as 'bright' (p.p. 64-75), with high performing girls considered "hardworking" (1998, p.p.64-75). In contrast all boys even low achieving ones were described as 'bright', with the claims that their performance could be attributed to other facts, such as boyish rowdiness and difficulty with focus; but still "bright" (Walkerdine, 1998, p.p.64-75).

The constitution of gendered intellectual ability runs deep and its relationship to mathematical ability is inextricably linked. Like Billington, Walkerdine also draws on psychometric assessment as a point of both enforcement of, and resistance to essentialist beliefs about gender and mathematical ability by highlighting the cases of girls who were assessed for high IQ at age four, yet assessed as 'stupid' at age ten (1998, p.p.64-75). Layered within the stories of these girls' lives, were stories of violence and anxiety which went undetected and unaddressed by the teachers (Walkerdine, 1998, p.p. 81-82). These girls' experiences with math were confounded by the hardworking girl /bright boy positionality that permeated the teacher's interactions with them and they were further confounded by the issue of class. In one instance, despite achieving the same test scores, the low score for the lone middle class female was characterized as something that could be explained and mediated though hard work and intensive instruction. In contrast, the working class girls, who achieved the same low scores, were characterized as "beyond hope" (Walkerdine, 1998, p.p. 81-81). Despite more recent claims that emphasize apparent gains in girls mathematics achievement 'scores' (Hall, 2012), such achievement data provides a limited view of issues of gender in mathematics education (Hall, 2012). According to Hall the issues of girls mathematics is far from "solved" (2012, p. 59), as despite the apparent gains in scores, girls' attitudes towards mathematics remain significantly more negative than males, and girls' participation beyond early compulsory shows a persistent 'gender gap'(Hall, 2012).

Walkerdine's critical qualitative analysis that examines the complexity of gender related to assessment of mathematical ability (or academic ability in general) provides an important counter-discourse to essentialist claims. It also highlights how research on curriculum based achievement data must be interpreted with caution, as it provides a narrow view of an issue that requires a wide angle lens. As illustrated by Walkerdine (1998), despite findings from psychometric assessment, which established middle class and working class girls on equal footing; bright and capable, the lone working class girl's later constitution as not being capable, occurred through multiple discourses, and was shaped by broader environmental influences of which the teacher's perceptions of gender and class were implicated. To the teacher, the working class girl was neither bright, nor hardworking, whereas the middle class girls, despite beginning on the same psychometric

footing, were able to achieve a degree of success because they could 'work' at it. Their abilities had been essentialized in multiple and hidden ways, and the teacher failed to recognize that her interactions with these girls played a role in shaping what they felt they were capable of.

Eliciting the experiences of individuals who identified as having dyscalculia, illuminated the complexity and extent to which gender and social class discourses have permeated their experiences with mathematics and illustrate the need for research employing bricolage for investigations that aim to explore aspects of gender and learning.

2.5 Critical Theory

Related to feminist inquiry is the intended critical theoretical framework for this proposed thesis. Though defining a critical theoretical perspective with brevity is a virtual impossibility. Patton asserts that "what gives critical theory its name - what makes it critical- is that it seeks not just to study and understand society, but rather to critique and change society" (Patton, 2002, p. 131). According to Creswell, "critical theory perspectives are concerned with empowering human beings to transcend the constraints placed on them by race, class and gender" (Creswell 2007, p. 27). Critical theory has many influences (and fuels much debate within each tradition as the interpretive analysis of issues of power lie at the core), but in relation to dyscalculia, considerations proposed by Billington, in how we consider children (2006, p. 8) are influenced by Michel Foucault, one of the major contributors to the critical theoretical tradition. "Foucault invites researchers to explore the ways in which discourses are implicated in relations of power and how power and knowledge serve as dialectically reinitiating practices that regulate what is considered reasonable and true" (Denzin & Lincoln, 2002, p.305). It may seem an irony that Billington has been influenced by Foucault's criticism of "modes of inquiry which try to give themselves the status of sciences" (Foucault, 1979, p. 208), which includes the discipline of educational psychology. However, such criticism does not necessarily condemn psychology, rather, it illuminates the importance of critical analysis within the discipline, and raises questions about the privileging of quantitative research to the virtual exclusion of methods drawn from critical social traditions.

2.6 Equifinality and Multifinality

Finally to synthesize this conceptual framework I explored how the principles of equifinality and multifinality (Cicchetti & Rogosch, 1996) run as a thread throughout the examination of dyscalculia. With etiology still shrouded in mystery, the reality is that individuals with mathematical difficulties appear to arrive and depart from the diagnostic criteria of dyscalculia from multiple paths. Though detailed psychometric assessment was not provided by the participants, in some instances participants were able to share detailed information about psychometric scores or scoring patterns that demonstrated the stark achievement discrepancy utilized for the diagnosis of a mathematical learning disorder[2] . Yet this dichotomy, for some participants, was not fixed, as the degree of mathematical proficiency gained by some participants eventually exceeded norms for math achievement.

This malleable nature of diagnosis and achievement is also supported by recent findings in neuroscience, where social and environmental factors have been implicated on various levels, such as how failure to acquire early foundational mathematical skills impacts the neurobiological architecture necessary to acquire more advanced skills (Ansari, 2010), and conversely, that given appropriate instruction and practice, changes in brain development in relation to mathematics can occur.

2.7 Conclusion

In this chapter I have outlined how understanding the phenomenon of dyscalculia necessitated stepping outside the traditional boundaries of educational psychology and employing diverse theoretical and methodological perspectives. I have illustrated that

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[2] The distinctions between low math achievement, a mathematical learning disability, a specific learning disorder, and dyscalculia, are interpretive constructions that depend on contextual factors associated with their use. Dyscalculia is not a diagnostic term outlined in the previous or current editions of the DSM, and the term 'learning disability' in the UK refers to intellectual functioning below an overall FSIQ of 69. See: http://www.bps.org.uk/system/files/documents/ppb_learning.pdf

research that employs bricolage is emerging as essential in understanding any learning phenomenon and that for too long, rigidity in approach has been conflated with rigor in research. I have also outlined how the merger of different theoretical and methodological perspectives (in this case, critical, feminist, cognitive and neuroscientific ones) not only facilitates new understandings, that implicate the importance of interdisciplinary perspectives, but promotes important interdisciplinary dialogue. Through this emergent dialogue a new rigor is achieved; one where metaphorically how to set the table is no longer considered more prominently than who to invite to it.

Chapter 3

3 The Literature Review

We must question those ready-made syntheses, those groupings that we normally accept before any examination, those links whose validity is recognized from the outset; They must not be rejected definitively of course, but the tranquility with which they are accepted must be disturbed; we must show that they do not come about of themselves, but are always the result of a construction the rules of which must be known, and the justifications of which must be scrutinized (Foucault, 1972, p. 22).

3.1 Introduction

In this chapter, I provide a review of a diverse body of literature drawn from cognitive, neuroscientific, medical, and critical social perspectives on the emergent discourse of dyscalculia. This review is intended to illuminate the diversity of perspectives on the constitution of dyscalculia and highlight the role that epistemology and ontology play in shaping our understanding of it. Also, through this literature review, I have identified a gap in the research that is born of disciplinary tensions and compartmentalization, and have established the need to employ a critical complex bricolage as a research methodology to address this gap. As the quote that prefaces this chapter indicates, the diverse perspectives on dyscalculia require a certain scrutiny that has not occurred in the confines of strict disciplinarity. Much of what has been presented on dyscalculia is presented as fact, rather than finding, and all too often overarching assumptions have been made about the etiology and prognosis of dyscalculia as a result. As mirrored in the quote from Foucault, my intent is not to reject certain disciplinary perspectives on learning, rather, it is to disrupt the 'tranquility' of how dyscalculia is constituted as an inherent deficit based on the pronouncements of cognitive 'science'. In opening sites of inquiry surrounding disciplinary strengths, tensions and findings, and by expanding the scope of inquiry to include those who have been left out of the discussion, a deeper and socially just understanding of the phenomenon dyscalculia is possible.

3.2 The Emergence of Dyscalculia

Though identification of isolated cognitive processes related to mathematical cognition began with the study of mathematical deficiencies that emerged as a result of brain injury (Ardila & Roselli, 2002) this condition known as *acalculia* is relevant but distinct from the phenomenon of low math achievement that emerges in childhood known as *developmental dyscalculia* (Ardila & Roselli, 2002). Unlike *acalculia*, definitive etiology of *dyscalculia* is unknown (Ardila & Roselli, 2002) and dyscalculia displays greater heterogeneity in terms of manifestations and prognosis (Ardila & Roselli, 2002, Shalev, 2004).

3.3 Cognitive Perspectives

Despite the uncertainties as to the origins of *dyscalculia*, the limited body of literature on it is dominated by quantitative accounts of it from the perspectives of neuro-cognitive deficits (Gifford 2006). Though two of the primary researchers in the field of dyscalculia (David Geary and Brian Butterworth) take decidedly different stances on the causal factors for dyscalculia, they are in agreement that it is a neuro-cognitive deficit. Geary's research has focused on performance on standardized achievement measures and has emphasized the role of *working memory* as the primary contributor to mathematical difficulty (Geary, Hamsen & Hoard, 2000). However, more recently, Geary's research has taken a somewhat modified position on this assertion proposing that although components of working memory contribute to specific mathematical processes, the *type* of mathematical tasks performed engage specific components of working memory (executive function, phonological loop and visual spatial sketch pad) and the importance of each varies dependent on the mathematical task (Geary, Hoard, Nugent &Bailey, 2011, p. 2). In contrast, Butterworth's research proposes that dyscalculia "seems to be a core deficit in an inherited foundational capacity for numbers" (Butterworth, 2010 p. 534) and is found in individuals with "normal working memory" (Butterworth, Varma & Laurillard, 2011, p. 1049).

3.4 Neuroscience

Adding to the growing diversity of research on dyscalculia, neuroscientist Daniel Ansari (2010) challenges the generalizations made by researchers (with the specific reference to Geary and Butterworth) based on interpretation of neuro-physiological data obtained from adult populations (Ansari, 2010) which he cites "ignores the crucial role that developmental processes play in these disorders" (Ansari, 2010. P. 123). Ansari further suggests that research on dyscalculia (Price, Mazzocco & Ansari, 2013) and brain plasticity (Ansari, 2012) implicates cultural and environmental influences on neural structures; "challenging the dichotomy between, on the one hand, neuroscience as describing biologically determined variations between people and, on the other hand, social sciences as accounting for socio-cultural and educational differences" (Ansari, 2012). The brain develops in tandem with learning and in extension has implications for the role of education and broader social and environmental considerations. The potential for emergent themes in participants' experiences may illuminate some of these social and environmental influences.

3.5 Gender

In this environmental and social realm the literature specifically on dyscalculia is virtually non-existent. However, a relevant body of research does exist on the issue of gender and mathematical achievement and gender and literacy achievement. Sufficient literature on these issues provides valuable insight into the complexity of social and environmental determinants on achievement, previously held to be based on essentialist differences. A focus in education to address lower achievement of girls in mathematics seemed to close the gender divide in mathematics achievement (Hall, 2012), yet gains made by girls in mathematics were followed by a "boy crisis" in literacy and a resurgence of essentialist based perspectives on the origins of and approaches to addressing the (apparent) decline in boys achievement (Martino, 2003, p.105). After considerable focus in the province of Ontario on the "boy crisis", new research has emerged that suggests that the gender gap in math achievement is far from "solved" (Hall 2012, p. 59). Recent standardized tests (though these tests are subject to controversy) show that although differences between girls and boys achievement at grades 3 and 6 are statistically

insignificant, by the time they reach high school, the grade nine assessment data shows a small but consistent decline in girls math achievement compared to their male counterparts[3] (Hall 2012, p. 59). Though not specific to dyscalculia, this bears relevance to the proliferation of essentialist perspectives on ability, and speaks to Ansari's research on the false dichotomy of social and biological influences. Girls are not collectively and inherently bad at math; broader influences contribute to these shifts in mathematical achievement.

3.6 Co-Morbidity

Returning specifically to literature on dyscalculia, it is essential to also address prevalence and confounds of co-morbid disorders and learning difficulties with dyscalculia. Though the ambiguity of diagnosis makes claims of prevalence somewhat speculative, estimates are between six and seven percent of the population (Shalev, 2004) and an estimated twenty five percent of individuals with dyscalculia are also diagnosed with dyslexia or attention deficit hyperactivity disorder (Shalev, 2004). As well, emergent research on bipolar disorder and mathematical performance suggests that individuals with bipolar disorder have greater mathematical impairment than typically achieving peers or peers strictly diagnosed with unipolar depression (Lagace, 2003). The issue of co-morbidity raises important considerations for the assumptions about the etiology, diagnosis and remediation of dyscalculia within a heterogeneous population.

3.7 Social Implications

It is important to emphasize, that the formal identification of learning disabilities is not *inherently* problematic (Billington utilizes psychometric assessment as a point of resistance), but insights from Nowicki (2013) "found that children believed belonging to a group defined by the presence of learning disabilities was less desirable and was lower in social status than belonging to a group defined by the absence of learning disabilities"

[3] According to Hall, 2012 "the gap between girls' and boys' achievement on the Grade 9 Applied EQAO mathematics assessment has been widening over time, from a 1% gender gap in favour of boys in 2003/2004, to a 5% gender gap by 2007/2008" p. 63

(Nowicki, 2013, p. 2). To constitute someone as disabled or disordered (or for them to constitute themselves in this context) has multiple implications about how children are perceived by others and how they perceive themselves. Yet the reality is that difficulties do exist within schools and students who are struggling are impacted yet again beyond the classroom. Nowicki's research raises important considerations for examining learning difficulties beyond etiology and remediation, as socially situated phenomena to be explored in context.

3.8 Social Ecological Research

The final entry into this brief literature review is Tamar Posner's Dissertation: *Dyscalculic in the Making: Mathematical Sovereignty, Neurological Citizenship, and the Realities of the Dyscalculic* (2008). This dissertation stands alone as qualitative research that examines etiology, diagnosis and prognosis of dyscalculia as a complex, culturally bound construct. Posner does not question the legitimacy of dyscalculia, rather she asserts that it is a phenomenon that is constructed via what she refers to as "communities of practice; (1) people (self) identified as dyscalculic, (2) advocates for and against dyscalculics, (3) professionals considered experts in assessing and diagnosing dyscalculia; and (4) neuroscientists involved in brain-imaging research on dyscalculia. (Posner, 2008, Abstract). She highlights how much of what is assumed about dyscalculia is not as definitive as is often presented in the literature and examines in detail what she coins a "definitional mess" (Posner, 2008, p. 147) regarding how dyscalculia is identified. Posner also sheds light on an emergent but primary theme in her research; what she refers to as "*mathematical sovereignty*" (Posner, 2008, p. 9). She describes this concept as "a governance system in which math is viewed as a significant marker of intelligence, and therefore gives the talented in math privilege over those deemed as less able" (Posner, 2008, p. 9). She calls into question the *basis* for western culture's embrace of this mathematical sovereignty.

Posner's dissertation provided a strong foundation for inquiry in this thesis; however, I have outlined some significant differences between Posner's work and my own. Unlike Posner's work, the objective of my research was to gain depth of perspective on the experience of dyscalculia from those who live with it. In contrast, Posner's research

encompassed a very diverse group of participants and her theoretical framework and methods are distinct from those that I employed.

Posner "conducted thirty-three semi structured interviews with people who identified as dyscalculics, learning specialists, clinical diagnosticians, learning disability legal experts, advocates and neuroscientists conducting research on dyscalculia" (2008, p. 281). Of this diverse group of participants, almost *half* were researchers, and not individuals who identified as having dyscalculia. Of those who did identify as having dyscalculia, the depth of information provided, and the way in which the interview data is presented does not emphasize their experiences (Posner, 2008). As well, the questions for the semi-structured interviews are not included, which speaks to the need for inquiry that emphasizes the experience of individuals who identify as having dyscalculia, and clarity surrounding the questions and methods utilized in eliciting and representing their perspectives. Posner employs a grounded theory approach to the identification of dominant themes that emerged in the research, but the diversity of the group and concepts, though relevant, does not provide the depth of inquiry from the view of the 'subject', nor does it include highly specific information about participant reports surrounding psychometric data and academic achievement. Her theoretical framework though certainly employs aspects of bricolage, never specifies its use, or follows guidelines for the use of bricolage. Instead, Posner's work, though important, centres primarily on examining the *constitution* of dyscalculia, not the *experience* of it. As well, Posner acknowledged that she came to her research with the "privilege" (Posner, 2008, p. 10) of being highly skilled at math, and that her inquiry positioned her outside of the participants experience trying to understand the "other". I *am* the other, and in asking participants to share their experiences, I am also acknowledging to them that I share a discomfort with disclosure and am deeply committed to accurate and ethical representation of their voices, not as deficient, but as multidimensional beings with unique insights and experiences reflective of both struggles and resilience.

3.9 Conclusion

In this chapter, I have provided a brief overview of the research related to the theoretical framework for this inquiry. To explicate the phenomenon of dyscalculia in light of the

diverse literature reviewed, calls for inquiry that employs such diversity. In the following section I outline this diversity in approach as I discuss the fusion of theory and methods known as bricolage.

Chapter 4

4 Methodology

….without the difficulties that arose, without the objections that were made, I may never have gained so clear a view of the enterprise to which I am now inextricably linked. Hence the cautious, stumbling manner of this text; at every turn, it stands back, measures up what is before it, gropes towards its limits, stumbles against what it does not mean, and digs pits to mark out its own path. At every turn, it denounces any possible confusion. It rejects its own identity, without previously stating; I am neither this nor that. It is not critical, most of the time; it is not a way of saying that everyone else is wrong. It is an attempt to define a particular site by the exteriority of its vicinity; rather than trying to reduce others to silence, by claiming that what they say is worthless, I have tried to define this blank space from which I speak, and which is slowly taking shape in a discourse that I still feel to be so precarious and so unsure. (Foucault, 1972, p. 17)

4.1 Introduction

As illustrated in the quote from Foucault, this chapter outlines how my choice to employ the methodological complexity of bricolage required continual reflexivity about my task, and within that reflexivity, I am faced with having to articulate a process that is wrought with tensions, that evades rigid conceptualizations of methodology, while at the same time having to articulate and justify the basis for and contributions of diverse methods. This process has involved both 'stumbling' and 'digging pits', uncertain at times how to proceed, followed by clarity of purpose and methods, as I examined the works of various scholars who outline how one 'does' particular methods. This chapter is written with narrative accounts interwoven with participant data and scholarly positions on methodological frameworks, in part to enable the reader to 'experience' the process of navigating these tensions along with me.

In the following section I draw on various scholars to highlight my use of narrative, auto-ethnographic, and critical methods (which in the case of Tamboukou (1999) involves a merger critical and narrative approaches), and I outline considerations involved in

accessing the participants, the process of constructing questions and conducting the interviews, the experience of engaging in data analysis, and ultimately outlining evaluative criteria for this thesis. Though my assertions are marked with confidence, they are also extended tentatively. This is perhaps a point of distinction between 'stumbling' and 'faltering', for such complexities and uncertainties are key components of the responsive nature of bricolage; where one discovers, one questions, one writes, then re-writes, sometimes becoming lost, but one does not desist from the goals that led the process.

4.2 Narrative Inquiry, Auto-ethnography and Interviewing

In addition to a theoretical bricolage, this thesis utilizes a methodological bricolage as well (Patton, 2002, p. 400). Drawing on Narrative Inquiry, Auto-ethnography and Qualitative People-Oriented Interviewing is intended to represent creative approaches "that are situationally responsive and appropriate, credible to primary intended users and effective in opening up new understandings" (Patton, p. 4004, 2002). To gain depth of perspective, elicit voice and recognize my positionality in relation to the subject matter and participants requires fluidity in moving from what Moustakas refers to as *being-in, being for* and *being with* participants (Patton, 2002, p. 8). *Being-in* involves the researcher being immersed in the perspective of the participants' world, listening, encouraging and supporting participants to share their thoughts feelings and experiences (Patton, 2002, p. 8). *Being–for* involves taking a stance to support the voice of participants in an advocacy role and *being-with* is about bringing "one's own knowledge and experience into the relationship" (Patton, 2002, p. 8). This position is elaborated by Lofland (Patton, 2002, p.28) who writes,

> There are four people oriented mandates in collecting qualitative data. First, the qualitative methodologist must get close enough to the people and situation being studied to personally understand in depth the details of what goes on. Second, the qualitative methodologist must aim at capturing what actually takes place and what people actually say, the perceived facts. Third, qualitative data must include a great deal of pure description of people, activities, interactions and settings.

> Fourth, qualitative data must include direct quotations from people, both what they speak and what they write down.

Being critically reflective of my own positionality, owning my subjectivity and honouring that of participants, while being cognizant of the concern for accurate and ethical representation, I knew that I aimed to conduct qualitative people-oriented interviewing, but I would concur, as Carolyn Ellis proposes; "autoethnography chooses you" (Ellis, 2004, p. 26).As with dyscalculia, I had never heard of auto-ethnography or narrative research prior to this year, but when introduced to qualitative inquiry, it found me.

To address these terms with brevity (as with qualitative research in general) is a virtual impossibility (for the interpretive breadth, historical context and divergent terminology within these genres warrants much attention). However, for brevity's sake, *Auto-ethnography*, "refers to writing about the personal and its relationship to culture (Ellis, 2004, p. 37) and "about how looking at the world from a specific, perspectival and limited vantage point can tell, teach, and put people in motion" (Holman Jones, in Denzin & Lincoln, 2002, p. 763). In this context, the culture or group in which I am loosely positioned as both researcher and participant is the "community of dyscalculia" (Posner, 2008).Though there is considerable debate on what constitutes auto-ethnography (Denzin, 2006), and some approaches to auto-ethnography take a decidedly structured (albeit yet again different) stance towards analysis (Anderson, 2006, Chang, 2008), the synthesis of narrative auto-ethnography advocated by Ellis, Holman Jones & Chase, (2011) is intentionally elastic, evocative, and intent on changing the world through speaking from the heart (Denzin, 2006). Thus returning to my own personal orientation to research, I found myself drawn to the conceptualization of auto-ethnography articulated by Ellis, Holman Jones & Chase (2011). According to Chase, "contemporary narrative inquiry can be characterized as all amalgam of interdisciplinary analytic lenses, diverse disciplinary approaches, both traditional and innovative methods-all revolving around an interest biographical particulars as narrated by the one who lives them"(Denzin & Lincoln, 2002, p. 651).

Having experienced profound difficulties with mathematics has had reverberating effects in my life. I am positioned not as expert, but as an insider who is cognizant of the depth and nuances to which this phenomenon is constituted and can impact a person's life. I saw myself as unintelligent and I disengaged with education entirely. I hated school, and was embarrassed by my performance. I experienced ridicule from teachers and peers and a particularly powerful statement (from a teacher) permeated my consciousness in this regard. I was told (in front of the class) that I was "*stupid*" and that "*it was a good thing you are good looking so that you can find a husband to take care of you because you'll never be able to*". I *believed* this, and in extension it influenced many of my choices; some of which had a high emotional cost. To explore the issue of dyscalculia from an auto-ethnographic perspective is not self-indulgent story telling that does not constitute real research (as has been accused). To examine the depth and complexity of dyscalculia as an isolated phenomenon, determined by achievement scores, swathed in the language of neurobiological etiology does not explore the evolution and emotion of its constitution. The experiential *became* the cognitive and the physical.

I was struggling, but I was labeled 'stupid' and encouraged to cultivate my femininity (which, as Walkerdine highlighted, has been historically counter to reason and logic). I felt sick when faced with math (and in my short-lived exposure to introductory chemistry and physics as well). I skipped classes, kept silent, didn't do my homework, and on one occasion came to a science class drunk (seeing that I was not perceived as 'smart', led to a misguided attempt to try to assert myself as 'cool'). This was pivotal, for it was on a day when tests were handed back to us. It was not uncommon in those days for the teacher to identify who had done well and who had done poorly in front of the other students. Somehow I had gotten the highest mark in the class. One student commented "*she must have cheated*". I had not, and the teacher did not suggest that I had, but the accusation hung in the air and my thoughts clouded by the alcohol I had consumed prior to class left me in no position to defend myself. In front of my teacher and my peers I was not just bad at math, but was presented as a *stupid bad girl* who even in demonstrating academic success could not gain positionality as capable. I had been further positioned as a *cheater*.

My sense of self and ability in relation to math has many layers. Narrative inquiry "communicates the narrator's point of view, including why the narrative is worth telling in the first place. Thus in addition to describing what happened, narratives also express emotions, thoughts and interpretations" (Chase in Denzin& Lincoln p. 656). In a narrative account about my experiences with math and school I am explicating my subjective experience, but in doing so am highlighting how that subjective experience was shaped by the discourse of others, and the internal dialogue, emotion and behavior that it spawned. It creates a counter discourse to the essentialist etiology of deficits and implicates other contributories to behavior and achievement. I know that my experience is my own, distinct from participant voices, but I have insight into the lived experience of having profound mathematical difficulties, and how this extends far beyond the classroom, and is layered with multiple contributories. In interviewing individuals who identify as having dyscalculia, I aimed to provide a forum that illuminates the human *cost* of living with it, and hopefully illuminate the *strengths* and *resilience* that emerge from those who live with, but are not *defined* by it.

Indeed there are vastly different interpretations of what constitutes narrative and auto-ethnographic research, and how one should 'do' these forms of research. Throughout this process I have navigated when to employ specific and strategic methods, and when to seek out alternatives. In the case of narrative for example, Clandinin and Connelly argue against imposing theory on narrative data (2000, prologue, xxii-xxiii), whereas Tamboukou illustrates that elements of Foucauldian genealogy[4] are well suited to narrative research, as such an approach illuminates how micro-systems of power function

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[4] Yates, S., & Hiles, D. (2010). Towards a "critical ontology of ourselves"? Foucault, subjectivity and discourse analysis. *Theory & Psychology*, *20*(1), 52-75.

Developed by Foucault, genealogy is a method of analysis that involves examining the ways in which systems of knowledge are produced, exposing their links to institutions, regulatory systems, discourses and history to illuminate how these systems construct and define individuals with the establishment of 'norms', and how the acceptance and surveillance of these 'norms' (in relation to the self, and others), is accepted as a 'truth'.

to define, classify, control and regulate people as evidenced in the stories they tell (1999). Applying Foucault's notion of genealogy to psychology, Yates and Hiles explain that,

> Knowledge that is gathered of human behaviour can be understood in terms of a norm or an ideal of desirability. This makes possible power relations which centre on monitoring and assessing a population, and identifying, disciplining, and correcting deviant individuals within it. Similarly, a power whose aim is to normalize or discipline produces and utilizes systems of knowledge which are useful in attaining this objective.

As dyscalculia is constituted based on systems of knowledge that assert its existence as deviance from a norm of mathematical proficiency, any inquiry surrounding its constitution requires examination of systems of thought that 'produce' it.

Thus for Tamboukou, "a starting point for doing 'genealogies' should be to focus on a particular problem and then try to see it in its historical dimension; how this problem turned out to be the way we perceive it today" (1999, p. 212). Narrative inquiry that employs elements of genealogical analysis involves the synthesis the experience of individuals, within the explication of the knowledge-power complexities that form those experiences. Simply put, dyscalculia exists within the knowledge and practices that *signify* its existence, and these knowledges and practices must be examined as complex multi-dimensional contributories that emerge in people's stories.

Although a full genealogical method was not employed, this was not a failing; rather it was a recognition, because to suggest that one has *done* a complete genealogy is problematic. According to Tamboukou,

> A deployment of Foucault's techniques and practices can never be exhaustive or finalised. Foucault's originality lies in his strategic use of different discourses and approaches in the writing of his genealogies. Each reading of these genealogies reveals hidden layers of attentive and detailed research of an immense variety of data. Rather than following methodological principles, Foucault's genealogies create a methodological rhythm of their own, weaving around a set of crucial

> questions…what is happening now? What is this present of ours? How have we become what we are? and what are the possibilities of becoming 'other'? (Tamboukou, 1999, p. 215).

Thus the interweaving of narrative, theory and history are a purposeful attempt to not only achieve the initial goals of the research (critically and democratically informed), but to demonstrate what can be achieved by transgressing methodological boundaries; namely anti-oppressive research practices that "interrogate the 'truths' of our world" (Tamboukou, 1999, p. 215).

4.3 Participant Sample

The participants (six in total) ranged in age from their early twenties, to late forties. All were university educated, with one participant just beginning an undergraduate degree and all others having completed one or more undergraduate degrees, and multiple participants having completed graduate, or post graduate degrees. Half of the participants completed college programs that later enabled later access university studies, as direct entry to university would not have been possible given the general level academic streams that comprised the participants' high school studies. The participant's primary areas of university study were diverse, with representation in the biological sciences, cultural studies, education, linguistics, medicine and psychology. However participants also reported having completed additional education and training in health disciplines, law, and trades. Some participants had considerable employment related experience, while others were in the beginning phases of their careers. Explicit data on socio-economic status was not obtained, however participant accounts of family background, parent education, and access to resources for education such as tutoring, suggest diversity within the group. Approximately half of the participants could be described as having come from working class families, while the remaining participants reported having grown up in homes that would be described as middle class. However, the process of attempting to outline categorizations of socio-economic status is difficult, as in one instance, a participant reported growing up in an environment that would have appeared to many as middle class, but was wrought with economic hardship as a result of family

job loss. All but one participant reported growing up in a two-parent home, and in most instances both, parents worked outside of the home.

4.4 Procedures

The primary means of recruitment involved authorized advertisement of the proposed study throughout the University in the form of posters. Permission for a university wide recruitment e-mail had been sought, however during the recruitment investigation phase of this research I was advised that university wide recruitment e-mails were being discouraged while policies were being reviewed and that I would be required to contact individual faculties for permission. Permission from one faculty was sought and granted and an authorized recruitment e-mail was distributed. Both the posters and the e-mail recruitment sought voluntary participants that "*identify as having dyscalculia, a specific mathematics learning disability/disorder or individuals who self-identify as having experienced profound mathematical difficulties in contrast to other academic learning domains." (Recruitment Poster and Script, 2013)*

Following detailed explanation of informed consent, answering any questions participants had about the research process and objectives and obtaining written consent for participating in interviews, participants were asked to participate in an approximately one hour interview. I obtained approval for the use of short term private space at the Faculty of Education, but also met with participants at alternately agreed upon public spaces on campus according to participant's requests. To ensure anonymity, participants were offered the opportunity to choose or have a pseudonym provided to represent their voice in the study. In most instances, participants advised me to choose a pseudonym. I honestly had not given the process of name selection a great deal of thought, and in an impromptu decision, variants of the names of my own family were chosen, and *Max. Sophia, Xander, Lauren* and *Jordan* emerged.

4.5 Interviews

According to Montanna and Frey, interviewing cannot be neutral and rather than progressing with the pretense of objective stance, research interviews should be

emancipatory in intent (Denzin& Lincoln, 2002). However, the emancipatory intent of this research is not to assume anything about the experience of individuals with dyscalculia, rather it is to emancipate their *voice* and the fact that it has simply not been represented.

In order to elicit depth of participant responses while ensuring consistency and adherence to the proposed framework even within interview methodology I turned to the bricolage (an approach also deemed appropriate by Patton, 2002). Though Patton articulates three distinct methods for interviewing; the informal conversational, the general interview guide approach and the standardized open-ended interview (2002, p. 342), the following interview guidelines provide a rationale for the synthesis and selective use of all three.

First, the informal conversational interview is unstructured and allows for the greatest flexibility to pursue information dependent on the participant responses. However, such open-ended interviews require multiple interviews with participants, a deep immersion in fieldwork and a degree of flexibility beyond the scope of this thesis. The second approach is to provide an interview guide that lists questions or issues to be explored. The guide provides topics or subject areas which the interviewee is free to explore within a subject area (Patton, 2002). Such an approach provides for a greater degree of structure in pre-determining subject focus, but allows for flexibility as well. The third approach is the standardized (or semi-structured) interview which involves a pre-determined set of open-ended questions. This approach is particularly well suited when the researcher has limited access to participants (which is the case with this study). However, the weakness of this approach, as Patton, suggests, is that "it does not permit the interviewer to pursue topics or issues that were not anticipated… and reduces the extent to which individual differences and circumstances can be queried (Patton, 2002, p. 347). As elements of these methods can be used simultaneously, the semi-structured interview questions were utilized as a guiding framework only, and the interviews became more conversationally driven as participants shared their stories. This flow back and forth between a more conversational interview to what is referred to as 'the list' in the participant narratives, is discussed within the narratives to highlight the rationale for and the process of navigating between these two approaches. Indeed as participant (and my own comfort level)

increased, the conversation flowed more freely, yet there were moments of discomfort, where seemingly benign questions seemed to elicit memories that were in fact quite painful and the importance of flexibility in ensuring participant comfort took precedence over interview structure. As well, though the intent of certain questions seemed clear to me, it became evident during the research process that certain pre-determined questions (particularly in relation to gender) were met with uncertainty from participants. Participants often asked for clarification, *was I referring to the sex of the teacher*? *Was I asking if they were better or worse at math because of their gender*? Initially, my thought was that I had poorly designed the question, (*what did I mean?)*, yet it became evident that as much was revealed about gender in the difficulties of in interpreting and responding to the question as there is in posing it. This is explicated further in chapters 5 and 6.

According to Patton, six types of questions can be asked: experience and behavior questions, opinion and values questions, feelings questions, knowledge questions, sensory questions and background demographic questions (Patton, 2002, p.p. 349-351). However, I have attempted to illustrate beside each question (see list below), that questions do not offer clear delineations in the realms of ascertaining responses that can be categorized. Knowledge, feelings and sensory experience can emerge simultaneously depending on the participant's experiences and interpretation of the questions. Billington suggests that the long standing delineation of cognition and emotion within educational psychology has guided inquiry in ways that is both limiting and illusionary. He adds that classificatory and compartmentalized views of cognition and emotion contribute to pathological and essentialist discourse that negates experience, whereas emergent findings in neuroscience illustrate their imbrication (2013). Although Billington suggests there are "warning signs as to where this biologism might lead" (2013, p. 181), he is cautiously optimistic that neuroscientific research that focuses on "the ways in which young people feel and learn, supports narratives which create new spaces for critique, synthesis, and resistance"(2013, p. 181). Thus even in citing 'expertise' in how one should approach designing interview questions, epistemology and method emerge as imbricated and raise questions about each stage of the research process in privileging certain knowledge and practice. In extension, the interview questions served as a starting

point that recognized the need to begin with structure, yet are continually reflexive in undertaking inquiry into the experiences of participants.

4.6 Interview Questions

In this section I provide, 'the list' of questions that were employed in (and extended on) in the interviews with the participants.

In most instances I began with an open conversational interview opening:

Myself:

> *I would like to start the interview by thanking you for your willingness to give your time and share your experiences. I would like to begin by asking a few broad questions about how you came to identify as having dyscalculia and how has dyscalculia or low math achievement (LMA) impacted your personal and academic experiences?*

Yet as the narratives reveal, a neatly delineated process doesn't always go as planned. Reflecting on the uniqueness of how each interview unfolded, raised questions about expectations regarding the research process; to what extent does the researcher have 'control' of the questions, to what extent can 'vulnerability' or 'low-risk' be pre-determined and to what extent do ethical guidelines become repressive of knowledge? These issues are discussed in greater detail in chapters 5, 6 and 7.

The list of questions for the semi-structured interviews

1. Do you self-identify as having *dyscalculia/LMA*, or has a mathematical (or other) learning disorder/disability been formally identified? (background, experience, knowledge, opinion)

2. If formally identified would you describe this experience as beneficial? If not formally identified, do you feel that doing so would be beneficial? (experience, opinion, feelings, knowledge, sensory)

3. What are your thoughts and feelings about the nature/origin of *dyscalculia/LMA*? (feelings and opinions)

4. When did you first encounter mathematical difficulties?(background, experience, feelings, sensory)

5. Are there specific aspects of math that you feel more confident with (and others that pose greater challenges for you?) (experience, opinion, feelings, behavior, knowledge)

6. How have others (educators, parents, peers) responded to your mathematical difficulties?(experience, opinion, feelings, behavior, knowledge and background)

7. Have you utilized or received specific learning or instructional strategies to support math learning? (If so, what are your feelings about their efficacy?)(experience, opinion, feelings, behavior, knowledge and background)

8. Have you encountered peers that share this condition? (If so, how has this awareness of shared condition impacted your thoughts about *dyscalculia/LMA* and your experiences with it)(experience, opinion, feelings, behavior, knowledge, sensory, background)

9. Has *dyscalculia/LMA* affected your academic and career choices? (experience, opinion, feelings, behavior, knowledge)

10. Do you continue to take coursework at the post-secondary level where mathematics is required? If not, when did you cease taking math related courses? (experience, feelings, behavior, sensory, knowledge)

11. What would you consider your greatest interests and or strengths?(experience, opinion, feelings, behavior, sensory, knowledge)

12. If there was something that you hope that participation in this research could achieve what would it be?(experience, opinion, feelings, behavior)

Final Question:

Open ended: "I want to thank you once again for your willingness to participate in this research and for your willingness to explore these questions. Is there anything that you would like to add?

Though provided as a framework for facilitating dialogue and encouraging consistent inquiry with all participants, participants were encouraged to share whatever they felt was relevant or significant to them. However, participants were also advised that responses to questions were to be guided solely by their comfort level with disclosure, bearing in mind that questions are not such as those surrounding co-morbidity addressed complex and sensitive issues. Participants were provided the opportunity to contact me with any questions, concerns or further information they felt was relevant throughout the research process and at times they did follow up with additional information. As well, I met with each participant for their review of the constructed narratives in order to have their feedback about what was written. This was done to ensure that participants felt the narratives reflected their experiences, but it grew into something more as participants reported their thoughts and feelings throughout the research process as being

emancipatory to varying degrees (this is discussed in chapter 6). Though the theoretical and methodological intent of this research was to be emancipatory in terms of *voice*, in certain instances, participants reported that their engagement facilitated positive changes in self-perception, and an awareness of the constructionist aspects of learning difficulties. This awareness, for some participants, was different than their initial perspective on dyscalculia which had been framed to them as an *inherent* deficit. This cognitive-emotional shift in tandem with the emergent awareness of vastly different achievement trajectories of the participants (as evidenced in the narratives in chapter 5) *becomes* emancipatory, as it counters notions of learning difficulties as fixed and inherent. Ultimately, *doing* research differently can lead to *seeing* things differently, and in ways that have anti-oppressive effects.

4.7 Analysis of the Data

"Back and forth autoethnographers gaze: First they look through an ethnographic wide angle lens, focusing outward on social and cultural aspects of their personal experience; then they look inward exposing a vulnerable self that is moved by and may move through, refract, and resist cultural interpretations. (Ellis, p. 38, 2009). Though narrative auto-ethnography is very much about blurred genres and resisting structure (Ellis, 2009), data analysis was interpretive, employed thick description (Patton, 2002, p. 437), and involved coding of emergent themes (Hays and Singh, p.p.297-376)in tandem with employing critical theoretical frameworks from diverse critical disciplines(this is discussed in conceptual and theoretical framework). I do not propose that this thesis is an auto-ethnography; rather it employs auto-ethnographic 'elements'. Though I have included my own experiences in the rationale for this thesis, and in the form of a narrative etiology of this thesis, I have not engaged in the disclosure of the vulnerable self that Ellis (2009) outlines as a component of auto-ethnography. This decision was guided by both a desire for this thesis not to be *my story*, for one voice does not achieve a democratically informed psychology, but also because the degree of vulnerability that Ellis outlines as a component of auto-ethnography, left me feeling *too vulnerable*. My private space would have become too accessible and there are implications in doing auto-ethnography that

extend far beyond the research. I have provided a narrative glimpse into some of the self-reflection involved below.

> *How will I feel about potential criticisms that I have engaged in self-indulgent story telling? Will admitting that I have the mathematical proficiency of an elementary school child and meet the diagnostic criteria for a learning disability haunt me as this information becomes public domain? I put out feelers throughout the process, I provide snipits of what I am doing by telling the occasional person that I strike up a conversation with on my many walks at the park, that I am writing about dyscalculia in part from my own experiences. The responses range from polite exchanges that convey lack of understanding or interest, to more pointed comments like 'how did you get into grad school'. I find myself frequently explaining, justifying what I am doing and why I am doing it. I am hesitant to discuss my family, my friends, and the exteriorities that have comprised my experiences. I question my choice to use auto-ethnographic methods. Auto-ethnography is not easy, I think if anything, if it comes too easily then the point has been missed. I do believe that stories matter, the participants' stories matter, and perhaps in being so open about my own voice in this process; I am trying to demonstrate to them that I used the same thought process in representing their stories. It is hard to put yourself out there. I don't want them to see weakness or deficit in my words. That isn't what I saw, but I saw a lot of hurt, and sometimes it is difficult to convey the depth of that hurt without coming across as conveying a vulnerability that makes people feel weak, even though they aren't. I found myself in constant internal dialogue about their representation, and my own.*

Yet the constant self-reflection and critical lens that I have employed throughout this research is evidenced in not only contemplating my own disclosure or positionality, but in the seemingly small decisions that were made throughout this process. Though audio-recording of data had initially been considered, during the Ethics Review Process, I made the decision to not pursue permission for audio-recorded data. Instead, data was transcribed by the researcher *in situ*. Though audio recorded data is often referred to as an essential component of qualitative interviewing (Patton, 2002), all but one participant

expressed a degree of relief at not being recorded. Despite assurances surrounding confidentiality, most participants expressed feeling more relaxed at not being audio recorded. Though Patton discusses note taking as an alternative to audio-recording, particularly in relation to sensitive issues (2002, p.p. 380-382), the participant responses raise questions about how assumptions are made about what 'sensitive research' is. As discussed previously, research and questions believed to be relatively low risk, may in fact have layers of sensitive issues that emerge unexpectedly. When planning on conducting interviews, qualitative researchers must be cautious that audio-recording does not assume a *de facto* privileged status. As well, participant fears of being audio-recorded raised important questions about how audio-recording may influence participant disclosure as much as the potential errors of note taking. Even in those seemingly small decisions, ontology emerges (the idea of 'truth'). One must be cautious that these small acts done without reflection may have unexpected outcomes and contribute to paradigmatic privilege. As a method, note taking should not be viewed as *less than*, rather it should be viewed as *different* than, and by engaging participants throughout the process it becomes a co-constructed alternative to audio-recorded data.

Working from data obtained via the interview questions, a preliminary descriptive summary was written for each interview (Hays & Singh 2012, p. 297). This formed the initial narrative context for the interview and served as a starting point for representing participant experiences, first with depth, followed by analysis of themes and patterns within transcribed data *within* and *between* participant data (Hays & Singh 2012, p. 300). However, the beginning narratives (acknowledging this was my first experience with narrative inquiry), read like case studies (which I have considerably more experience with). This reflexive, iterative and participatory process resulted in a decision to approach the participant data in distinct ways in chapters 5 and 6.

Analysis involved comparative pattern analysis (Hays &Singh, 2012, p. 302) and identification of heterogeneity and homogeneity between participants. Review of the data also involved consensus coding (with advisors) of emergent themes in context with the conceptual and theoretical frameworks as a means not only for gaining consensus, but to reduce researcher bias (which although integral to the research, is not intended to occupy

the representation of the participants' perspectives throughout the research). Both chapters are indicative of bricolage, drawing on theory and method as iterative, employing flexibility throughout. Though admittedly not neat, the result is reflective of the emancipatory and democratic intent of the research, and is supported through the use of interdisciplinary lenses that both support and question one another along the way.

4.8 Evaluative Criteria for This Research

Evaluative criteria calls on the reader to engage in the process of viewing the findings of the research through not through the expectations of *triangulation*, rather it calls for viewing the research through a *crystal* with multiple lenses (Denzin and Lincoln, 2011, p. 5) with readers becoming *bricoleurs* themselves; open to interdisciplinary interpretive discourse. The aims of this research are not rooted in generalizabilty; rather they are rooted in illumination of human experience in context with diverse theoretical frameworks and qualitative data. Yet evaluative criteria are tricky when employing a bricolage of theory and methods. Expectations that adherence to frameworks for auto-ethnography, narrative inquiry, and critical theories must be suspended to a degree. The explication of these theoretical and disciplinary tensions is interwoven throughout this work, but for illustrative purposes within this section, narrative inquiry for example, sits in complex tensions in regards to differing perspectives on the representation of experience and the development of internal versus socio-culturally constructed "meta narratives" (Andrews, Squire, & Tamboukou, 2008, p. 6) and whether or not theory should be utilized in narrative research (Clandinin & Connelly,2000, prologue, xxii). Instead, evaluation of this work involves asking if what was employed: supported the goals of the research, in this instance, a critical, democratically informed interdisciplinary inquiry into the phenomenon of dyscalculia, and, did this work employ a bricolage of theory and methods to explore "epistemological, ontological, cultural, social, political, economic, psychological and pedagogical domains for the purpose of a multi-perspectival analysis" (Kincheloe, 2001, p. 682),and lastly, did this research employ the reflexivity that Billington urges when he asks those within educational psychology to consider how children (and adults) are constituted and represented in the disciplines of education and

educational psychology, in extension providing potential sites for amelioration of oppressive knowledge and actions.

Chapter 5

5 Participant Narratives

I think that we have to get rid of the more or less Freudian schema--you know it--the schema of interiorization of the law by the self. Fortunately, from a theoretical point of view, and maybe unfortunately from a practical point of view, things are much more complicated than that. (Foucault, 1993, p. 204).

5.1 Introduction

Though Foucault refers to the interiorization of thought about the self as a 'Freudian schema', this is to be understood as illustrative of what emerged as the dominant ontology within the discipline of psychology. The historical etiology of the turn toward seeking 'inner truth' holds far earlier origins and extends beyond the scope of this thesis as a technology of self rooted in medieval Christianity. [5] However, in the context of this inquiry, Foucault's call to reject the inward looking practice born in Christianity but proliferated in psychology is significant, as it speaks to historio-cultural constructions, accepted as expertise, that have become conflated with 'truth' about oneself. The early Christian obligations of self surveillance and confession before god, marked a significant historical shift in conceptualizing morality, the self, and truth in ways that eventually morphed into techniques of objectification and examination utilized in psychology (1993). Foucault suggests this process of self-examination linked to Christian beliefs became extended by Freud, whereby constructs of abnormality and notions of repressed

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[5] Foucault, M. (1993). About the beginning of the hermeneutics of the self: Two lectures at Dartmouth. *Political theory*, 198-227.

According to Foucault, one's sins originated in the violation of church dogma, and such deviance required penance to avoid exclusion from the various rites of the church. Confession was an act of penance and 'purification' which necessitated exposing one's inner truths as a means of reconciliation and a progression towards god.

or hidden truths about oneself could only be 'cured' through disclosure to, and guidance from the 'expert'. However, just as Billington (1996) cautions that educational psychology should not be considered solely as oppressive, neither should the concept of self examination be similarly framed. In being self reflexive about one's thoughts feelings actions and experiences (which are particularly relevant in narrative inquiry), the process of examination becomes expository of multiple influences. Knowing oneself in relation to these influences reframes 'deficit', as it exposes not inner 'truths', but exposes the processes which shape realities. This in fact holds immense potential for amelioration, such as the resistance of self-castigation that occurs when we examine ourselves for 'internal' psychological phenomena. This is significant in relation to the participant narratives, as it introduces the history of the discourse of deficits that runs as a thread in the lives of the participants. It is a psychological ontology that shapes how we think, and how others think about us. Yet it is illusionary, as these 'inner truths' can only occur as a result of external constructions. Exposing what Foucault refers to as 'exteriorities', a different analysis of the self occurs, new knowledge is born, and with that (though Foucault may have rebuked the word), a degree of emancipation can occur.

However, the degree of emancipation that occurred for the participants (and myself), cannot be articulated in a homogeneous or linear fashion. In extension, the narratives are winding, juxtaposed with questions, thoughts, feelings and periodic interjection of theoretical insights.

I begin by providing the foregrounding to my use of narrative through my own '*Narrative Etiology of a Thesis*', to illustrate the emergence of narrative inquiry as a methodological choice for this research. This is followed by a discussion of Clandinin's framework for narrative inquiry (2010), and Tamboukou's Foucauldian genealogical approach to narratives (2010, 1999). This brief discussion of frameworks is followed by the participant narratives and my own experiences interwoven throughout. These narratives are presented in the order they were conducted, as in addition to the participant's experiences with dyscalculia, the chronology of the narratives illuminate my own experience as an emergent researcher; the beginning uncertainties, the roller coaster of

emotions, the constant self-reflection, and ultimately the transformative aspects of research.

5.2 Narrative Etiology of a Thesis

I have always struggled with math. The reasons for this are complex, but this struggle has been personified as an ominous creature whose presence mocked me, pushed me and inspired resistance within me. This creature became an integral part of my identity, both in how I viewed myself, and in how others viewed me. It has imposed immense challenges, some which were overcome, others which were circumvented, and others which were lost. Having attended elementary and secondary school in the 1970's and 1980's, the concept of low math achievement being constituted as a learning disability was unheard of. An inability to achieve required benchmarks within mathematics was considered reflective of overall intellectual ability; if you were smart, you were good at math. In my case, as mathematical expectations increased, my performance decreased and the resulting decline spilled over into other learning domains. Though I would eventually find a window of opportunity for academic pursuits in the ability to avoid taking coursework that involved any degree of mathematical proficiency, the journey to post-secondary education and emergent identity as someone capable of intellectual pursuits came *in spite of* rather than *as a result of* my elementary and secondary education. I had never heard of *dyscalculia* until I was a graduate student, yet I became immensely interested in this condition as area of inquiry when the creature reared its ugly head again and I found myself struggling to interpret the discourse of statistics in quantitative data. How quickly my confidence and sense of identity as a capable student became overshadowed by my sense of inadequacy tied to this domain. Yet I steadied myself with the reflexive self-talk that has evolved as my mantra; asking myself "what can you *do* about it?" After much contemplation (and guidance) I made the decision that I could confront it, understand it, force it to relinquish some of its power, and make it the focus of my *thesis.*

5.3 Narrative Frameworks

Though a story had emerged as a means for expressing my own thoughts about exploring dyscalculia as the focus of my thesis, it was a beginning that led to the unfolding of methodology as well. For as long as I can remember I loved to read stories, listen to them and to be transported by them. I found them to be powerful learning tools that stayed with me long after much of the data that I had crammed into my mind had dissipated. I can revisit them and be transported again, sometimes returning to the same thoughts and emotions, sometimes encountering new ones. Stories were also pivotal in my own turn towards engagement with education. Though initially mere electives at college, courses in humanities, delivered by the greatest orator I have ever known, made history and culture come alive for me. These stories of history, culture and music opened my world view and inspired me to pursue both further education and study abroad. Just as my mathematical failings heightened by the sexist ridicule I encountered spilled over into other domains, my emergent academic success in the arts, guided by a mentor who inspired and encouraged me to think critically and deeply about what I was learning, spilled over into other domains. I had been transformed from the "math idiot" to a "straight A student". I saw myself differently, as did others, and it impacted life choices in a positive way. When I discovered that narrative inquiry could be utilized as a methodology, it seemed a fitting way to explore the phenomenon of dyscalculia. I knew of the prevalent discourse of deficits within educational psychology, and the impact that it has on those who struggle with certain learning domains. I also had come to learn that the dominant 'truths' about dyscalculia (those asserted by Geary and Butterworth) were problematic; first in their essentialist perspectives on dyscalculia, second, in the contradictory "evidence" surrounding some of their claims, and third, that emergent neuroscientific research (Ansari) was proving to be a new point of resistance against fixed reductionist perspectives on dyscalculia. To understand dyscalculia differently required a different approach. People's lives are storied and eliciting experience and discourse in people's lives reveals and constructs alternate knowledge.

However employing narrative brought with it the challenge of understanding how one "does" narrative inquiry. There are diverse interpretations of what narrative inquiry is,

and having proposed a critical complex bricolage as the framework for my inquiry into dyscalculia, led me to two somewhat distinct approaches, one that emphasizes evocative storied experience, free of constraints of theory, and one that employs theory within a narrative framework. Thus in the intent of bricolage that urges the merger of theory and methods and blurring the lines where appropriate, I chose to employ elements of both approaches.

Clandinin and Connelly propose, narrative is best explored and presented outside of theoretical frames (2000, p. 128), whereas Tamboukou (2010, 1999), takes a Foucauldian approach to narrative that employs theory. I begin with Clandinin's approach (2010) in chapter 5 and demonstrate how Tamboukou's approach began to emerge and was continued in the critical anti-oppressive analysis of the narratives in chapter 6.

Perhaps the most significant starting point for beginning narrative inquiry is not to explore *how* one does narrative inquiry, but *why* one does narrative inquiry. Though Clandinin and Connelly begin a discussion of their framework with "three commonplaces of narrative inquiry, *temporality, sociality*, and *place*, specify dimensions of an inquiry and serve as a conceptual framework" (2010, p. 3), they take a step back from *what* is explored using narrative and turn their focus to justifying the use of narrative. Though with any research some degree of justification occurs, the degree of justification that is placed upon the choice to use narrative inquiry is indicative of the reason for doing it; simply put, such methods are subject to epistemological oppression. Yet as I have addressed these issues in the rationale for bricolage, I will only briefly revisit them. When one justifies the use of narrative, it is not simply a justification of the method, but about situating oneself as a researcher and about establishing the relevance and importance of narrative inquiry for achieving a specific purpose. In relation to the participant's experiences with dyscalculia, narrative inquiry explores the phenomenon in ways that other methods do not, it privileges voice, and I acknowledge my own positionality as both researcher and subject throughout this work.

Returning to the three dimensions outlined by Clandinin (2010), *temporality* in narratives involves exploring past present and future events in relation to the individual, the

researcher and the phenomenon understudy; *sociality*, encompasses personal and social conditions within experiences, and *place* refers not only to the physical locations revealed in stories but an awareness of the relevance of the physical site that the research. In the participant narratives, their experiences are situated historically, yet move to the present and look to the future, they explore the personal and social conditions that contributed to the constitution of dyscalculia and they involve explication of the sites that have been pivotal in their stories. These sites however are not restricted to the physical location of elementary or secondary school, they implicate home and family (which is why Clandinin cautions that there isn't a neat delineation between these dimensions). Clandinin also proposes that narratives are intended to: frame a "research puzzle", explore "research undertaken from differing epistemological and ontological assumptions" and to be conscientious at every turn regarding "ethics and representation" (2010, p. p. 6-15). Throughout the narratives I have incorporated elements of the framework provided by Clandinin, yet I was also conscious of previous readings (cited in the introduction of this thesis), particularly Moustakas, who refers to *being-in, being for* and *being with* participants in the research process (Patton, 2002, p. 8). As a result, I have interwoven my own experience in, signifying the shifts that occurred from the positions of *being'*; the immersion into their stories, the resultant sense of advocacy that emerged, and the tensions involved with trying to "*be with*" the participants.

5.4 Max

"I felt like I had a target on my back"- Max

My interview with *Max* was the first interview that I conducted, and despite having spent many years working in an interviewing role, I was incredibly nervous. I wondered about the questions I would be asking and how he might feel about them. Would he feel that I was scrutinizing him from a clinical gaze, verbally poking and prodding at him to somehow get a glimpse inside his life, his head, his "dyscalculia"? I was actually deeply

frustrated as well, because I knew that in my initial proposal to the Research Ethics Board I had included my desire to disclose my own positionality as someone who struggled immensely with mathematics, a positionality that I believed was theoretically sound, reducing the space between the researcher and subject and deconstructing a clinical stance towards participants. Yet my positionality on this issue had been met with an emphatic "no" from the Research Ethics Board. Such disclosure I had been informed was considered 'unethical'. I couldn't wrap my head around the idea that my desire to alleviate potential discomfort that participants might feel by sharing that I too, struggled immensely with mathematics was somehow unethical, yet to gaze clinically, verbally poking and prodding from an 'objective' stance was acceptable. I didn't intend to, nor did I want to share details of *my* story, but *because* of my story, and the informal conversations that I had had with others who met the diagnostic criteria for dyscalculia, I knew that it felt somehow safer to share with others who did not gaze quizzically at us, questioning our sincerity or intelligence when we shared stories of having trouble dialing a telephone number correctly, or never being able to remember the difference between the greater than less than signs. I was worried. I hoped that I could help *Max* feel safe and comfortable sharing. And when I met *Max* for the first time, it became clear that I was asking a great deal of him.

Max contacted me to express an interest in being a participant in this study after having seen a recruitment poster at the university which was seeking individuals who were formally identified or who self-identified as having dyscalculia or a mathematical learning disorder. *Max* stated that although he believes he had some form of psycho-educational assessment completed when he was a child in elementary school, he was not privy to the information and cannot confirm the nature of the assessment, or if he had a clinical diagnosis of a mathematical learning disorder. *Max* stated that as an adult who was experiencing academic struggles restricted to domains of mathematics, he attempted to access his elementary and high school records and inquire about the existence of a psycho-educational assessment in his school records without success. He was advised that these records were no longer available. Furthermore, school staff said they could not provide him with details that would enable him to speak with personnel that had been privy to his records or experiences as a youth (teachers or psychologist). *Max* stated that

he was unsure if he would meet the criteria for the study because he did not have an official diagnosis of dyscalculia, but he had brought post-secondary transcripts as his evidence of a significant achievement discrepancy compared to other learning domains (a general overview of DSM-5 criteria for learning disorders was indicated on the recruitment poster). I advised *Max* that documentation was not necessary and that participation in the study was based on how individuals felt their experience with mathematical difficulties has impacted them. *Max*, was intent on showing the transcripts and said; "*here, just look at the grades and see if you can spot the math.*" *Max* handed over a compilation of transcripts for all post-secondary coursework completed. I reviewed the transcripts as *Max* had requested and was able to clearly identify '*the math'*. His transcripts listed grades that could be best described as extraordinary. The transcripts read as a straight line of A's, A+'s or numeric grades in the high 90's, in a diverse array of coursework in the arts, social sciences and science. Spotting *"the math"* was not difficult. *Max*'s transcripts listed a couple of college courses with grades listed beside them as C's; such a sharp contrast to the numerous other courses in which he had demonstrated such outstanding academic achievement. His university transcripts followed the same pattern; straight A's or A+'s and grades in the high 90's, but this time not contrasted with poor grades, rather the contrast was in the indication of *"withdrawn from course"*.

It was evident that my own nerves paled in comparison to *Max*'s. Sweat seeped through his shirt like blood through a bandage, foreshadowing the wounds he would reveal. He had difficulty meeting my gaze and that troubled me. I hadn't anticipated such a visceral display of emotion in meeting someone to discuss "math". It troubled me, but it was clear that *Max* wanted, in fact needed to share his story. So I tried to hide my own nerves and discreetly took a deep breath and exhaled slowly, trying to move as little as possible as to not give my own anxieties away. I needed to pull it together and appear calm and put *Max* at ease. So I took a step back and reiterated the purpose of the study to *Max*. I told him that my intent was to listen to the stories of individuals who had struggled with mathematics, not to make a determination whether or not someone met the diagnostic criteria for dyscalculia, which I was not qualified to do. I added that currently dyscalculia isn't an actual diagnosis, and the complexities of diagnosis were part of my inquiry, with

the central focus being that *voices count*. It was clear that *Max* had given much consideration to participation in my study (in part evidenced by coming prepared to advocate for himself as meeting the diagnostic criteria of a mathematical learning disorder through the compilation of transcripts he laid in front of me as soon as he sat down), but I could not help feeling that his decision to participate had not been an easy one. *Max*'s responses were slow and methodical, like he was giving a witness testimony, and indeed he was. *Max* painted a picture of a system that not only failed him, but abused him, leaving him with deep emotional scars made visible as he sat before me. He spoke of the imbrications of experience, shattering compartmentalized approaches to understanding children's learning.

> *I barely made it through High School, but things took a turn for the worse much earlier than that. Things had been ok up until grade seven. I was a quiet kid, I didn't have a lot of friends, but I did have one consistent friend. Then I had to change schools in grade seven, we all did. From the start we were considered the outsiders. Most of the kids had gone to the school their entire life and then there was this small group of us from another school. It was clear we weren't welcome and the teachers made us feel that way too. I ended up getting bullied verbally and physically on a daily basis. The teacher was a bully too. She called me 'stupid' or an 'idiot' when I didn't give her the correct answer in class. It was especially hard in math because I didn't get it. I felt like I had a target on my back. I tried to talk to my parents about what was going on, but they didn't believe me. They talked to the school, but the teacher denied it and said that I was the source of my own problems.*

When *Max* sought help, it was not available and the taunting from the teacher and his peers persisted. As *Max* continued to return home with the visible signs of altercations, his parents, though *Max* asserts were supportive, had been led by the school to believe that he was *"too sensitive"* and in response, (reflective of dominant beliefs from their generation and culture) encouraged him to *"man up"* in response to the bullying from other kids. Eventually, *"that's what I did. I snapped, and fought back, becoming verbally, and at times physically aggressive towards others"*. But *Max*'s actions did not alleviate

his suffering. Instead *Max* was painted as the source of his own troubles, as the teacher had postulated.

Max stated that eventually his outbursts led to his frequent removal from class, so frequent in fact, that he spent the better part of the year in the hall. *"I never learned a thing"* he said. *How could he,* I thought. With *Max*'s consistent displacement to the hall and virtual removal from any learning opportunities, towards the end of the year the school sent him to see a psychologist. Though *Max* recalls meeting with the psychologist and taking tests, his memory is vague and he does not recall any outcome from the assessment being conveyed to him. *Max* stated that he even inquired about this as an adult, asking his parents their recollections, but they too only had vague memories and could not recall being involved or having anything specific communicated to them about the process or findings.

> *They knew I had an assessment, but that was it.* A*ll I know was that after the assessment they called in a child and youth worker to sit looking over my shoulder all the time*.

When I asked *Max* about his feelings and recollections about the Child and Youth Worker, specifically if he felt supported by her, he said:

> *No, I felt like she was just there to intervene if I freaked out. I felt watched and afraid that she was there to possibly send me away. I didn't know exactly what was going on, but I didn't feel like she was there to help me in any way. It just made me feel more singled out.*

Max added that he eventually began missing a considerable amount of school, due to illness, indicating that he would experience significant somatic reactions to the prospect of going to school. He also shared that he received multiple suspensions from school during these two years for *"verbal outbursts"* directed at the teacher. Eventually everything had just *"spun out of control"* and two years of his life were *"a complete write off"*. *Max* had been bullied, by his teacher, his peers and the Child and Youth worker brought in to support him had been no support whatsoever. He had been singled

out as *"a problem child",* and eventually his perception shifted towards his role in his these experiences, stating: *"it was probably my fault"*.

I was sickened by the story *Max* had told and the fact that he had come to internalize what had been done to him. He clearly felt guilty and defeated. There was no sense of hope left in him. By High School, he had given up. "The *damage had been done"* he said. He was trapped. He isolated himself and began to suffocate under the weight of depression. Yet somehow the isolation and depression was more bearable than the anxiety he felt at the thought of going to school. No matter which alternative he chose, he would suffer the consequences.

It is hard to imagine that amidst his turmoil, moments of positivity would emerge in High School. *Max* said that the freedom to take courses of his choosing helped motivate him to attend some classes. Most of all he really enjoyed taking the social science courses offered at High School, he loved learning about sociological insights into human behaviour and being able to for the first time hearing that others shape our world. Perhaps it was his respite, the one place where everything wasn't his fault. *Max*'s resultant grades and engagement began to emerge as a dichotomy; doing well in individual and society courses and struggling to get through the required maths and certain sciences. Though *Max* was eventually able to graduate High School, he did so without a sense of hope, optimism or direction for his future. Young, unemployed and with a paradoxical relationship with school (a love of learning in some domains, but a long history shrouded in fear and negativity from the treatment that he received within the school setting), he would eventually enroll in an employment focused academic upgrading program that was required to pursue any post-secondary education or training. During this time, *Max* was able to choose some elective courses and began to experience support and positive feedback in the arts and social science courses that he enjoyed. For the first time, *Max* began to experience a high level of academic success; he wasn't just managing, he was excelling. Simultaneously although still anxiety-provoking, his experiences with courses in the domain of math were not as pivotal in shaping his academic self-concept. His considerable efforts were acknowledged and his challenges were not marked by ridicule or feeling singled out in any way. The college instructors provided positive feedback

about his abilities outside the math domain, and within math, though his challenges persisted, they were met with support and assistance. With an emergent self-awareness of high ability in other domains, *Max* was able to not only be successful in college but to *excel* at it.

As I moved through questions on my list, when I came to the question of gender, *Max*'s responses once again illuminated that his experiences were about much more than math, and that the issue of gender runs deeper than gender myths about math ability. Though *Max* said that he didn't know if gendered attitudes had permeated his experiences with mathematics, he did highlight how gendered attitudes towards his behaviour had been influential in his life in general, and painfully so. Sweating profusely and taking occasional pauses to breathe deeply and gain composure when his chin began to tremble, *Max* was frequently apologetic about the visibility of his emotion and anxiety while discussing his past experiences. Despite reassurances that no such apologies were necessary, *Max* could not seem to stave off a sense that he needed to apologize and he continued to do so throughout most of our meeting. Being told *"man up"* and being criticized for being *"too sensitive"* echo in his mind as he reflects on his experiences in school. He said that as an adult he has learned that emotional expression is normal, healthy and not gender specific, but that doing what he knows to be *best for him* and doing what he was always led to believe was *expected of him* are at odds. He is embarrassed by his emotions, and they evoke an entanglement of guilt for him, that somehow he was culpable for his experiences.

As I listened to *Max*, the issue of dyscalculia had receded into the distance. *Max* had shared a story that shattered illusions of the compartmentalization of learning difficulties. How could his experience with math be extricated from the abuse he endured? How could learning occur under such conditions? Yet something had drawn *Max* to share in my study on dyscalculia and I wondered how he had come to view his struggles with mathematics as a learning disability. When I asked *Max* about his feelings on the nature/origin of dyscalculia, he indicated that he was torn about this issue. He indicated that although there has always been a sense of "*something inherent*" about his difficulties with mathematics, he was also aware of the complex interplay of the bio-psycho-social

and that it was difficult to know to what extent the traumatic experiences he had in grade seven and eight may have played in compounding his internal dialogue about math and his own self-efficacy. He stated that:

> *There was something about math that emerged early. It was anxiety provoking even prior to what happened in grade seven and eight.* [*Max* paused and reached for a sheet of paper before adding:] *Have you ever seen this before?* [*Max* proceeded to draw the numbers one through five, demonstrating how he visually counts 'pieces' of these numbers as opposed to quickly identifying the number representation].

I smiled when *Max* showed me the dots. Indeed it was not the first time I saw someone break numbers down into pieces that way, I had done it myself, and knew that math beyond what my fingers could manage left me overwhelmed. I wanted to tell him, but I moved on.

I asked *Max* if he recalled how he had done in other subjects before everything had spun out of control. He indicated that he read well, but that he didn't always do well in school in language arts because he had difficulty organizing his thoughts on paper. He stated that:

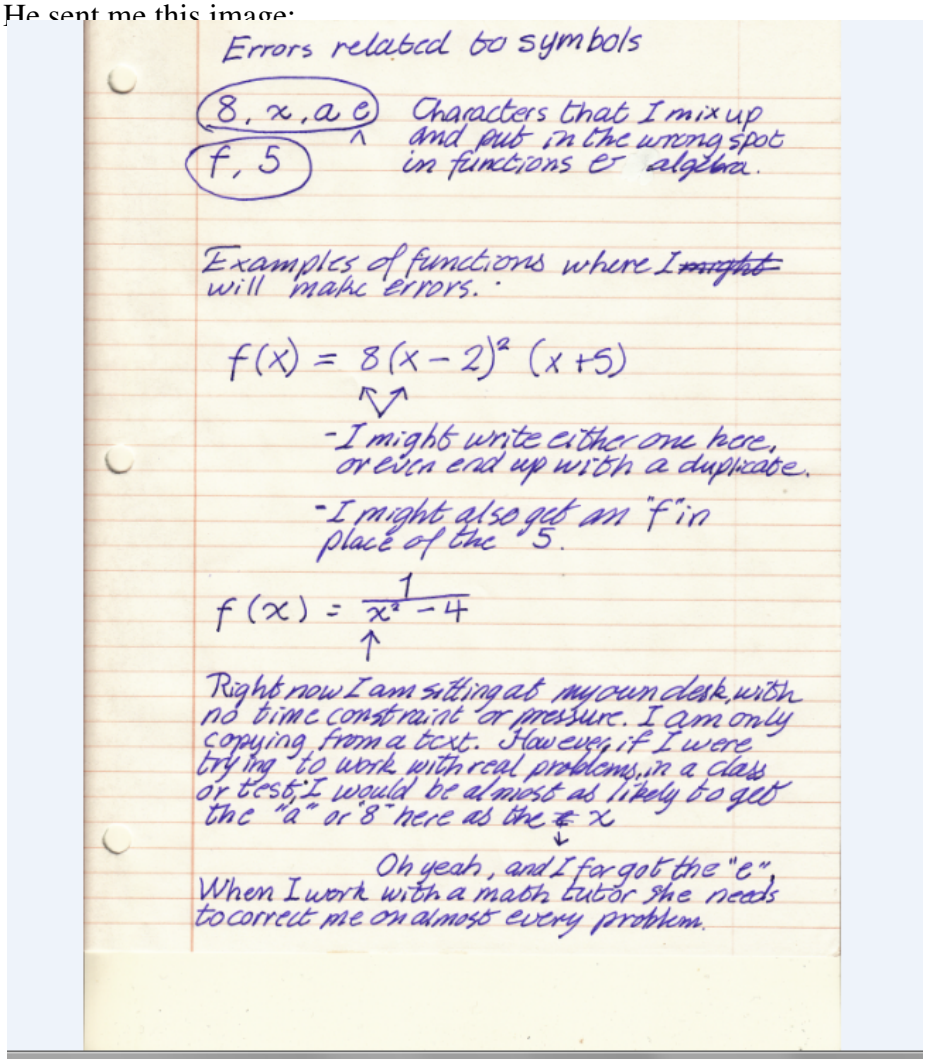
> *Sometimes the thoughts come too quickly all at once and end up jumbled up on the page. I misspell words that I know how to spell, not because I don't know how to spell them, it is just some kind of anticipation as to what I am going to put next that interferes with what I haven't gotten out yet. I have trouble with organization. The ideas are there, but it isn't always reflected in the work.*

According to *Max*, the experience of doing math has always been anxiety provoking. His negative experiences in grade seven and eight, with his teacher, support personnel and his peers, compounded these anxieties and have contributed to profound social and academic anxiety, depression, and as an adult, substance abuse. *Max*'s recollection of his experiences in school are marked by tremendous pain, but also an emergent recognition of his strengths and a desire to improve the experience of others by pursuing education that will ultimately lead to a career within an as yet undetermined helping profession.

Max's identity is inextricably linked to his experiences in school and is marked by an ongoing struggle of an emergent self-awareness of *high ability*, and feelings of *sadness, loss, anger, self doubt* and *inadequacy* based on his experiences. As an adult, *Max* has engaged in counselling to deal with the feelings of depression and anxiety that have permeated his world. During counselling, *he* completed a personality assessment that has proven invaluable in reframing what he once perceived as weaknesses as strengths. *Max* indicated that the assessment indicated that he was *"an INFP"*(an acronym for the Myers Briggs personality typology representing *Introversion*, *Intuition, Feeling,* and *Perceiving*), often described as an "introverted idealist" and "healer"; and as someone who has a strong preoccupation with ethics and social justice. Though positivists question the validity of the Myers Briggs assessment (arguing that results are not always consistently replicated), I could not help but think of Billington's comments about the potential for assessment to serve as a mechanism for resisting pathology. For Max, the INFP construct has enabled him to see himself differently, positively, and is helping him heal the wounds inflicted by a system intent on finding something *wrong with him* instead of acknowledging the *wrongs done to him*.

At the end of our meeting I advised *Max* if there was anything that he wanted to discuss, add, clarify, or review his responses, to please contact me at any time. *Max* did indeed contact me, with images of a couple of questions (mathematical in nature). He had taken the time to write annotations beside the questions, reflections about what he perceived as problematic for him

He sent me this image:



I honestly didn't know how to interpret what *Max* had sent me. I had given up on anything remotely mathematical years ago, and I had no idea what it meant. Though his notes describe confusion of symbols I was in awe that *Max* had dedicated so much time and energy to understanding and conquering math. Though I had told *him that* I would include his drawing, its significance seemed diminished in light of all that he had revealed through his stories. I came away from our meeting exhausted, having experienced a roller coaster of emotions. I had been saddened, angered and inspired, beyond what I could have imagined. *Max*'s story reminded me of one of the most widely known stories in the history of psychology; a story that should have slipped into the

annals of history and not bear such resemblance to what *he had* endured. The story goes as follows:

> A teenage girl with a persistent cough and frequent headaches says her father's friend has been making sexual advances to her when she accompanies her father on visits to his household. No one believes her. Her father takes her to a therapist and tells him to bring the girl to her senses. The therapist was Sigmund Freud, the founder of psychoanalysis, and the patient, Dora. . . Freud from his patriarchal perspective, assumed that any young girl would appreciate the attentions of a man like Herr K. and accede to them. Therefore, he regarded Dora's problems as hysteria resulting from her aroused and disguised sexual desire. When he tried to press these views on Dora, she quit therapy. This led Freud to label her not only as disturbed, but also as disagreeable, untruthful and vengeful. The adults involved acknowledged some time later that her claims about Herr K. were true (Fox, Prilleltensky, & Austin, 2009, p.83).

Like Dora, no one believed *Max*. Like Dora, *he* was positioned as the source of his own troubles. Like Dora, when he resisted, he was pathologized as deviant. Though relatively little is known of Dora's life beyond the confines of Freud's famous case study, I wonder if like *Max*, she had been filled with feelings of guilt and shame, internalized angst for the suffering she endured. No one listened to her, and when she asked for help, the voice of authority spoke and she was pathologized through a gendered lens. Her voice did not count. With over a century's distance between them, I shudder at how similar their stories are.

I felt guilty somehow. Like I had asked too much; peered too deeply into someone's pain. My study was to have been about mathematics, hearing the stories of those who struggle with it. Low risk; benign. But it wasn't. *Max*'s struggles with mathematics cannot be extricated and compartmentalized from his teacher, his peers, the abuse. I am still unclear what motivated *Max* to come forward and share his story. *Max* could have been angry, but he wasn't. His soft-spoken gentle demeanor stood in such stark contrast to the image of the young boy labeled deviant. He was still hurting, the wounds at times visible, his

feelings of guilt and shame still a struggle. I wondered about the shame he felt. He shouldn't feel this way, yet he does. How does one overcome it? According to Brown, (2006), part of overcoming shame, is speaking it, understanding its origins, and the language used to perpetrate it, knowing that it does not act alone. I hoped that somehow, though I worried that I had asked too much of him, *Max* needed to share his story, to understand that he was not guilty. He was not the defendant, but an expert witness. His testimony standing in evidence against those who perpetrated acts of emotional and physical violence against him; his voice *does* count.

Though *Max* believes that math has always posed challenges for him, his story counters the belief that one's learning in any domain can be reduced to some finite neurobiological etiology. His story is a cautionary one, inciting a need for a critically informed psychology that questions the positivist and essentialist discourse so prevalent in educational psychology (Nolen, 2009).To struggle with math may indeed position one as *having* dyscalculia, but to suggest that one *is dyscalculic* is a semantic distinction that should not be made. Teachers, parents and peers reverberate in our stories about math. To suggest that *Max is dyscalculic* reduces him as a person, and acquits those whose wrongdoings played a part in the construction of his struggles with mathematics.

As our meeting came to an end I asked Max what he would like to see as an outcome of this research. He said:

> *I hope that your research contributes to a better school experience for future generations, better recognition and utilization of an individual's unique sets of strengths and talents. To help people understand that we all learn a little differently, and that's ok.*

I had learned so much from *Max* in such a short time, and was inspired by his parting words and his desire to make a difference. I had been left with much to consider about how to represent his story, but the resounding message had been made clear; *it's about much more than math*, much more indeed.

I thought that I had completed the narrative that I had written of *Max*'s story, when nearing the end of my work on this thesis, *Max* contacted me to tell me that since our last meeting he had pushed further with the school he had attended as a child, and the psychometric report that had been "unavailable" had since been located. *Max* advised that with this information, he was able to also obtain support in accessing a current psychometric assessment. He said that the assessment "*as expected, confirmed both ability and disability*". From his words, I felt in that moment, that what Billington was advocating for was possible, that psychometric assessment could serve as a form of resistance against pathology. Unlike what had happened as a child, *Max* came away from this process highlighting his *strengths* above any deficit. He wasn't a behavioural problem, in fact, on the assessment he indeed scored in the gifted range (99th percentile) in multiple domains, and his primary difficulties were in the areas of visual spatial tasks and math (6th percentile). *Max* was indeed twice exceptional. He now felt validated, understood and listened to, and he felt that with the insights obtained from the assessment, he would now be able to access the support he had long hoped for in order to address any challenges that he may face in his studies. I was beyond happy for *Max*. His anxieties were evaporating in light of his emergent belief in himself. He thanked me for the opportunity to participate in this research and told me that it had it had truly made a difference to him. I welled up. This journey had left me feeling such a connection to the participants. I was saddened that as my research was coming to an end, I wouldn't know what came next for *Max*, or the other participants. I wondered what it would be like for us all to meet and to share our stories without judgment. I knew it would not happen, but I had promised each of the participants notification of eventual completion of my thesis, so perhaps in some way this thesis will serve as a small bridge in bringing us together, feeling a little more understood and a little less 'othered'.

5.5 Sophia

"Even though I was good at other things, it didn't matter, it became all about me not being good at math" - Sophia

The experience of meeting with Max had filled me with some trepidation about meeting further participants. His story had been about so much more than a glimpse into his experience with mathematics. It was powerful in a way that I had not anticipated. His stories were raw, and filled with a terrible injustice about how a child had been treated in education. I began to worry that in asking participants my seemingly benign questions, that they would in fact evoke feelings and responses that were painful. Though the assessment of risk in the REB process had been considered low, through Max, I learned that a sterile assessment of risk was not the same as considering how participants would *feel* when I asked questions. Though my questions were centered on mathematics I realized that experiences with mathematics and in extension reflecting on the actors in one's story could evoke painful memories. We simply cannot know in advance what stories people will tell, and to what extent they have been affected by them. I had started to ruminate around these questions prior to my meeting with Sophia. What would she be like? What stories would she tell me? Would I be asking too much of her? Yet when the day came and I met Sophia for the first time, her effervescent personality stood in stark contrast to Max's quiet, private demeanor, and my anxieties began to evaporate. She instantly reminded me of the vision of a kindergarten teacher that every child would want to have. She had a smile that would light up a room and a voice that seemed to extend a hug with a melodic tone and intonation to her words. The fact that Sophia would later share that she indeed hoped to be a kindergarten teacher some day was comforting somehow. She embodied the word's true meaning, and I imagined her tending a garden of children, planting the seeds of confidence, nurturing their growth, protecting them from the elements until they were strong enough to thrive on their own.

Sophia represented the very essence of what Max should have experienced from educators but had not. Though initially we engaged in small talk, I found myself drifting a little as I listened, wondering how this extraordinary young woman who exuded the essence of a skilled and compassionate educator had come to be a part of this study. What was her story of dyscalculia? It turns out she had more in common with Max than I would have imagined.

Sophia began her story with a smiling account of how she enjoyed school and was a "happy go lucky" child. She said that although she can't specifically recall having had significant difficulties with mathematics, she knows that she was referred for a psycho-educational assessment in grade three. Following the assessment, she received intensive ongoing support from the Special Education Teacher for mathematics. Sophia stated that she didn't know if she had received a formal 'diagnosis' of a mathematical learning disorder, but she did know that she had been identified as having a learning disability and she had an IEP that outlined her 'need for extra time' in relation to mathematics that followed her throughout her time in school. Her warm smile was matched by her keen wit she said:

> *So I wasn't privy to the actual assessment in grade three, nor would it have many sense to me at the time, but seeing that I only received help for mathematics and had LD identification, well, you do the math! [laughs]*

Sophia's comment made me think of Billington's questions, about how we consider children in education. Was Sophia's recall blurred by time, or was she never *told* the nature of her assessment, and *why* she was receiving "*special help*"? With the experts standing in differing camps as to what constitutes dyscalculia, how can teachers, parents, students and most of all the children who are subject to these assessments interpret them? Her words made me consider more broadly, what does singling out a student for "*extra help''* from the "*Special Education Teacher*" signify to them, and to their peers? And what does telling a child they have a learning disability *mean* to them? Though Sophia brushed her own experience off with levity and humour, I found myself thinking just how well this small glimpse into her experiences illuminated important questions about these issues.

Despite the fact that my meeting with Sophia had begun with relatively unstructured dialogue, there was a brief pause in our conversation that I interpreted as a cue for me to return to 'my list'. When I asked her if there was anything in addition to the assessment that stood out to her as pivotal with regards to when she first began experiencing difficulties with mathematics, her warm smile seemed to evaporate in the heat of the

question, and she paused for a moment before responding. She held her breath slightly in a clear effort to hold back tears. I was taken aback by the contrast to the levity that she had displayed only seconds earlier. A few tears did come, and I offered some Kleenex and apologized, concerned that my questions had evoked something painful. Chastising herself for "losing control" of her emotions ever so slightly, she became intent on regaining her composure and expressed embarrassment that something that occurred so long ago could stir such an emotional response. "*I'm fine*, *this is silly. I want to do this*" she said. She then began her account of when math became an issue for her.

> *I actually loved meeting with the Special Education Teacher, she was really nice and she did things to help me that really made sense to me. She used manipulatives and tried to make it fun, and she was always calm and patient and made me feel good about myself. But then I would go back to class. There I felt stupid all of the time and never knew the answer. I remember getting a work sheet back and all of my answers were circled showing they were all wrong. I was humiliated. I hated how the [classroom] teacher would make us do 'mad minute' worksheets all of the time. It just made things worse for me. I felt like I was making progress and understanding things better with the Special Education Teacher and then I would go back to class and feel stupid again. Those mad minute work sheets were the worst. Everyone could see how much you finished and then taking things up in class just made me feel stupid and singled out. Even though I was good at other things, it didn't matter, it became all about me not being good at math.*

Sophia's story of how she moved from feeling good about herself and her progress with mathematics, to how she felt stupid, singled out and humiliated in front of her peers in the regular classroom was troubling. Math and what it represented to Sophia and her diminishing sense of self had become central to her story. It struck me that I didn't want to ask something that was going to probe the issue of struggles or deficits in that moment. I wanted her to return to the vision of the happy smiling kindergarten teacher that I had first encountered. Once again my questions, though structured to be benign, were not necessarily benign to those who experienced them. Yet I also realized that Sophia could have responded in any way she chose to the question of when her mathematics

difficulties began, which in Sophia's case could have been a pat "grade three" or "after the assessment". Despite her discomfort, she had a *story* to tell. But I didn't know how to balance what I was thinking and feeling. Should I choose a different question to ease the discomfort that seemed to hang in the air, or should I continue with "my list', and let her tell me what she wanted to, perhaps needed to?

Uncertain if I was driven more by my own discomfort or the desire to ease Sophia's discomfort, I chose to ask her about her strengths. She smiled again, and I was relieved. Our eyes connected and in that moment I sensed she knew my inner dialogue. "I'm fine" she said smiling. "I know you are" I said. I looked forward to the metamorphosis, feeling that as much as Sophia had stories to share that might illuminate the pain of experiencing what she had in school, I knew that she would also have stories of resilience and transformation that brought her to the confident teacher in training that she is.

Sophia listed numerous strengths. She was an avid and very advanced reader early on, and did well in all other academic domains, athletics and the arts. She described herself as "very social" and having had a very close and supportive family. Sophia also stated that although her parents had limited education (high school), her mom was a source of considerable support in dealing with her mathematical challenges. She recalled smiling and laughing that her mom "flash carded the heck" out of her, and that her mom would spend considerable time trying to engage her in games that were math related, like "yahtzee". She said she knew what her mom was doing, trying to do, sneaking in math whenever and however she could, but, added that "*it was all good, she did the best she could and I didn't feel pressured. I did that to myself.*"

Sophia credits her mom for her constant support in tackling math, finding ways to make it fun or meaningful. However, to this day she said she twinges with anxiety both on recall of past experiences and when faced with having to do math "*on the spot*", she recalls a pivotal experience that lessened the sting of her previous humiliation and turned a corner in how she viewed her abilities in relation to math. It seemed an irony that it would come in the form of summer school mathematics, something hard to imagine as many teens

would recoil at the thought of giving up their summer to do what they dreaded most; math. But for Sophia, summer school was key.

Prior to starting High School, Sophia's mom had encouraged her to attend summer school to take math in order to give her a "*head start*" for high school. Too young for a summer job she decided she might as well. In retrospect she is so glad that she did. Sophia said that despite her anxieties and fear of being "*the stupid one*" in the math class, most of the students in the class were ones who really struggled as well and were repeating the credit. She said the teacher was quite good, the math was more tangible and with no other commitments but math, she could really focus and immerse herself in math. She said

> *That summer course was a huge self-esteem booster; I actually went from feeling stupid to feeling quite advanced. I was quite good at solving word problems, analyzing scenarios and picking out the details..... I ended up doing much better than many of the other students. I was the smart one in the class and it felt good. You would think that high school math would have been more challenging for me than elementary school math, but it wasn't. I seemed to do better with more complex math. Maybe it was the teacher, maybe it was the setting, maybe it was just being able to focus on math intensively. I don't know. But I know I eventually was able to do stats at university, but to this day I can't keep those darn less than greater than less than signs straight!*[laughs].

Though she had her shining mathematical moment in summer school, her previous experiences with math had led the high school's guidance counsellor to suggest that she "should only take the applied math at High School and avoid any professions that would involve math". Sophia said that she deeply internalized her mathematical struggles as "*you're not good enough*", and that although she excelled in other areas, the idea that "*smart people can do math*" did permeate her consciousness and her post-secondary choices. She only took math in order to fulfill the minimum credits required to graduate high school, and she believed and followed the guidance counsellor's advice. "*I wasn't University bound and I dropped math after grade eleven. It is quite ironic that education*

has since become such a focus for me". When I asked Sophia her thoughts on the etiology of dyscalculia or low math achievement, she said,

> *I am not sure if it is innate. I made strides with math, through having a patient and caring teacher, a mom who supported me and by doing more tangible math, but I also know that having had bad experiences, curriculum that didn't make any sense, and quite frankly not being interested in math makes it difficult to know why math was such a challenge for me. I have insights now into learning disabilities and assessment and struggle with the idea that it is innate. I am truly conflicted on this one. I met diagnostic criteria once, but doubt I would now. I know it isn't about effort or intelligence. I worked my butt off, and I wouldn't be in the position I am in now without being strong academically. I guess that the anxiety and panic I felt with math will never be forgotten. It was emotionally exhausting at times and I am still trying to shake it by pushing myself, proving that I really am smart. I don't think any other subject does that to you the same way. There's definitely a hierarchy.*

Sophia's insights are reflective of Ansari's position on dyscalculia(2012, 2010), that to suggest an innate mathematical deficiency as a defacto scenario fails to acknowledge the complex bio-psycho-social interplay that occurs when we learn. But Sophia/s stories also tell of a student who was strong academically in all other domains who was identified as having a learning disability. Sophia had read a great deal about dyscalculia and shared that she knew that she fit many of the descriptors that float around the internet as 'warning signs for dyscalculia', particularly the visual spatial piece. She laughed again that she didn't have the best sense of direction, and she certainly struggled with '*patterning*' in elementary school, but she wants to resist the label because she sees math and learning in general as "*too complex to be reduced to inherent deficits*". She shook her head and shuddered slightly to convey a level of frustration before adding;

> *Children shouldn't be reduced this way, and there are such mixed messages in education. On one hand we are told to focus on students' strengths, and on the other hand we are inundated with all that is wrong with them; dyslexia,*

> *dyscalculia, autism, ADHD. Everybody is an expert these days, but the more I look into these things, the less convinced I am about the level of certainty they are presented with. I know from my own experiences that I had struggles sure, but I have done very well academically. It is frustrating. We talk about inclusion, but I certainly won't be open about having 'dyscalculia'... whatever it means..., when I start looking for a teaching job. Getting a teaching job is hard enough, if they think I have a learning disability, I doubt they would hire me.*

Sophia's words resonated with my own interpretation of the current climate in education. The paradox of the discourse of inclusion and anti-labeling juxtaposed with the positivist discourse of assessment and categorization. But Sophia's words deepened my thoughts about this dichotomy in relation to Billington's questions about how we *speak with*, *write of*, *listen to* and finally, *how we consider ourselves* when working with children. Sophia forged the connection that as children become *adults*, the very system that identifies them as 'deficient' in some way, may not be so welcoming to them should they hope to pursue a career in education. Indeed there are teachers who share their 'exceptionalities' publicly, but often they do so after the fact, waiting until they have achieved a certain degree of job security; safe from administrative foreshadowing of parental concerns regarding a teacher who has a learning disability and the preconceived notions of what that might mean for their own children.

Sophia was navigating borders in speaking to me, as a student, teacher, participant and co-author of this narrative. Her responses defied categories, resisted societal and educational narratives of disability, and demonstrated insights that will make her an extraordinary teacher. I could have spoken with Sophia for hours, but I knew that I was limited to my agreed upon hour. I hadn't gotten through all of my questions on 'the list', but it did not matter to me. Sophia had told me what *she* wanted to, what *she* needed to. Sophia had illuminated questions that weren't even on 'the list' and helped me to see it wasn't about my list. It was about her. I listened, and I saw what she wanted me to see; tending a garden of children, planting the seeds of confidence, nurturing their growth, protecting them from the elements until they are strong enough to thrive on their own. The vision of the smiling happy kindergarten teacher that every child deserves; an

advocate, an ally and an insider who will make a difference as a result of her struggles, but who will be known for her strengths

5.6 Xander

" I remember hearing, 'Xander is never going to be a doctor'" – Xander

Unlike my meetings with other participants, there was very little preliminary small talk prior to commencing my interview with *Xander.* He had approached our meeting with considerable pre-contemplation and his responses challenged the dichotomy of a visceral versus intellectual account. *Xander* presented with an intensity that is difficult to define; it was as if a starter pistol had gone off at the beginning of a race and he was delving into the experience of having lived with dyscalculia with the mindset of a professional athlete. He said that he knew what he wanted to share and that it was "all up here" (pointing to his head). Before I began asking questions he proceeded to embark on his story, leaving me wondering if I should focus on scribing his narrative or interjecting with my questions at the risk of interrupting his focus. Though at times the rate and intensity of Xander's words could be described as pressured (as it was necessary to occasionally interject to ensure that I could capture both his words and actions in my notes), there was nothing tangential or disorganized about his communication (as pathological interpretations of the term would suggest). As it became clear that my pen and paper scribing could not match the rate of his speech, eventually a balance was struck between open ended scribing and posing the semi structured interview questions that I had planned. Despite feeling conflicted about interrupting Xander's pre-constructed narrative, the contrast in watching his observable pauses while contemplating questions that perhaps he had not anticipated, created the impression that Xander was very much in control, delving into his thoughts, feelings and experiences with depth and precision, providing responses that were swathed in evocative language that seemed to represent the essence of narrative interviewing. Though my thoughts spun with how I would analyze and represent Xander's stories (as he dashed my initial illusions as a beginning researcher that I was somehow guiding the interview process), it became clear that he was telling me about a relationship, a powerful at times tumultuous one, but a relationship as tangible as any other.

Xander's relationship to mathematics is deep, prominent in his stories and challenges widely held conceptions about dyscalculia, low mathematics achievement, psychometric assessment and academic trajectories. It is a relationship wrought with periods of conflict, avoidance, efforts at reconciliation and a tenuous coup d'état. The particularity of *Xander's* relationship with mathematics is emboldened even further when contextualized by the fact that he was both identified as gifted academically, and by his chosen profession as a medical doctor. His earliest recollection was not of people who represented mathematics in some way, rather it was of mathematics itself, as a living entity in his life, and one whose prominent role was instigatory, contentious and the source of conflict for Xander.

> *I've' never been good at math, and I refer to myself as a mathematical moron at least once per month. I really struggled in High School, but it was clear that I was struggling more than my peers since grade five. I hated those mad minute work sheets, I couldn't do them fast enough and it was a schism for me. I was not just an avid reader, but a voracious one. I literally motored through novel after novel, and not kids stuff. I read the Grapes of Wrath when I was twelve. To struggle with math to the extent that I did when I excelled at everything else was hard to reconcile. It still is.*

Xander's account of the emergence of his troubled relationship with mathematics was thick with description that was indeed thought provoking. Having been formally identified as gifted, having been an advanced and 'voracious' reader, and having excelled in all other academic domains, challenged the math = intelligence hegemony that is prolific in society and education. For Xander, despite the quantification of his 'intelligence' (a concept Xander stated he does not believe in), the idea that he could not achieve the same benchmarks in mathematics as his peers (or excel beyond them as might have been expected given his advanced performance in other domains) was not only difficult to reconcile, but according to him, "became the measure of self as an inherent flaw".

Though Xander described his relationship with his family as supportive, and he detailed many ways in which his family was dedicated to helping him not only achieve academically, but to pursue whatever he was passionate about, he recalls that his parents doubted given his challenges with mathematics that his desire to pursue a career in medicine was realistic.

> *I remember hearing 'Xander is never going to be a doctor'. It stuck with me and I moved from dedicating my focus from beating math, to avoiding it as much as possible. Though I was achieving mid to high 90's in all of my Science and Arts courses in High School, I was getting 60's and 70's in math.*

For Xander, despite the support of his parents and intensive efforts to help him to be successful in mathematics (he received tutoring and said his mom "flash carded the heck out of me"), his frustration and mounting self-doubt eventually led him to resist the dominant role that mathematics had taken in his life.

Though Xander didn't explicitly state that he gave up on his desire to be a physician as a result of his struggles with mathematics, for a time he decided to decrease his focus on mathematics and focus on exploring his strengths. This led to focusing on his athleticism (he was a varsity athlete at the Post-Secondary level), and taking courses in the Arts as well as Sciences to enable him to have an outlet for his thoughts and energy level. For Xander, this realization of needing to expend energy both physically and intellectually would be epiphinal

> *I could ruminate and explore thoughts while I was exercising", but ultimately I began to overdo it and my grades suffered in certain classes. I hadn't given up on the idea of being a doctor, and I realized that In this country and in this time, there is a threshold that you must reach or you will never get looked at [medical school] … the computer will exclude you, and that was my threshold moment.*

The epiphinal moment for Xander, in recognizing that the hegemony of mathematical proficiency stood as a barrier to his goal of becoming a doctor, was both daunting, and yet somehow more manageable in light of their time apart. Having had the opportunity to

grow and gain confidence in his strengths, the idea of confronting mathematics again was now met with a sense that somehow, someway, he was going to have to reconcile with it and find a way that he could accept its purpose and address the boundless energy, which both fuelled and inhibited him.

Though Xander's father was a physician, to Xander the purpose of mathematics had seemed overarching and the venue for learning it largely intangible.

> *I saw in my father that medicine was the practice of persons, I share that same desire, that medicine is about helping people, engaging with them, listening to them and in order to do that I needed to find a way to learn to love what science represents and the role of mathematics in it. A calculation may be expected, justifiably needed.*

Along with needing to establish a connection with the purpose of mathematics, Xander also aimed to reconcile the role his energy level played in mitigating his mathematics performance. While reading, writing and his zeal for competition as an athlete provided outlets for this energy, the focus he needed for math was different. He couldn't create, expend or channel his energy with mathematics. He needed to find other ways to manage it. Though as a child Xander had never been formally diagnosed with ADHD and as an adult, still does not have the formal diagnosis of ADHD, he decided to meet with a psychiatrist who agreed to prescribe Ritalin and engage in cognitive behavioural therapy to work on developing greater organizational and self-management skills and planning where to get assistance if he needed it. For Xander both the medication and the CBT were crucial in being able to mend his broken relationship with mathematics.

> *Ritalin changed the way I think, and I see it as crucial in being able to focus. The organizational strategies and counselling were also really helpful. It was what I needed to do.*

Though Xander describes Ritalin and CBT as key, his dedication to mathematics was both intense and deeply creative.

> *I needed to have numbers tell me a story. I would build characters about chemicals and as strange as it sounds complex interactions came easier to me than the basic calculations. I now have a lot more confidence about my ability to do math. Though I had been completely bamboozled in class [elementary and secondary], I no longer see myself as having an inherent deficit in math. The curriculum felt like jail to me and I hated loosing at the curriculum game, but when math was presented in a different way, when it seemed tangible, when I could use my strengths to understand it, when I could focus, it was different somehow.*

The resultant shift in Xander's self-perception, the end of the internalized conflict, the time apart and the ultimate reconciliation with mathematics were a coup. The mathematics governance that had positioned him as an outsider had in some way been overthrown.

> *Though marks say more about us than they should, I was now a 32 S MCAT and a 3.84 GPA. I was quantifiably acceptable to the computer system that would otherwise have rejected me and prevented me from enrolling in medical school.*

But it is an uneasy coup. Though Xander is now a medical student, he holds fears of being '*found out*' in relation to his math struggles, and even more so, his unofficial diagnosis of ADHD and use of Ritalin. He knows that the stigma for both within the medical sciences is paradoxically high.

Though Xander's previous recollection in relation to the question of gender wielded a response of neutrality earlier in our interview (he suggested that he never felt there were any aspects of his experience that held some connection to gender in any way); his reflection on his current experience seemed to surprise him to some extent, as it countered his earlier experiences somewhat.

> *I generally try to work with the females students. Though I have always ascribed to a different masculinity and felt comfortable with males and females alike, the male medical students are really competitive. I feel more comfortable working*

> *with the female students, like if I might have difficulty with something, I could talk to them and not be intimidated or embarrassed. Some of the male students are weird, very into math and scores, [pause] Bio-power quantification [smile].*

Though Xander holds some apprehension about how he will manage his relationship with mathematics, adding that he is "*so self-conscious at times about math ability that I will push myself to do it in my head while others use a calculator*", the stories of his relationship with mathematics illuminate much more than the story of mathematical difficulties. Having once met the diagnostic criteria for a mathematical learning disability, it no longer defines him. Instead, his strengths, passion and ingenuity have enabled him to achieve a level of academic prowess that has granted him elite scholarship in a discipline dominated by the very quantification that once excluded him. Xander's relationship with mathematics has evolved. From a little boy filled with a voracious appetite for learning stifled by a curriculum that didn't make sense, to a tormented youth who internalized his struggles with mathematics as his nemesis, he has emerged as an adult with a degree of perseverance matched by only by his extraordinary competencies. His stories challenge the static perceptions of learning disabilities and shed important light on how mathematics is presented to students and how the resultant measure of performance has deep and reverberating consequences. Though some may suggest that ADHD was at the heart of Xander's academic challenges, and that pharmaceutical intervention held the key in enabling him to focus, such a stance fails to acknowledge how his extraordinary perseverance, competencies and the very energy that drove the pursuit of his passions, are all actors in his story. Xander did not overcome his mathematical challenges as a result of Ritalin, rather he achieved his goals through the complex interplay of factors that shaped the ontogenesis of his relationship with mathematics.

However, juxtaposed with Xander's story, an important question emerges about the hegemony of mathematics and our societal obsession with quantification. Although he excelled in reading, writing, the biological sciences and even chemistry, he was required to prove his suitability for a career in medicine by achieving a degree of mathematical proficiency that he will not likely use as a physician. There is no denying the utility of

mathematics for physicians, but to what extent was the degree of mathematical proficiency that was required of Xander is a utilitarian issue, and to what extent was it a subjective screening tool aimed at measuring a conceptualized intelligence that is as restrictive as it is predictive. Though Xander's story (at least for now) ends with a coup, in that he was no longer governed or excluded by an inability to demonstrate mathematical proficiency, there is an unwitting obedience to a system and hierarchy that exists for purposes beyond arguments that can be sustained as necessary. My interview with Xander made me question my naively constructed questions of gender. Was I merely falling into the trap of unwittingly reinforcing simplistic and false gender stereotypes, actively looking for stories of gendered encounters in relation to mathematics? Though Xander initially offered a neutrality in relation to gendered interactions in relation to mathematics (with the exception of his later reflection on his interactions with medical school peers), his stories touched on something deeper. I found myself troubled with how to represent his resilience and perseverance, while questioning the depth to which the hegemony of mathematics had found a new means to permeate his experience. According to Foucault,

> ....hegemony is a state within society whereby those who are dominated by others take on board the values and ideologies of those in power and accept them as their own; this leads to them accepting their position within the hierarchy as natural for their own good (1980, p. 133).

Though Xander would eventually reject the notion of himself as inherently flawed in relation to mathematics, I hold a degree of unease that somehow another means of subjugation has permeated his story. I find myself hoping, rooting for him in his pursuit of the '*practice of people*' that somehow the boundless energy that has both served and troubled him, coupled with his creativity and ingenuity and ability to think differently will emerge as a voice that will challenge the hegemony of mathematics and a system where difference is marginally tolerated, but yet to be embraced. Perhaps most of all, through Xander's stories of the complexities of mathematics as a *relationship*, and through my own interpretive lens which follows Xander's lead, what emerges is a collective voice that challenges not only widely held ideas about dyscalculia, low

mathematics achievement, psychometric assessment and academic trajectories, but one that challenges the myth of epistemological innocence[6] that has been ascribed to mathematics for far too long.

5.7 Lauren

"There had never been a problem, and all of a sudden my future was reduced by a score"
- Lauren

Prior to meeting each of the participants, I had felt anxious, yet somehow I had been able to focus on setting aside my anxieties and putting the participants at ease as much as possible. I had been starting to feel confident in my ability to do this, but meeting Lauren would be different. Somehow one of the many posters I had arranged to be posted throughout the campus had caught the eye of a participant that I had not anticipated; Lauren was not a peer, but a professor. My anxieties were heightened by this, and my usual ruminations about how the participants would feel about my interviewing them had shifted. Fort the first time my thoughts were of what she would think of me and my study. I wondered not just what kind of person she was, but what kind of professor she was. Would she share my interest in qualitative inquiry, or would I be sitting squarely in front of staunch positivist, perhaps knowledgeable about dyscalculia who would find my methodology foreign. With each interview a certain intimacy transpired as participants shared stories of events and people that had deeply affected them. It felt awkward somehow to imagine interviewing a professor. I thought how ironic that with all of my concern for alleviating any angst that the participants might feel and aiming to dissolve the distance between researcher and subject, I didn't know how to navigate this space.

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[6] The position of neutrality proposed through employing methods of 'objective and value free science' is an illusionary one, as the both the techniques employed by and the privileging of certain kinds of knowledge can have oppressive effects. The term 'epistemological innocence' is drawn from Rawolle and Lingard's discussion of the work of French sociologist Pierre Bourdieu in Bourdieu and educational research: Thinking tools, relational thinking, beyond epistemological innocence. *Social theory and education research: understanding Foucault, Habermas, Bourdieu and Derrida*, 117-137 (2013).

When we finally met, I knew that I must stick to my allotted hour, yet the need for more time to engage about small talk about the weather and to ensure that I reviewed the letter of information and consent with a fluent precision never seemed greater. I think that Lauren sensed my nervousness, and she seemed to try and ease it right away by sharing what brought her to me and my study on dyscalculia.

Lauren exuded a sense of warmth and confidence of a professor skilled at interviewing others. I knew right away that she embraced qualitative research, and though her focus was outside of education, she was aware of paradigmatic tensions in relation to how individuals are represented in research. I began to relax. Lauren, like the other participants, had stories to share and I needed remind myself that this was not about me; it was about her and her stories. It wasn't about finding commonalities between the participants that somehow would act as cues that signified indicators of dyscalculia, it was about how, this phenomenon is interpreted, responded to and managed by individuals with dyscalculia and those around them.

Lauren's story did not begin with a detailed account of how she had always struggled with math. Instead, she described what seemed more of a sudden break up; in fact, *a blindside* She told me that she had been a good student, who enjoyed school and who came from a loving and supportive family. Her reflections on elementary school were not filled with teachers who had humiliated her, or of feeling less than her peers in any way. She recalls being engaged in group work and feeling good about herself, her peers, her teachers and education in general. And then "*the blindside*" happened.

On the first day of high school, Lauren was administered a diagnostic test. Two weeks later in the form of a letter, Lauren and her parents were advised that she should not be enrolled in the academic stream at school. Based on the assessment, it was recommended that Lauren should enroll in the general level four year program at high school. It took her breath away. She had planned on career that required university and the measure of her ability came as a complete shock, and one that posed a threat to all that she had hoped for. She had been ranked and sorted. Her worth and her hopes cast aside like blemished

fruit not worthy of the market. It was a devastating pronouncement that left her mind spinning.

> *I had come from a rural school and was distracted by the newness. There had never been a problem, and all of a sudden my future was reduced by a score. How could it be that this test, this stupid test on the first day of school could say what I was capable of?*

The support of her family in light of the test's pronouncement for her future was key. Her father was a farmer, a man with relatively limited education who had never had to question what the teachers said. But this time he would. Not only did he question the suggestion that his daughter was better suited to less advanced study, he hotly contested it. He recognized the implications of the four year stream for his daughter, and he would not have it.

Although Lauren's reflection on the support of her father is one filled with appreciation, it is also filled with frustration for the impact it had on her and her family and how quickly it affected and altered her interactions with teachers and education.

> *My parents had never had to go to the school for something like this. Now I was a 'problem', and I felt like it. My parents hadn't taken high school math. We lived on a farm. My dad had chores, we all had chores. Finding the time and resources to deal with my 'math problem' was difficult. They did the best they could and arranged for me to go to a retired High School Principal for tutoring. I know he was well meaning, but it wasn't very helpful and I was so intimidated. I knew my parents didn't blame me for the added work and expense, but they didn't need it. We all felt the stress of it.*

Lauren also shared how the school responded to '*her math problems*'

> *My High School Math teacher said I could come and see him if I needed help, but the extra help meant knocking on the staff room door and standing there waiting in the entrance of a smoke filled room for him to come over and assign more of the same homework. In class he would stand at the front of the room with his back to*

> *the class, writing out problems. There wasn't any interaction. He also had a habit of handing papers back to students in order of grade, highest to lowest. Things just seemed to be getting worse, it was like everything started with this test and then it all spiraled out of control.*

Lauren's reflection on how the results of '*that one test*' impacted not only her life, but her family's lives speaks to the reality that when students do not meet the established norms for grade level, the issue of support is largely divested to families, many of whom do not have the resources (time, knowledge or money) to help their children 'catch up'.

Her story also speaks to the reality that subject matter expertise, in the absence of effective teaching, is problematic. Though her grade nine math teacher was more specialized in mathematics than her elementary teachers had been, his ability to teach and his knowledge of how to meet the needs of a student who wanted support were lacking, and in Lauren's story, this was not isolated to one mathematics teacher.

> *My grade 11 math teacher wasn't any better. I remember he wore a brown suit every single day and was a caricature, literally, with no life outside of math. He didn't know how to teach. He just lectured. In fact all of my math teachers were formal; chalk and talk, never helping, no individual instruction, no walking around clarifying who needed assistance. They knew their subject, but weren't effective teachers.*

Lauren's words made me drift for a moment, thinking of one of the books that I had read about gender and mathematics, though it wasn't the issue of gender that popped into my head in that moment. It was the issue of mathematical qualifications and subject matter expertise. According to Walkerdine (2004) , while most primary teachers held undergraduate coursework that often included an emphasis on developmental psychology and educational theory, mathematics teachers often held the most basic teaching qualifications with "minimal knowledge of educational theory" (Walkerdine, 2004, p. 106). This finding is important as it counters current rhetoric that suggests more intensive teacher training in mathematics holds the key to the emergent 'crisis' of Ontario's declining math scores.

Despite the fact that limited research regarding student achievement outcomes has been touted as a signifier that teacher subject matter expertise in mathematics is directly linked to student achievement, a closer examination of this research yields more complex findings (Hill, Rowan & Ball, 2005). In this study ,the link to student gains in relation to teacher mathematical knowledge must be understood in relation to the teacher's *foundational* math and the teacher's knowledge of *how to teach* math, as having a mathematics background alone (as was measured by an assessment) did not improve student achievement. As well, though a combination of mathematical knowledge and knowledge of how to teach mathematics was presented as the having the greatest effect on student achievement, the actual gains were not significant, and there were numerous variables that must be considered prior to making the assumption that one must have a strong mathematics background for teaching grade one and grade three math (the two grade levels assessed in the study). Teacher experience level, student socio-economic status, cultural background, student absenteeism and numerous other issues were imbricated (Hill, Rowan & Ball, 2005). Although it would be remiss to suggest that content knowledge is not important, and that having a passion for a subject, and in turn being able to effectively convey that passion and expertise to students are not valuable, the popular common-sense notion that student achievement is linked to teachers lack of mathematical knowledge is overarching. Lauren's story highlights how a knowledgeable math teacher, wasn't an effective math teacher and despite the fact that this was an 'isolated example', it serves as a cautionary tale against knee-jerk responses in education, which too can quickly embrace ideas gleaned from an oversimplified representation of quantified data.

My momentary drift into epistemological frustrations ended when I realized the time. I had run over the allotted hour. Though Lauren had given me so much to consider, I couldn't end our meeting at this stage. Lauren's experience with education was unraveling yet I knew that this wasn't remotely an end point in her story. I didn't know what she was going to share next, but I knew that the educational unraveling was a mere part of her story. I am reminded once again of Lauren's position and how it would serve as a counter story to the discourse of deficits surrounding dyscalculia. I needed more time, and I asked for it. Graciously she agreed.

I knew that it must have stung for Lauren to hear that the results of a single test led to hearing that she was "*better suited to a four year program*"(implying she would not be university bound) and to be singled out in front of her peers, struggling in a math class with no help from the teachers whose job it was to help her. I also imagined the incredible weight she must have felt; knowing that her father had advocated so strongly for her, believing in her, while no doubt the seeds of self-doubt had taken root. I was filled with both empathy and anticipation, eager to hear how the tide had turned for her. What was it that urged her on to resist the narrative that she was being given, and to write her own? I waited for the moment, anticipating an event, a person, something pivotal that ushered in a change that would signify and end to the downward spiral. But it did not come like that. Instead, she pushed back gradually, first for others, and then for herself.

> *I remember accompanying my sister to a parent teacher meeting. My sister had begun struggling with mathematics as well. My parents were as involved as possible, but it wasn't always manageable with the farm. My sister had been feeling singled out in class. I tried talking to the teacher and the teacher wasn't very receptive. I actually told her to stop shaming my sister and to try encouraging her. Her response was, 'we don't reward people who are not doing well'. I knew this was wrong.*

Though Lauren had experienced much of what her sister was experiencing, viewing similar events through someone else's story gave her a new perspective; that 'her math problem' was about more than her. Others were struggling. The intimidation and humiliation that she had been feeling were being supplanted by a resistance; one fuelled in part by the stories of others, and in part by examining her own story through a different lens. I thought of *Xander* and *Sophia* in that moment, and the seismic shift in thinking that occurred when deficits gave sway to strengths.

Though her struggles with mathematics had consumed much of her focus, the reality was that Lauren was an exceptional student in other domains. She excelled in English, the social sciences and the arts. Lauren was deeply engaged in learning and her other

teachers recognized and acknowledged her capabilities. She believes that eventually how she was perceived outside of mathematics, spilled over into mathematics. She said:

> *In my last year of High School my math teacher was married to my English Teacher. I had a great rapport with my English teacher and did very well in her class. I really think that her perception of me was conveyed to him. After so much hard work and so much struggling with mathematics, I finally felt that I had a real math teacher. He actually had students work together and paired students who were strong with students who were struggling. Class time wasn't just a lecture. I still had to work had at math, but I eventually got a mark in the 90's on my grade 13 final exam. He saw me differently, positively and that combined with the fact that he didn't just know math, but knew how to teach math was huge. I just stopped worrying after that. I knew one way or another I would get though.*

And there it was -Lauren's math *success*. It grew out of perseverance and from seeing her own story differently in light of her sister's. It grew out of the support from her family and teachers who recognized her strengths. And perhaps most of all, it grew out of Lauren's realization that *test*, that stupid test, did not define her.

So was it all a mistake? Was this talented student thrust into a downward spiral that touched her and her family's lives in error? I can hear the positivists (was the test psychometrically sound, did Lauren even have dyscalculia?). Yet I return to the current realities that the diagnosis of dyscalculia does not exist, it is the diagnosis of a learning disability (mathematics now relegated to a sub-category). When does it *exist*? When a psychologist interprets an achievement discrepancy and *says* that it exists? Lauren had been performing at grade level until a standardized mathematics test suggested otherwise. Tools used in the diagnosis of learning disorders are not magic. Despite the 'psychometric soundness' of tests like the WISC and WJ, they are tied (particularly in the realm of mathematics) to what one has been *taught*. I reflect on the *definition* of a learning disability, had Lauren's mathematics proficiency not been significantly below that of her peers, had she and her family not experienced the reverberations of her struggles in their daily lives, and was her functioning in mathematics not better attributed

to intellectual ability or other developmental influences, sensory or motor impairments? I am reminded again that I am sitting across from a professor, someone who, as the quantitative data suggest, is representative of the top two percent of the population in terms of academic ability[7]. How should Lauren's struggles with math be interpreted? Though she indeed achieved successes within the realm of mathematics, when I asked her about her feelings about the etiology of mathematical learning difficulties, like Sophia, she was somewhat conflicted on the issue. She expressed frustration with how her mathematical performance on one test had been used to signify her academic potential not only in mathematics, but in suggesting that she was not university bound. Yet for one brief moment the emotional intensity of her experiences and how she internalized her struggles with mathematics surfaced, her face flushed and she held her breath slightly. I knew the signs, and the tears were there just beneath the surface.

> *I had to work so hard at math in a way that I just didn't have to in other domains. I remember having to make change at my parent's fruit stand. I couldn't do it in my head, I needed to work it out. I wasn't good at mental math. My parents drilled times tables into me, but even today I still struggle with them a bit [her face flushed].*

I acknowledged to Lauren that I could see her emotional intensity in her admission that she still struggled with times tables. In that moment she was not a professor to me. I felt her embarrassment as my own, knowing that the widespread belief that those who excel in mathematics are somehow more intelligent runs deep. To share that something considered a 'basic' skill acquired in elementary school does not come easily makes us feel vulnerable. My own emotions had surfaced in this shared reflection, not only in the shared experience, but in my role as a researcher. In hearing Lauren's stories the distance had been dissolved. I always believed that stories were important, but meeting with Lauren deepened my belief in the power and utility of stories. Not only had our meeting provided deep insights into the phenomenon of mathematical learning difficulties, but by

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[7] Consideration for admission to Post Graduate education frequently involves a ranking system which involves being considered in the top two percent of graduate student applicants.

listening to her story, I saw *her* differently. My anxieties about her position had evaporated. I had heard *Lauren*, not '*Dr. X'*. I thought of the damage that can occur through the quantification of people, juxtaposed with the vast potential that stories have to unite, to heal, and to inspire hope. I thought of the current rhetoric surrounding math scores, the emergent 'crisis' in education and the dominance of quantitative data. According to Skovmose (2005, pp. 164–165), "The school mathematics tradition may provide qualities, like obedience, trust in numbers, exaggerated belief in authority etc.". Thus the utility of mathematics extends beyond its economic utility, but it fosters the continuity of a knowledge-power paradigm. And again, according to Greer and Skovmose, "As a consequence of this lack of critical agency, people are subject to many forms of control, resulting in a combination of powerlessness and uncritical compliance." (2012, p. 232).Lauren's stories of struggles with mathematics may contain elements of a resistance to its hegemony and the obedience of the tradition. She has emerged as an individual who raises questions about inequities and illuminates new ways of thinking. Perhaps not being good at math isn't simply about lack of ability or confidence, or even about teachers and methods, but about emergent epistemological differences.

Our meeting had almost come to an end and I asked Lauren if there was anything she wanted to add or if she had any hopes for what purpose her story might hold in understanding dyscalculia.

> *I want to see people stop placing all of the problems for math success on the student. It has taken me a long time to see this. The idea that anyone that doesn't fit the norm is somehow deviant and that labels are fixed and factual is wrong. If I had given in to that, if my family had given in to that, I wouldn't be here.*

I felt triumphant with her. Her resistance to being defined had brought her here. The distance had been dissolved, my anxieties dissipated, and most of all, Lauren's voice had been heard. She was the author of her own narrative, and I was grateful that she was willing to share it with me.

5.8 Jordan

"When you start looking for answers and help, it all seems so easy. It feels like there are answers and there is help, but it definitely isn't the case." - Jordan

I was relieved to finally meet Jordan as we had actually had some challenges in scheduling our meeting. Bad weather had intervened, and subsequent discussions surrounding scheduling placed options precariously close to exam time. We decided to wait until the New Year to meet and when we did, I was grateful that her desire to share her story had not dissipated amidst our scheduling delays. It seemed an irony that in meeting the last participant in my study, that her story would begin almost verbatim to my own; with a quest to understand the etiology of mathematical difficulties and perhaps find a way to overcome them.

Like my own quest, Jordan's began with a requirement to complete courses in statistics and quantitative research in order to satisfy program requirements. Though she had been an exceptionally strong student at university, she was afraid that her past experience with mathematics could not only impact completing her studies, but her overall GPA sufficiently to reduce her chances of securing a coveted spot in a highly competitive graduate program. She was worried, and through her studies and her own self-reflection she thought she had an answer.

Jordan had been introduced to the term dyscalculia at university. It was the first time that she encountered the perspective that struggles with mathematics could be a learning disability with neurobiological origins; a condition posited as distinct from low math achievement. She was intrigued and propelled to dig deeper. She began reviewing websites that focused on understanding dyscalculia; signs, symptoms and means of identification. The more she read, the more "it fit".

> *Everything that I learned about dyscalculia was like it had been written about me. I am not just 'bad at math'; I have trouble with phone numbers, addresses, military time and definitely the anxiety. I buy everything on debit because it is too*

> *anxiety provoking to go to a store with cash. I can't add up in my head how much something is going to be, let alone figure out the tax.*

After sharing her initial story of her quest to understand her mathematical difficulties in the context of dyscalculia, Jordan began to recount her earliest and most specific memories of how math and more specifically numbers were the source of difficulty for her. She said that she had the same teacher for grade four and five and although her perception of the teacher was positive, the teacher's observations were pivotal in recognizing that she was falling behind her peers in math. The teacher shared with Jordan and her family that she had observed a vast dichotomy in Jordan's academic achievement in other domains and a virtual standstill in her mathematics progression from the previous year. Despite these observations, Jordan said the teacher didn't seem to know what to do about it, nor did her family.

> *My dad would sometimes sit and work on math with me. It helped sometimes, but there isn't anything that stands out as having been really helpful. He was good at math, I wouldn't say it was his thing, but at least he was patient. He tried. Math came so easily to my mom that I couldn't work on it with her. She simply didn't understand how I didn't get it. There was a lot of pressure from my mom. My mom is good at everything, and she is really driven.*

Jordan's account of struggling to learn from someone that math came easily to, was not an uncommon thread. Other participants shared similar experiences, thought provoking ones that raise questions about the assumption that "math experts" hold the key to helping struggling learners to overcome mathematical difficulties. The "math expert", has not worn the shoes of the struggling math learner. *"It's easy"* they say, *"here, I'll show you",* is then followed by a rapid fire explanation that they think sounds epiphinal. But then their enthusiasm gives way to quizzical looks, they become frustrated with us, and their faces betray their thoughts. They think we're stupid. Sometimes they say it, shrouded in humour, sometimes it is more direct, and sometimes we are put on display. For Jordan, the feeling of being ridiculed surfaced quickly as she described a "pivotal moment" in her feelings towards math.

> *By High School everything about math was a source of anxiety, ridicule and embarrassment. My High School math teacher was awful. I worked really hard on every assignment and got 100% on each one, and then I failed every test. He would call on me in class, shaming me on my performance by holding up my work as an example to the class of 'what not to do'.*

Jordan's eyes filled with tears as she recalled the ridicule she experienced. I shared the emotion, and felt a lump in my own throat. We paused, and I assured her that there was no shame in tears, nor was she the only participant to be brought to tears when reflecting on her experiences with math. It wasn't silly. Her experience had been painful, and instances of ridicule in education simply shouldn't have happened. But they did. They still do. I felt for Jordan. I've felt *like* Jordan, and in meeting with all of the participants, it is something we have all shared. We have all been pelted with words like rocks. Sometimes we've ducked and they missed, sometimes they landed a perfect hit leaving us bruised by them, and sometimes, the words were carefully selected weapons which carved deep wounds that never completely healed. These wounds are prone to infection which frequently courses through our veins as self-doubt. There was a momentary pause and we seemed to drift a little, our minds swirling with memories of math and all that it represented for us. As the awareness of each other's presence somehow jolted us from our momentary drift, we smiled at one another in a subtle knowing smile, took a short breath, and resumed.

Like I had felt with Sophia, I was eager to move on to discussing Jordan's strengths. I didn't like opening wounds and leaving them unattended. I felt that the shift to focusing on the positive would alleviate her discomfort. Yet for the first time, the discussion of strengths did not provide immediate shelter. For Jordan, they presented a paradox. Like Xander, she had been identified as academically gifted, and to be gifted while having difficulty being able to make change, challenges the former. Despite the fact that Jordan excelled in all other academic domains (she had been nominated for a gifted program as a student, was linguistically adept, fluent in English, French and Spanish, she was involved in the arts, theatre and dance and her academic record at the university had been exceptional), her accomplishments were overshadowed by this deficit. She was seeking

an answer, trying to understand how these things came so easily to her while math did not. Strengths were not her focus right now, dyscalculia was, and though her research had told her that the severity of her difficulties with mathematics read verbatim to the diagnostic criteria for a mathematical learning disorder, she needed something she did not yet have; "proof.

Though psychometric assessment today is swathed in the language of strengths, for an adult to undergo a psychometric assessment, particularly an adult who is well versed in research on the theoretical principles of it, is daunting. The feeling of having one's cognitive abilities measured and laid bare is akin to standing naked in front of a stranger. It exposes something private and the prospect fills us with self-doubt about what the assessment will reveal.

Although psychologists generally do not provide reports to parents with a Full Scale IQ (instead placing individuals on a spectrum across specific categories), as adults, we can be privy to that information. If we choose to lessen the blow of a stark numeric finding of our "intelligence", we can opt for our percentile scores in the sub-categories. Yet the prospect of staring down at a percentile score with a corresponding "below average" to prove our dyscalculia reduces us none the less. Yet if we want proof of our dyscalculia, we must cognitively disrobe, revealing something intimate, and potentially taking something away; gifted identification.

Whereas Xander had undergone a psychometric assessment that led to his placement in a gifted program, Jordan's gifted identification came from a teacher nomination. Though policies regarding gifted identification vary, they frequently involve quantitative proof of "gifted" status in the form of an elite percentile status associated with one's full scale IQ. This presents a paradox for Jordan, as although being identified as twice exceptional (gifted and learning disabled) does occur, the degree of 'giftedness" must be so substantial that it outweighs the learning disability. Depending on the severity of the learning difficulties, in particular areas assessed, those weaknesses can depress the FSIQ significantly, cumulatively rendering one "average" or even "below average". I couldn't help but shake my head at the power that numbers hold over us. How could a score take

away achievements or what we are good at? I *knew* it couldn't, but when you have been assaulted based on your mathematical deficiencies, that gifted status is rehabilitative. It helps to heal the wounds and keep us going, believing that despite the hegemony of mathematics, and the discourse of neurobiological deficits, we are indeed intelligent. It is our shelter from the storm, and having to relinquish it to prove our dyscalculia seems an unnecessary sacrifice.

Despite the fears associated with what an assessment would tell her, Jordan's desire to be absolved of culpability in her mathematical struggles, was stronger than her attachment to her gifted identification. Willing to make the sacrifice in order to obtain the quantitative proof that the university would require in order to be entitled to accommodation and support, she made the decision to face her fears and pursue an assessment. She sought out assistance from the Office for Students with Disabilities and was advised that formal identification of a learning disability would require a psychometric assessment by a clinical psychologist. Jordan was prepared for this, but what she did not anticipate was the *cost*. Clinical assessments are expensive, and although some individuals have access to personal benefits programs that will cover the cost of the assessment, many do not; Jordan did not. She was stuck. She *wanted* a test, in fact *needed* a test to validate her struggles and 'legitimize' her cognitive abilities. But Jordan learned that there is an irony in 'legitimizing' one's status as having a learning disability as an adult; it is a privilege, and one that she was not entitled to.

A privilege? How could embracing an *academic* deficiency that is generally presented as an *inherent* one in any way be considered a privilege? The word kept swirling in my mind. I thought of how Jordan's story was emerging in contrast to Lauren's. While Lauren's story was very much rooted in a resistance to a clinical pronouncement of her abilities, Jordan's had emerged as contingent on just such a pronouncement. And what would Jordan actually get for the "privilege" of identification; academically, very little. With so much ambiguity surrounding dyscalculia, strategies for supporting individuals diagnosed with it are quite limited. But if more time, a quiet space to complete tests, or access to tutoring (generic strategies often afforded to students with any identified learning disability), why must she go to such lengths to legitimize her struggles, by

having the numbers define her and the voice of authority speak for her? Why isn't Jordan's voice good enough?

I was troubled by this, but knew it well. When I began my quest to understand dyscalculia, my initial readings had led me to share the same assertion; that dyscalculia was a condition with a neurobiological etiology that was in some way an inherent deficit. But by the time I met Jordan I had been immersed in an exhaustive range of literature on dyscalculia and psychometric assessment, and had peered through different disciplinary and analytical lenses that found me questioning the facticity of dyscalculia as an *inherent* brain based deficit or one with either a collective or fixed trajectory. I had learned that despite widespread claims as to what constitutes dyscalculia, or scientific research that proposes etiology, no *definitive* etiology is known. Though conditions such as *acalculia*, have provided insights into the reality that one's ability to perform mathematical calculations can be impaired by damage isolated to a specific region of the brain, the criteria and mechanisms for establishing a diagnosis are heavily problematized.

I thought of Geary's previous work on gender, and how the assertion of *inherent* brain differences between men and women was based on findings drawn from the same conceptual measures being utilized to explain dyscalculia today. Such findings in relation to gender have now been largely explained or refuted through cross disciplinary discourse. The feminist, queer and post-structural lenses have exposed layers of bias and deconstructed gender binaries, and the neuroscientific community has provided an understanding of the brain that implicates many actors and influences. Despite the utility of psychometric assessment in identifying strengths and challenges in the context of education, I have come to see that it is a constructive act, where scientific judgments are made based on layers of subjective interpretations, inextricably linked to people, events, institutions, and ideas in ways so complex that etiology will inevitably remain elusive.

Meeting with Jordan as the last participant in my study was epiphinal for me. Perhaps it was because our stories seemed so similar, but perhaps more so, because I was now able to reflect on Jordan's story in light of that of the other participants. We all shared certain bonds, math was our shared nemesis, we had all experienced the sting of shame from

teachers, family or society for our mathematical shortcomings, but it had also become clear that despite these challenges, some of us, including Jordan were able to achieve a degree of mathematical proficiency, that might not be expected of individuals who identify as having a mathematical learning disorder. Jordan did take statistics, and it wasn't easy. She had hoped that a psychometric assessment would offer insights and support or accommodation in order to be successful, yet without that option, she did it on her own.

> *I had to work 10 times harder to get that grade than I did in any other subject. It was brutal, but I did it, and I got and A in it. There was a focus on ethics in the course and somehow it seemed less 'mathy'. It made sense and it seemed relevant.*

Jordan's success in statistics does not negate her struggles. Instead it highlights the reality that regardless of etiological certainties, having profound mathematical difficulties to the extent that one could meet the diagnostic criteria of dyscalculia does not necessarily preclude success in subjects requiring mathematics. Rather, just as someone with dyslexia can learn to read, someone with dyscalculia can learn to do math, with each individual achieving varying degrees of success, contingent on a multitude of factors. Perhaps what is most troubling about Jordan's story, is that the emergent discourse on dyscalculia that is popping up in online communities, message boards and blogs in both public and academic domains, is encouraging individuals to seek help for their "disorder" where none is available. Psychometric assessment holds pre-eminence, as they are key to officially establishing one's status as having dyscalculia through a clinicalized quantitative pronouncement of "disability". "*Help is available*" the blogs read, yet access to that help and the process of being assessed comes at a price, monetarily and emotionally, particularly for adult students where the quest for help frequently ends with "access denied". The Privilege of disability status is restricted to those who have the resources required to access "proof" that their difficulties with math place them in the below average range in math as compared to their peers; something we already know.

I was nervous that Jordan would be looking to me for answers that somehow confirmed her dyscalculia when we met to review her contributions to this research. Our stories

began so similarly, and our quest for answers remains elusive. Math has been a challenge for all of us, but our experiences and academic trajectories differ so greatly that the "aha" moment of insights into spotting the dyscalculia and differentiating it from low math achievement never came. Instead, the threads that run through our lives heavily implicate others, teaching methodology and perhaps the most profound thread is that the greatest homogeneity between participants is in our strengths rather than in our deficits. During our meeting, I sensed that she was a little disappointed. When I asked her if she had any comments, questions or concerns about aspects of the narrative that I had written, she said,

> *No, it is what I said. It is interesting what you said about the blogs and online communities though, it's true, when you start looking for answers and help it all seems so easy. It feels like there are answers and there is help, but it definitely isn't the case. I also should mention that although I did well in the particular stats course that I took, a friend of mine that took the next one said there is no way you could do this.*

I felt for Jordan, that despite all of her successes, the end of our journey together was tinged with the words of a friend, telling her what she was not capable of. I admired her perseverance and was in awe that she had achieved all that she had. I had long ago given up on math, so entrenched in the idea that I could never do it, when, dyscalculia or not, I may have been able to achieve more than I believed I could. But I am not sure that I would have wanted to. Despite my limited mathematics proficiency, I haven't encountered any functional difficulties in life as a result of it. It has strictly been linked to pre-requisite coursework that privileges a certain way of thinking, and in experiencing ridicule from those who have equated mathematical proficiency with intelligence.

5.9 Conclusion

In this chapter, I have outlined the techniques and processes involved in constructing the participant narratives as well as the rationale for interjecting my own narratives throughout. I have illustrated how a bricolage of narrative approaches enabled a

composite view of the experiences of the participants in relation to their knowledge and perspectives on the constitution of dyscalculia, mathematics, the discourse of deficits, internalization of thought, schooling, family, gender, as well as the considerable homogeneity and heterogeneity in the participants' experiences. I have demonstrated the reflexive process that occurred *insitu*, as well as post interview, exposing my own bias, and exploring the transformative aspects of research that emerged, rather than were imposed as a component of this research.

I have also explicated the *temporal* aspects of the participant's experiences in most instances as beginning early in elementary school, yet extending throughout their lives as their history becomes part of their present. I have also illuminated how dyscalculia itself is constituted temporally, in ways that challenge the inherent discourse of deficit as some of the participants provide insights into academic trajectories that include moving from 'math deficient' to relatively skilled at mathematics even in the face of having been signified as 'learning disabled' in the realm of mathematic.

Place and *sociality* also figure in the participant narratives, and are heavily imbricated, as although difficulties with mathematics are situated as phenomena that largely manifests within the school setting, it emerges in relations with peers, family, friends, strangers and as articulated by Sophia, becomes a source of fear in disclosure of 'disability' in a workplace setting. Sophia's fears raise significant concerns about how the discourse of inclusion and acceptance that are promoted as integral to the practice of education are not perceived as applying to educators, and perhaps fail to address how education is preparing students with 'exceptionalities' to navigate transitions to higher education and the employment.

Ontology and epistemology also figured prominently in the participant narratives, as participant ways of viewing themselves and the constitution of dyscalculia speak to the privileging of 'science' in absence of a criticality of the science itself. The ways in which knowledge is produced, and individuals are constituted is exposed not as neutral, but as part of a broad number of factors that are heavily politicized.

In extending the analysis of the participant narratives in the following chapter, I revisit the participants' narratives to further explicate these findings through a continued bricolage of methods, but with emphasis on analyzing data from the participant narratives within a critical and anti-oppressive framework, turning the gaze on systems of knowledge production and oppression, and signifying sites of resistance as evidenced in the stories of the participants.

Chapter 6

6 Critical Reflections on the Narratives

Schools serve the same social functions as prisons and mental institutions- to define, classify, control, and regulate people. — Michel Foucault

6.1 Introduction

In this chapter I extend the analysis of the participant narratives to demonstrate the critical, democratically informed educational psychology that Billington advocates for (2006). Central to this analysis, is the assertion that when voices are privileged, they dislodge dyscalculia from an essentialist discourse and encourage further inquiry into the intricacies of power relations that shape and manage identities. Drawing on Foucault's theorization of knowledge, power and classificatory systems, I begin by illustrating Foucault's own use off narrative as a mechanism for explicating the historical imbrications of how systems of thought are produced, and how the 'disciplines' of education and psychology exercise power relations that both privilege and oppress children. Furthering the analysis of themes of oppression in the participant narratives, I draw on Kumashiro's framework for anti-oppressive education (2000). Through this lens, the explication of privilege and oppression moves beyond categorization, rejecting pre-supposed homogeneity within categories of sex, gender and socio-economic status. However, these loosely defined categories of oppression are explored to illuminate the complexities of these categorizations, and to expose covert sources of oppression that are imbricated in participant experiences. This analysis disrupts perspectives of 'girls' or 'boys' achievement in mathematics, and demonstrates the multiplicities of gendered experiences that are revealed through narrative inquiry. Finally, I address the emancipatory potential of employing critical and narrative methods for understanding learning and ability, with particular emphasis on how employing these methods in educational psychology is essential to transforming the knowledge paradigm that contributes to oppression.

6.2 Foucault's Theorization of Knowledge, Power and Classificatory Systems

It is fitting to begin to discuss the merger of narrative and theoretical perspectives by drawing on Foucault's theorization of knowledge power and classificatory systems as contained in his 1977 work, *Discipline and Punish*. Though Clandinin and Connelly caution against the use of theory when employing narrative inquiry (2000), I suggest that their positionality is not anti-theoretical, rather it is an assertion that theory, particularly within the discipline of educational psychology, has silenced voices (2000, prologue, xxii-xxiii). In contrast, on first entering *Discipline and Punish*, (and I say *enter* as opposed to read, for read is too benign a word and fails to signify the deep experiential nature of taking up this book), Foucault begins the unraveling of the knowledge-power nexus that implicates education (and later psychology) with a *story*. It is one that initially seems removed from the current beneficent image of these disciplines. Yet the beginning story of a tortured man is, like the participant narratives, evocative, illustrative, and though I use the word with some hesitation for its broader implications, archeological[8], for it begins excavation into what Foucault refers to as the "micro-physics of power" (1977, p. 26). The story of the tortured man reveals the role of punishment as a mechanism for control of persons (which Foucault refers to as the body). For Foucault, punishment is central to nexus of power and knowledge, for the threat and enactment of punishment served a utilitarian purpose for control of the masses. As the shift from rule by kings to rule of government emerged punishment too began a transformation, moving from a strictly corporal realm to one in which the role of institutions such as prisons developed a multitude of techniques for management of persons. This shift from the strictly corporal realm of punishment to disciplinary techniques employed by institutions and 'disciplines', (a word with etymological origins that imbricate *punishment,*

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[8] Foucault, Michel. (1971). *The order of things: An archaeology of the human sciences*. New York: Pantheon Books. (preface, xxiv)

Note: Foucault's archaeological method involves a complex non –linear analysis of contributories to the development of knowledge and theory (history, philosophy, language, and politics), particularly the configurations that have shaped 'empirical science'.

instruction and obedience), became what Foucault coins "technology of the 'soul'"(1977, p. 30). For Foucault, even contemporary education is rooted in techniques employed in penal, military and monastic traditions through the assemblage and partitioning of students (1977, p.p.142-143). He wrote, "The organization of a serial space was one of the great technical mutations of elementary education.....It made the educational space function like a learning machine, but also like a machine for supervising, hierarchizing, rewarding." (1977, p. 147). The diligent, pious and obedient were separated from the "unruly and frivolous". (1977, p.147).Techniques for managing the masses would continue to transform and be transformed through education (keeping always in mind that "there is no power relation without the correlative constitution of a field of knowledge, nor knowledge that does not presuppose and constitute at the same time power relations" (1977, p. 27). Discipline is exercised through spatial relations, spatial relations are enmeshed in rank and observation, and hierarchies emerged for utilitarian purposes. Foucault's' theorization of knowledge power and classificatory systems is not neat. Though winding, this turn to history to understand the emergence and imbrications of power-knowledge and techniques of discipline, is essential in understanding the contemporary disciplines of education and psychology. As Foucault summarizes,

> In short, the art of punishing, in the régime of disciplinary power, is aimed neither at expiation, nor even precisely at repression. It brings five quite distinct operations into play; it refers individual actions to a whole that is at one a field of comparison, a space of differentiation and the principle of a rule to be followed. It differentiates individuals from one another, in terms of the following overall rule: that the rule be made to function as a minimal threshold, as an average to be respected or as an optimum towards which one must move. It measures in quantitative terms and hierarchizes in terms of value the abilities, the level, the 'nature' of individuals. It introduces, through this 'value giving' measure, the constraint of a conformity that must be achieved. Lastly, it traces the limit that will define difference in relation to all other differences, the external frontier of the abnormal.... The perpetual penalty that traverses all points and supervises every instant in the disciplinary institutions compares differentiates, hierarchies homogenizes, excludes, In short, it *normalizes*." (1977, p.p. 182-183)

The *norm* becomes a powerful measure that at once is both technique and knowledge. In education, demonstrated performance becomes *ability*, ability becomes *internalized* and in doing so enacts a powerful mechanism of control and regulation of populations in relation to norms. The knowledge of one's own 'abilities' becomes lodged in one's goals, and yes, one's economic utility. Foucault's' theorization of knowledge power and classificatory systems is not neat. Though winding, it is a necessary journey in order to understand how the techniques of discipline, (observation, normalization and examination) bear relevance on any explication of the phenomenon of learning 'disorders'. However, *observation* is imbricated in *normalizatio*n, normalization in *examination,* with continual arrival to and departure from these points, thus making it difficult to employ a Foucauldian 'structural' framework. In fact, according to Shiner, if Foucault is understood he will not be seen as offering scholarship one more methodological option, but as seeking to elicit an awareness of the politics of truth and the continual forging of instruments for political struggle" (1982, p.397).

Though the weight and complexity of Foucault's theorization of knowledge, power and classificatory systems can seem like a condemnation of the disciplines, this is not the case. Foucault himself cautions against this when he urges,

> Do not concentrate the study of the punitive mechanisms on their 'repressive' effects alone, on their 'punishment aspects alone, but situate them in a whole series of their possible effects, even if these seem marginal at first sight. As a consequence, regard punishment as a complex social function (1977, p. 23).

It is through this potential space, where power relations are understood and acknowledged, that new knowledge emerges, and with that; *power*, specifically, the power to cultivate anti-oppressive knowledge and practice.

6.3 Kumashiro's Framework for Anti-Oppressive Education

Kumashiro is indeed well versed in the writing of Foucault, and when he writes, "The desire to learn only what is comforting goes hand in hand with a resistance to learning

what is discomforting, and this resistance often proves to be a formidable barrier to movements toward social justice" (2002, p. 4), he is engaging in the knowledge- power nexus that Foucault wrote of, and is in turn contributing to a comparatively young body of knowledge(one that sits in absentia in educational psychology); Queer theory. Though my intent is not to employ or detail a framework for queer theory, for no such agreement exists, (Denzin& Lincoln 2012, p.p. 197-207), and indeed neither gender nor sexual orientation (which are more typically characteristic of inquiry that draws on queer theory), are 'central' to the participants stories of dyscalculia, according to Cohen, "the task of queer theory then is to explore, problematize and interrogate gender sexuality and also their mediation by other characteristics or forms of oppression e.g. social class ethnicity, colour, disability. It rejects simplistic categorization of individuals, and argues for the respect of their individuality and uniqueness"(Cohen, Manion, & Morrison, 2011, p. 71). In this sense, the way in which Kumashiro moves beyond binary categorization of race, socio-economic status, gender or, sexual orientation, yet does not invisibilize them, is an important illustration of the ability to open new ways of seeing and understanding which has the potential for being anti-oppressive. Though debate over queer theory extends far beyond the scope of this inquiry, perhaps Gever, Greyson and Parmar explain it best with the words "On a queer day you can see forever" (Denzin& Lincoln, 2012, p. 201); it is about possibilities.

According to Kumashiro, "Rather than assume that a student's class background or community has no bearing on how he or she engages with schooling, educators should acknowledge the realities of day-to-day life that can hinder one's ability to learn" (2000, p. 29).Kumashiro's framework for anti-oppressive education (which I have utilized as an anti-oppressive framework for research), is not definitional in approach, rather, like Foucault he aims to disrupt and excavate knowledge within and between 'categories', and look to ways in which disciplinary techniques that Foucault has unraveled are implicated in education (and later, what can be done to transform oppressive knowledge and practices). Kumashiro's anti-oppressive framework aims to identify,

1. How processes normalize and perpetuate privilege

2. How certain identities are privileged

And

3. The transformative potential of anti-oppressive research and practice

In the following section, I revisit the participant narratives to explore themes that emerged which illuminate the theoretical perspectives of Foucault and Kumashiro. As well, I draw on various other scholars within the disciplines of educational psychology and psychology, to demonstrate the contributions being made to these disciplines from 'insiders' working to disrupt the dominant epistemological and methodological perspectives from within. They, like Kumashiro extend the Foucauldian lens (particularly Billington), to not only critique, but to show what is possible, and in doing so, further emphasizing the viability of bricolage as a research methodology that takes interdisciplinary lenses from debate to dialogue.

6.4 Themes of Oppression that Emerged in the Narratives

1. *Oppression is a covert operator.*

Situated within the discipline of critical psychology, Fox, Prillenltensky & Austin, assert that "doing theory critically means questioning the analytic move that isolates individuals from their life contexts in order to explain their behaviours solely in terms of internal or immediate situational factors" (Fox, Prillenltensky & Austin 2009,p. 322). Thus doing theory critically within educational psychology seems counter intuitive as the discipline has long held a clinical objectivist gaze on the 'other', problematizing cognition, emotion and behaviour as internal processes. This foregrounding is important as *Max, Sophia, Xander, Lauren*, *Jordan* and *myself* all to varying degrees, internalized our experience with mathematics, as *something inherently wrong with our brains.* This is not surprising as each of us had some degree of familiarity with the dominant perspectives on the etiology of dyscalculia drawn from cognitive perspectives which present dyscalculia as something inherent. Yet why we have come to embrace our difficulties as deficiencies, privileging the cognitive perspective has emerged as a common thread throughout this

inquiry. Our exposure to certain modes of thought has taught us to trust in numbers, and believe in the quantification of human cognition, and to accept rather than question. Moreover, what has been excluded is any consideration of the value of subjective qualitative accounts of the mediated experience of classification and subjectification; in short how such classifications impact on the lives of those who have been diagnosed and how through the diagnosis and imposed classificatory system certain norms become internalized with devastating consequences.

According to Fox, Prillenltensky & Austin, the absence of critical inquiry that challenges such established thinking within and about psychology has occurred in part due to increased compartmentalization within the psychological disciplines, which has reduced exposure to other ways of thinking about and understanding human experience, and in part due to epistemological fundamentalism within psychology which is enraptured with the mythology of a value-free empirical science (2009, p. 2). They further suggest that limiting critical inquiry within disciplines that serve the interests of government is a technique of government[9] when they write,

> by teaching that the source of most oppression and inequality is individual or interpersonal rather than societal and political- 'bad apples' rather than a 'bad system' - institutions such as schools, religious bodies, courts, political parties, and the media deflect movements for social change[10]." (Fox, Prillenltensky & Austin, 2009, p. 6)

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[9]Foucault, M., & Rabinow, P. (1984). *The Foucault Reader*. New York: Pantheon Books.

Foucault asserted that as governments began to establish mechanisms for the care of populations, they also began to develop new techniques for the management of populations. This is new knowledge-power nexus established a link in which "scientific categories of (species, population, fertility, and so forth)... become the object of systematic, sustained political attention and intervention" (1984, p. 117) and 2) that through this categorization and examination of persons, they can be, "subjected, used, transformed and improved" (1984, p. 117) in relation to government goals. Foucault terms this interplay of government interests and the establishment of rules, norms and institutions to regulate persons 'techniques of government".

This absence of critical epistemologies, exercises a role in the disciplinary power relations that Foucault exposes. It limits knowledge production within the discipline, and maintains the power knowledge nexus, that what is utilitarian to government, is what is privileged. Silencing *voices*, also silences *critics.*

Thus, when children are spoken of, and written of, in terms of *inherent* deficiencies, and their experiences are deemed irrelevant, the practice of educational psychology becomes implicated as a mechanism for oppression. *Max, Sophia, Xander*, and *Jordan's* narratives illuminate this trust in educational psychology's pronouncements as fact rather than finding, keeping the gaze firmly fixed on internal flaws. In contrast, through our exposure to an anti-oppressive critical lens, *Lauren* and *I* have emerged as placing the least amount of trust in quantitative pronouncements of our abilities, revealing the emancipatory potential for educational inquiry that takes a critical stance on how knowledge is produced.

2. *Oppression is perpetuated through psychology's utility to government - We are ranked and sorted*

Billington, drawing on the work of Foucault, asserts that the discipline of educational psychology "contributes to the social regulation of children in ways and for reasons which usually remain unacknowledged" (Billington, 1996, Chapter 3, p.37). He dismisses the notion of value free empiricism, by situating educational psychology historically as an agent of government, that acts authoritatively as a 'science', while in fact such authoritative judgments' are constructed based on transient and culturally dependent notions of normalcy which are driven by broader economic forces (Billington, 1996, Chapter 3, p. 39). Though Billington's assertions are indeed not knew to those familiar with the works of Foucault, they border on heretical to the positivist voice of educational psychology[11]. Yet this privileging of knowledge (arguably a complete silencing of

[11]Willig, Carla, & Stainton-Rogers, Wendy.(2008). Educational Psychology. In the SAGE handbook of qualitative research in psychology. Los Angeles, Calif: SAGE Publications.

alternate knowledge) has virtually prevented the emergence of critical theorists within the discipline. Currently, "Every overtly social justice-oriented approach to research... is threatened with de-legitimization by the government-sanctioned exclusivist assertion of positivism... as the 'gold standard' of educational research"(Denzin& Lincoln, 2011, p. ix). The imbrications of governmentality at work again; silencing *voices*, silences *critics*.

Further illustrating the merger of epistemology and methods that contribute to oppression, Nikolas Rose's *Governing by Numbers* (1991) highlights the power of numbers in a democratic society whereby the ability for citizens to achieve levels of numeracy is considered economically essential, the classification of citizens numerically via numerous systems (i.e.: the census) becomes integral to decision making, and the ethics of ruling by numbers becomes imbued in public consciousness as a utilitarian truth (1991). Though on the surface Rose takes a decidedly different stance on the *concept* of democracy than the democratically informed psychology that Billington calls for, their divergence is strictly semantic. Rose and Billington both share positions that are deeply aligned in a critical stance regarding the control of persons via the systems of making individuals calculable. It is simply that Billington's positionality on the concept of a democratically informed psychology is one in which the discipline does not act from an authoritative stance, setting parameters that contribute to invisiblization and which ignore and perpetuate oppression. Billington sees emancipatory potential within educational psychology, while Rose takes a more skeptical view of the discipline in its current form.

Critically examining the participant narratives to explicate levels of oppression is difficult because it is not only difficult to grasp where sources of oppression begin, intersect or end, but it involves looking for what is hidden, and about challenging the validity of the very groupings utilized to examine oppression. However, themes of oppression are

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Note: in a five year period (200-2005) only six journal articles that employed qualitative methods were published in Educational Psychology Journals compared to 160 quantitative studies, and of those published, mixed methods (therefore partial quantitative methods) were utilized.

imbued in every voice and the role of numbers as an act of government[12] is central, for they are key to understanding the control of knowledge, and by extension, persons. Educational psychology's role in relation to the calculability of citizens is rarely acknowledged within the discipline, yet according to Billington, "a principal undeclared function of medicalized, social pathological methods of defining what a child should be is to refine the process of regulating access to the labour market" (Billington, 1996, Chapter 3, p. 39). In examining the participant narratives, the link between making abilities calculable for economic purpose is evident (with the exception of *Jordan* and *Xander*, whose family demographics require later explication),when the rest of us were *ranked and sorted*, largely on the basis of our limited mathematical proficiency. Excelling in the arts held no value as *Max, Sophia* and *I* were all streamed into what are typically described as vocational pursuits; no university required. *Lauren* too had been steered in that direction, but through her father's advocacy and her own tenacity, she resisted the sorting process. Undoubtedly for *Max*, the abuse he had endured had worn him down. He was too tired to resist, and his parents were situated both culturally and historically, to believe in the voice of authority. *Sophia* also succumbed to the sorting process, but she did so with an ember of hope that a glitch in system might enable her to move through, and beyond college if she chose to (something *Max* and *I* would discover much later). Through this sorting process whereby individuals are streamed into their place in society to fulfill a certain economic purpose, they once again experience acts of oppression through the government's stance on mathematical proficiency. The covert indoctrination of ability as *inherent*, combined with mathematics being the greatest measure of ability, privileges both ontology and discipline. We are ranked and sorted. We are governed by numbers, keeping the gaze averted from the layers of oppressive contributories that our stories reveal.

3. *Socio-Economic Status as a source of privilege and oppression*

[12] Reference to Foucault and Governmentality

Though not explicit in the narratives (as decisions on what to address in the narratives were driven largely by the evocative lens intended to humanize the discourse of disability), through the interview process participants also shared information about socio-demographic factors that highlight the role of economic privilege in education. While *Xander* would eventually achieve considerable success in mathematics, *he* also reported that both of his parents had a high degree of post-secondary education in what could be considered high status professions. *Jordan*, who like *Xander* did not succumb to the sorting process, came from a dual income family with parents working in professions in health sciences and technology. Both *Xander* and *Jordan* grew up in homes where parental education granted a certain degree of privilege in terms of access to support with mathematics. Both had post-secondary educated parents able to provide instructional support, and both had parents that had the financial means to pay for additional support as needed to help each of them navigate their learning difficulties. Though a certain degree of socio-economic privilege was advantageous to both *Xander* and *Jordan*, *Xander's* socio-economic status was reported as being considerably higher than Jordan's and ultimately *Xander* achieved the highest degree of mathematic proficiency of all participants. While precise numbers regarding parental income were not available, participants did disclose information about parental education and income which revealed a degree of hierarchy in mathematical achievement; higher status led to higher math achievement.

Yet the ways in which this socio-economic privilege is exercised are not always so overt or quantifiable. Census like categorization fails to illuminate what socially constructed concepts such as "middle class" or "working class" mean, or how they are malleable and intersect with other categories. In contrast, stories provide alternative ways of learning about these power relations. However, without an awareness of socio-economic influences, participants and researchers alike may miss their relevance, or in the case of gender, may lack the understanding to articulate their relevance.

4. *Sex and Gender as sources of oppression*

When it comes to sex and gender, the participant narratives highlighted the importance of developing educators' awareness that these are not synonymous terms. They also illuminated how positivist research on academic achievement in relation to sex is limiting, problematic and potentially harmful. My interactions with the participants also raised questions for me about how to approach these issues in research, and how important complex critical inquiry is in relation to them. Though in my own experience, issues of sex and gender were overt, this was not the case for all participants, and my rather ambiguous question on sex and gender though intended to be vague as to not lead the participants in any way, seemed to leave them feeling uncertain about what I was asking. Based on my own experience, I had blinders on. I entered the research with bias about how 'gender' would be revealed in the participant's stories. I was convinced that based on my own experience, having grown up in a generation where the false belief that females were inherently less capable than males (particularly in mathematics) was prolific. But my sense of how gender would be manifested in participant stories ran deeper than the discourse of ability. The words of a teacher had once cut me to the core, when I was chastised for my 'stupidity' in front of a class of largely male peers, while simultaneously being offered 'hope' that my 'good looks' at least held some prospect for finding a husband as a means of financial support. Where does sex end, and where does gender begin in my reflection on this experience? Through this teacher's exercising of 'humour', I had been humiliated and reduced to a commodity, but worst of all, I came to believe him. As a result, when I began this research I was convinced there were others, who as 'girls" had endured similar degradation. Perhaps not as extreme, perhaps worse, I didn't know how, but I 'knew' that it would be there. This is one of the dangers of intertwining the stories from one's own life with that of others in research. As Weis and Fine caution, as qualitative researchers employing these methods, we frequently need to stop and remember that when looking in a mirror that "objects can be closer than they appear" (2000, p. 68). I had simultaneously been so sure that my question would evoke similar stories, yet so fearful that if I elaborated on the intent of the question (the meaning of sex, gender and how it influences our experiences), that I would lead the participants away from their own stories. So I let the question linger, and if nothing emerged I moved on hoping that somehow this domain of inquiry would surface. And it did. Although there

were initially no earth shattering revelations (most secondary math teachers were white males and all female participants did acknowledge that, they had been shamed by these male teachers in front of their peers), when specifically asked about their thoughts on gender in relation to their experiences they did not articulate a connection. This in retrospect is not surprising, given the covert nature of gendered power relations in mathematics education, where according to Walkerdine (1998), not only are teachers of both genders likely tend to downgrade the intellectual ability of girls in their interactions with them, girls are positioned to be anxious of asking questions in math both to their male teachers and in front of male peers. As a result, my ambiguous question of gender may have been difficult for participants to process. Though my story was the only one that detailed overt gendered shaming (I was a 'stupid girl'), the prevalence of male math teachers has subtle influences, gray ones that are not easily identified or articulated. Yet being female and being shamed by a male in a position of power indeed urged our desire for distance from the subject that they held power over us in. *Sophia*, *Jordan* and *I* all terminated math courses as soon as we were able to meet the minimum required courses for a High School Diploma. *Lauren*, on the other hand, as the sole female participant to take math all the way through High School, brought another perspective on sex and gender to the table, the power of her father, as a male whose vehement advocacy for her with the school gave her a different perspective on how gendered privilege could be exerted; not for subjugation, but as an ally for emancipation. Similarly, *Xander's* story, although not laden with memories of overt gendered interactions, is tightly centered around the gendering of a particular conceptualization of intelligence; one where mathematical reasoning, logic, and a distancing from emotion, is held not only in highest regard, but traditionally as masculine traits (Walkerdine, 1998, p. 20). When I asked *Xander* about his thoughts, feelings and experiences in relation to gender, he was aware of the hegemony of math and science, and although he had "come to terms" with needing to meet certain criteria or be excluded from his goal of becoming a doctor, he also said that he hoped to see change in the profession on these issues and that he himself ascribed to "a different masculinity, one that was more closely aligned with the complex characters in the novels that he read as a child. He valued a version of masculinity that included empathy, compassion and sensitivity; characteristics that he confidently asserted

"*makes for better doctors*". Then there was *Max,* my first participant. I admit that when he first contacted me (his was the first inquiry I received), I remember being surprised that the first person to contact me about this study would be male. Yet ultimately, *Max* made this process come alive for me and his story moved and challenged me in so many ways. I was angry for what had happened to him, how couldn't I be, after hearing all he had endured? Yet what I learned from Max extended far beyond the evocation that flowed from hearing how he was treated by educators and his peers. *Max* exposed my own bias and forced me to throw out my preconceived notions on the discourse of sex and gender in relation to mathematics.

Max was filled with feelings he struggled immensely to manage. He lived in conflict. He was trying to claim an identity as a quiet, caring, sensitive person who wanted to help others. Yet Max endured continual *surveillance*, which according to Gore, circulates between the teacher, other students and within the individual. It "singles out individuals, regulates behavior [sic], and enables comparisons to be made" (Gore, 2001, p.170). Though long beyond the confines of his elementary school experience, his sense of self remains tied to these experiences. Though several participants welled with tears at the recall of their experiences, Max did not. His only reference to crying during our interview was to express that he had been "too sensitive" at times and that made him a target. We are all designed to cry, I told him. He nods acknowledgement, but the voices are a cacophony heckling him; *Sissy!, freak!, Moron!, Stupid!, Man up!, don't take it, fight back* ! He punches a wall instead. He breaks skin, there is momentary relief. But he knows the pain will be back. The techniques of surveillance; who he should be, how he should act, and what he should feel continue to circulate, and to oppress.

On first glance, Max's story may not resonate as one tied to gender, but indeed his story of gender may be the most powerful of all. The ridicule of traits and behaviours in a boy that were perceived and perpetuated as feminized and undesirable, stand in contrast to the masculinisation of violence, that was wielded at him, that was encouraged in him, and that he ultimately began to wield against himself. The blood runs not only on his hands, but on societies', and a system that allowed this to happen. *Max's* story in relation to gender may not be in relation specifically to mathematics, but it is powerful glimpse into

how deeply gendered myths have the potential to cause reverberating harm. When the discourse on achievement is isolated to performance measured, or sex categorized without considering the ways in which quantified pronouncements flow into public consciousness and affect lives, research in education becomes implicated in perpetuating, or at the very least failing to deconstruct harmful falsehoods. How could *Max* do well on mathematics amidst the taunts of a teacher and his peers, ultimately exiled to the hall for the behaviour that they incited? And the imbrications of gender run deeper for *Max*, as he was eventually *pathologized* for his behaviour, his '*inability' to have peer relationships*, his '*inability' to read and respond to social cues*, and his '*defiance'*. This is why according to Martino, "What is required [in education] is a more nuanced analysis of the ways in which gender intersects and interweaves with sexuality, race, ethnicity, social class, disability, geographical location to impact, in significant ways, on boys' social practices of schooling" (2003, p. 111). Though Martino's words were aimed specifically in relation to boys due to the context of the article [boys literacy] Martino's insights should be extended into the domain of educational psychology for they illuminate what compartmentalization does not. Though it was evident in the participant narratives there was a clear level of oppression towards the *feminine*, the complexity of how the feminine was interpreted and responded to was not restricted to sex. Nor were the power relations clearly hierarchical, as in certain instances oppression become clearly internalized.

5. *The Transformative Potential of Anti-Oppressive Research*

Following each interview, I returned six to eight weeks later to meet with the participants for their review of the constructed narratives. It was at this time, that the 'breach' occurred, though I had been advised that I was not to disclose my own positionality on the issue of dyscalculia at the time of the interviews, the reality was that the auto-ethnographic component of the thesis (which had been authorized) was interwoven with the participant narratives. As a result, when the participants read their narratives with my own experiences and insights juxtaposed within their stories, their responses indicated that this interweaving provided new insights for them, sometimes revealing things about

themselves that they did not know, and sometimes simply feeling less alone through our loosely defined group. Some asked questions about the other participants, and all were eager to see the final thesis, hoping to gain both further insight into the phenomenon of dyscalculia from the theoretical framework that I had employed, and to read more about individuals who like themselves had come to identify with having dyscalculia.

As most of the participants had for so long endured the comments of others who asserted that their difficulties with mathematics were nothing but a myth, brought about by bad teachers, lack of effort and a self-imposed psychological block towards mathematics, they were eager for evidence to the contrary. Yet each participant expressed conflicting feelings on this issue; on one hand seeking validation of the depth of their struggles with mathematics as a legitimate isolated form of learning difficulty, and on the other hand resisting an essentialist view of their "deficiencies". I knew that I could not answer such a question, and my research had evolved into exploring the imbrications in their stories, in light of theories from diverse disciplines that constitute our knowledge base of the phenomenon. Initially, I felt that somehow I had failed the participants, by not giving them the sense of closure that I felt they were seeking on this conflict. However it was through the lens of anti-oppressive education that I came to see that this work, their stories, and a critical understanding of the phenomenon of dyscalculia is not about answering, accepting or rejecting knowledge, it is about disrupting it.

According to Kumashiro, "disruptive knowledge, in other words, is not an end in itself, but a means toward the always-shifting end/goal of learning more (2000, p. 34), Through the exchange of knowledge about the experiences of other participants, through the involvement of participants in reviewing their stories in light of interwoven themes of gender, oppression, knowledge and power, from different theoretical perspectives, the research process became transformative. All participants reported learning things about their experiences that they had not realized. They shared that engaging in the process was helpful, and that although there is still much to digest (and their perspectives on dyscalculia vary), they felt that their contributions constituted a form of advocacy, for themselves and for others who have in some way been constituted as having dyscalculia.

However, the transformative potential of research on dyscalculia and mathematics could (and should) extend further in anti-oppressive aims. For Kumashiro, "the role of the school in working against oppression must involve not only a critique of structural and ideological forces, but also a movement against its own complicity with oppression" (2000, p. 36). Standardized curriculum and practices in education that emphasize certain paradigms must be questioned. Kumashiro illustrates that in the case of science, where demands for objectivity and rationality grant epistemological privilege, and in mathematics, where privilege is extended to the *discipline* without considering its political utility, which has led to oppression, and yet again in writing, where the very act of citation of expert knowledge privileges established ways of thinking at the marginalization of new knowledge (2002).

6.5 Conclusion

Max, Sophia, Xander, Lauren, Jordan and *I* indeed all experienced multiple levels of oppression through the disciplining process. Though a popular folk assertion is that such struggles have contributed to our success, I reject this view. Instead, I suggest that each of us, in various ways and to various degrees, began to question the knowledge-power nexus before we knew what it was, and through questioning and acquiring new knowledge we have shifted, at least to some extent, the power that those oppressive forces have held over us. Perhaps this has been the greatest finding of all, for it provides a broad and ameliorative strategy; that critiquing knowledge across all subjects and disciplines should be cultivated much earlier, and given as much relevance as the ability to recount it.

Ultimately, the critical democratically informed psychology that Billington advocates for is possible, but it is not a destination, it is a process and one that must begin with an end to the pretense of epistemological innocence[13]. According to Billington, the positivist

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[13] The position of neutrality proposed through employing methods of 'objective and value free science' is an illusionary one, as the both the techniques employed by and the privileging of certain kinds of knowledge can have oppressive effects. The term 'epistemological innocence' is drawn from Rawolle and Lingard's discussion of the work of French sociologist Pierre Bourdieu in Bourdieu and educational

methods and that dominate educational psychology can no longer persist with claims of objectivity, for they are heavily implicated in the techniques of government that marginalize children (2013). Billington further argues that much of what is presented as 'scientific' in educational psychology is in fact unscientific "since such accounts can be seen not only to misrepresent science [for measurement in educational psychology involves to performance on socially constructed norms], but also to omit crucial data (i.e., experience) and are thus incomplete" (2013, p. 176). A critical democratically informed educational psychology must also involve a commitment within the discipline to cultivate different ways of thinking, through engaging those who are marginalized, and by exposing levels of marginalization by delving into learning that is, as Kumashiro warned, uncomfortable, yet necessary.

That is perhaps the greatest challenge of this work; that in order to achieve the disruptive knowledge intended to facilitate transformation of thought about dyscalculia, how research is conducted, how knowledge is certified within academia, and how it trickles (and even pours), into public domain, I must intentionally step on the toes of giants as much as I stand on the shoulders of them[14].

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research: Thinking tools, relational thinking, beyond epistemological innocence. *Social theory and education research: understanding Foucault, Habermas, Bourdieu and Derrida*, 117-137 (2013).

[14]The phrase 'standing on the shoulders of giants' is borrowed from: McGrew, K. S. (2009). CHC theory and the human cognitive abilities project: Standing on the shoulders of the giants of psychometric intelligence research. *Intelligence*, *37*(1), 1-10., and is used to reference the 'giant status' of psychometric theory within educational psychology.

Chapter 7

7 Implications and Concluding Thoughts

"Each society has its regime of truth, its 'general politics' of truth; that is, the types of discourse it harbours and causes to function as true; the mechanisms and instances which enable one to distinguish true from false statements, the way in which is sanctioned; the techniques and procedures which are valorised for obtaining truth; the status of those who are charged with saying what counts as true. (Foucault, in Rabinow 1984, p.73).

7.1 Introduction

In this chapter I discuss how this research does not provide *answers or 'truths'* about dyscalculia, but is intended to explicate dyscalculia as a complex phenomenon that required a bricolage of theory and methods in order to achieve a perspective of depth, diversity and democracy surrounding its constitution. I revisit the 'hypothesis' proposed at the beginning of this research, that dyscalculia is a phenomenon that represents the principles of multifinality and by re-examining the research on dyscalculia presented in the literature review in light of the participant data. I also speak to some findings within this research that were not presented within the narratives or critical analysis (there is a specific rationale for this that will follow). However I do so with tremendous caution in how these findings are interpreted, as the intent at their address is intended to raise further questions about the multiple ways in which individuals are categorized, and not to propose any kind of homogenous truth about dyscalculia, individuals with dyscalculia. I discuss how ethical considerations that were unanticipated, figured prominently in this research, expanding considerations about the ways in which ethics and methods are a site that requires constant dialogue and reflexivity to ensure that attempts to 'protect individuals, does not silence them'. This also involves recognizing that when 'advertising' for participants, we cannot make assumptions about those with whom we wish to speak. We are seeking access to complex lives that must be handled with, and represented with care.

Finally in my concluding thoughts, I discuss the paradoxical benefits and limitations of presenting a complex and malleable view of a 'mathematical learning disorder', and how this understanding is imbued with potentialities and challenges for both practice and pedagogy.

7.2 Bricolage as a Path for Transformative Knowledge and Practice

By drawing on the diverse array of theory and methods employed in this work I have demonstrated that, although gray and winding, bricolage does indeed provide a framework ideally suited to the transformational goals of this research. Though the loosely defined framework for bricolage have been discussed (and justified) throughout this work, I will briefly attempt to illustrate how the sites of examination advocated by Kincheloe (2005), were acted upon, by drawing on examples from findings that emerged through this method of inquiry.

1. *To explicate and implicate orders of reality*–in this instance, Kincheloe is referring to the 'patterns of reality over time' and 'hidden process' that contribute to those ordered realities. Patterns emerged regarding the privileging of modes of research, logic, mathematics, gender, social class, and the oppressive effects in the lives of participants. However, in explicating the "hidden processes", that implicate orders of reality through Foucault's theorization of knowledge, power, classificatory systems and governmentality, the link between mathematics and one's 'economic utility' are revealed in the academic streaming process that emerged in the participant's stories in chapter 5.
2. *To question universalism*– the concept of universalism was critiqued throughout this inquiry as in the case of the 'generalizability' of findings on psychometric assessment and intelligence, which employ socially constructed, socially interdependent measures of performance. These measures which serve as the primary mechanism for the identification of dyscalculia and are rooted in cognitive theory are frequently conflated with ability. As well, findings proposed as

generalizable using the same measures have contributed to divergent perspectives on the role cognitive mechanisms that underlie dyscalculia (as in the case of differing perspectives presented by Geary and Butterworth).

3. *To examine Polysemy* –The language of 'dyscalculia' was explicated to have multiple meanings. What 'dyscalculia' is, and whether or not an individual *has* dyscalculia is not a question of truth, it is a frame of reference. For Butterworth, dyscalculia is *distinct* from low math achievement, for Geary, there are sub-categories of dyscalculia. In research, the language of dyscalculia is employed, differently. As well, there are politics associated with the use of the word, has one been 'signified' as having dyscalculia from an expert stance, or does one self-identify based on a vastly dichotomous academic record. Though the latter conceptualization is frequently dismissed as lacking 'credibility', this itself raises questions; though certain participants were 'signified' as having a mathematical learning disorder based on achievement score discrepancies, of the individuals 'diagnosed' with mathematical difficulties, their academic performance in mathematics was in fact much higher than the participants that simply did not have access to assessment. As well, even when the data illustrated meeting the diagnostic criteria for a mathematical learning disorder, there was hesitancy among psychologists to employ the terminology available to them, instead favouring generic representation of a 'learning disability'. (This was particularly evident in Sophia's account of psychometric assessment when she said, *"I only received help for mathematics and had LD identification, well, you do the math! [laughs]"*).

4. *To examine the living process in which cultural entities are situated* - dyscalculia is not a fixed entity. It is a relatively new area of inquiry, and both what we know about it, and how we know what we know are in flux. In this research dyscalculia is not examined as an isolated phenomenon located in a narrow or isolated context, it is

examined as a phenomenon that emerged, was enacted, and in certain instances both faded into the distance when other influences were explicated, and 'disappeared' when participants were able to achieve a degree of proficiency in mathematics that no longer positioned them as having dyscalculia (this was particularly evident in the case of Xander's eventual high math attainment).

5. *To examine the ontology of relationships and connections* – 'culture' and 'the self' are inseparable notions, dyscalculia cannot be considered outside of the complex lives of those under study. This is evident in the instances of shaming that the participants endured, how can math performance be conflated as *ability* without considering the forces that contributed to it? In my own case, I came to fear and despise math, creating distance from it whenever possible. Thus as an adult my math ability is imbricated with experiences and decisions surrounding mathematics.

6. *To examine intersecting contexts* – according to Kincheloe, "contextualization is always a complex act, as it exposes connections between what were assumed to be separate entities"(2005. P. 328).Quantified and normative research on dyscalculia would have categorically separated participants by sex, and in doing so, the complexities of sex and gender remain hidden. The context of lived experience however, provides insights into assumptions held as separate such as male 'femininity' or female 'masculinity'.

7. *To examine multiple epistemologies* – Simply put, in employing bricolage, cognitive theory, neuroscientific research, critical social theories, narrative and auto-ethnographic methods, multiple epistemologies are invited to a table. Though I make no assertions about having achieved balance in *content* (as critical epistemology figured most prominently), I believe this is warranted for far too long dominant paradigms have sat at the head of the table, leaving other orientations to research either uninvited or sitting at the proverbial children's table.

8. *To examine the discursive construction of research* –According to Kincheloe, bricoleurs "work to uncover the hidden rules that define what a researcher can and cannot say, who possesses the power to speak/write about particular topics and who must listen/read, and whose constructions of reality are valid and whose are unlearned and unimportant"(2005, p. 329). In explicating my positionality that voices count, in acknowledging the complexities of my role as participant and researcher, in explicating the criticism that certain modes of inquiry face within the discipline of educational psychology, I continually examined issues that exist at the knowledge-power nexus in research in education.

9. *To examine the interpretive aspects of all forms of knowledge* - not as a 'flaw' but as a reality. This inquiry rejects the pretense of objectivity and has explored the multiplicities of the interpretive as a reality that is navigated, not transcended. I have explored the multiplicities of being a researcher-subject and how interactions with participants both facilitated and required constant self-reflexivity about these relations. I admit and explored my bias, acknowledging that I cannot be free of it; simply that I must constantly strive to be aware of it and its potential influence.

10. *To examine the fictive dimension of research findings* – In this instance Kincheloe implicates both the issue of how any methods are subject to degrees of blindness and interpretation, and the extent of the use of fictive elements is not to be viewed as "fiction", instead they must be examined for purpose. In this work, the narrative representations involve fictive elements that are intentionally evocative (a component of narrative inquiry), but I have also addressed how in doing anonymous research, caution must be taken to ensure the details relayed in the research do not have the potential of inadvertently disclosing data that could potentially 'out' participants. Sometimes information is simply too specific, to be included.

11. *To examine cultural assumptions within all research methods* – this is evident in not only in examining the privileging of 'objective'

science, in educational psychology, but in the cultural situatedness of modes of inquiry utilized in educational psychology, as evidenced by the greater representation of critical methods in the United Kingdom (Willig & Stainton-Rogers, 2008).

12. *To examine the relationship between power and knowledge*–the role of power in producing and subjugating knowledge has been addressed throughout this work, and lies at the core of much of this inquiry. From the justification of voice, theory and methods, to illuminating the transformative aspects of anti-oppressive research this work has been wandering, but never wavering in its purpose, and in my positionality as both subject and researcher, I have achieved one of the goals of examining this knowledge power nexus asserted by Foucault; "to change myself and in order not to think the same thing as before. (Foucault, 2001, p. 240).

Thus, my foray into bricolage, though wrought with tensions has indeed been guided by a purposeful framework that provides an alternative evaluative criteria that upon reflection, I believe I have met. Having put the methodological justifications to rest, this leaves me with the task of returning to the initial postulation of how dyscalculia is phenomenon with multiple influences and potential trajectories.

7.3 Equifinality and Multifinality Revisited

In this section I revisit the concept of equifinality and multifinality presented at the beginning of this thesis. Though the participant narratives and the critical analysis of the narratives in chapters 5 and 6 illuminate the multiple influences and trajectories of participants' stories with mathematics achievement, I revisit this concept with a certain degree of distance from the participants themselves, with a rationale for this distancing interwoven.

Some themes explored in this section are not included in the participant narratives, due to participant concerns that despite the cloak of a pseudonym, sharing certain highly specific details within their narratives could potentially act as signifiers to their identities.

Both participant fears and my own sense that focusing on 'pathology' was not in keeping with the intent of this work posed a significant challenge for me in considering how to present some unique findings that emerged in this research. Thus it is presented with some trepidation as my hope is to present the multiplicity with which participants were marginalized, urging the same criticality to other categorizations be employed in understanding them and NOT to suggest homogenous assumptions about individuals with dyscalculia.

Within the participant sample, each of the participants met criteria for some form of co-occurring exceptionality. Some received a formal diagnosis through a psychologist, psychiatrist, medical doctor and others self-identify with a co-occurring exceptionality (in some cases participants reported multiple co-occurring exceptionalities). Though co-occurring exceptionalities are often presented as a 'confound' to 'true' dyscalculia, it is important to note that despite the co-occurring exceptionalities, all participants performed above average in other academic domains, and with the exception of gifted identification for two of the participants, none of these other exceptionalities were diagnosed/assessed in childhood. Thus mathematical difficulties were a relatively isolated academic domain and the DSM-5 exclusionary criteria for dyscalculia (technically a sub-type of specific learning disorder), cannot be "not attributed to other factors", DSM, 2013).

This raises questions about the acceptance of co-occurring exceptionalities as *defacto*. Just as multiple oppressive influences are illuminated in the participant stories of 'dyscalculia', any 'co-morbid condition' must be considered subject to a critical examination of oppression.

However, the emergence of co-morbid conditions should not be dismissed from consideration in terms of potential contributories to mathematical difficulties either. Though most of the co-morbid conditions reported by participant emerged later in life, this is not to say that they may have been present in childhood and gone undetected. Co-occurring exceptionalities should neither be dismissed as confounds, nor asserted as the etiological basis of learning difficulties. Instead, they are factors that simply raise questions that require further inquiry.

As well, the range of co-occurring exceptionalities reported by the participants indicated both homogeneity and heterogeneity in terms of exceptionalities. The greatest degree of homogeneity within the sample was in the domain of gifted identification. Though there is definitional variance with how gifted status is identified (this is previously addressed in chapter 5 in Jordan's narrative), all participants met some form of gifted/high ability criteria.

This high ability in non-mathematical domains served, to varying degrees, as a counter discourse to the negative, and deficits based discourse that the participants experienced in relation to mathematics, yet it is complicated by further findings in relation to the next most frequently occurring co-morbid condition, that of bipolar disorder.

Within such a small sample of participants, this shared diagnosis was unexpected, and troubling. Though a limited body of research on bipolar disorder presupposes a higher degree of mathematical difficulties (Lagace, 2003) as compared to other learning domains, the contributories to the participants' mathematical difficulties are well illustrated. To briefly illustrate some further complexities surrounding this issue, bipolar disorder is both rare and contested in relation to children, so to suggest that bipolar disorder was influential in the participant's childhood mathematical difficulties is problematic in the face that the participants did not have this diagnosis in childhood. As well, the limited body of research on mathematics and bipolar disorder has been drawn exclusively from adult or adolescent populations (Lagace, 2003). Deepening the complexity are assertions by Missett (2013) and MacCabe (2010) of a link between giftedness and bipolar disorder. Further conflating this issue is research that explores the prevalence of psychiatric misdiagnosis of bipolar disorder which Amend and Beljan (2009) suggest is due to the medical profession's lack of knowledge of twice exceptional learners. Amend and Beljan's (2009) work also raises important questions about the influence of disciplinary orientations towards diagnosis. The possibility that a psychologist and a psychiatrist may arrive at alternate diagnoses utilizing the same data speaks to the need for critical interdisciplinary work that a research bricolage advocates for.

Thus like dyscalculia, although neurobiological etiology is hypothesized, bipolar disorder is a condition that should not be assumed as a 'truth' without a similar criticality to the one employed in exploring dyscalculia. Levels of oppression that were explicated in the participants' lives do not vanish in light of yet another subjective classification. As a result, the frequency of participant reports of bipolar disorder should be interpreted with caution. This finding simply raises questions for further inquiry surrounding any intersecting claims, and about the role of disciplinary compartmentalization[15] and the classificatory systems applied to individuals.

Of particular relevance to potential pedagogical implications surrounding this research, was the prevalence of reported visual spatial difficulty (with all but one participant identifying visual spatial difficulty as significant). How visual spatial difficulties were reported varied, with both psychometric measures and interpretive self-reports and being provided. More than one participant reported formal assessment of their visual spatial abilities being below the tenth percentile, while other participants reported difficulties with games that involved visual spatial ability, coursework that was visual spatial in nature (particularly the identification of patterns and use of arrays in mathematics). For most participants, the use of visuals in mathematics was not described as helpful. The use of arrays in particular was described as "cumbersome" and even "dizzying" by multiple participants. The visual spatial requirements in mathematics vary considerably, as do what constitutes visual spatial representations. However, according to Hegarty and Kozhevnikov (1999), the overuse of visuals in mathematics is not helpful for *most* individuals and clarity on the nature and role of the visuals (are they pictorial or schematic) is an essential point of clarification in their utility. As well, if a student is struggling with visual spatial perception, heavy use of visual spatial 'aids' may confound or even contribute to 'mathematical' difficulties. Yet there is a preponderance of

[15] Just as the diagnosis of a learning disability is culturally situated and involves considerable variance as to who may deliver a diagnosis , the diagnosis of bipolar disorder occurs with similar variance in both methods of assessment and the credentials of individuals conducting them.

literature published[16] that encourages visual spatial mathematics instruction based on the concept of meeting the needs of 'visual spatial learners'. The focus on matching instruction to 'learner types' is also discussed by Hegarty & Kozhevnikov (1999) as a widely held belief in education that, despite its popularity is highly contested within educational research. As well, a similar scoring dichotomy that is utilized to diagnose a mathematical learning disorder bears similarity to scoring patterns (in the domain of visual spatial difficulties) among individuals considered to have a non-verbal learning disorder. Like dyscalculia, non-verbal learning disorder is a phenomenon that is not listed in an official diagnosis in the DSM (past or current) and is itself a contested diagnosis. Though the distinguishing hallmark of a conceptualization of non-verbal learning disorder over a mathematical learning disorder lies in its emphasis on 'impairments in social skills'(Forest, 2004), the complexity and subjectivity of social skills, combined with the reality that NVLD is a relatively new area of study, provides further evidence of the diversity of potential contributories to mathematical difficulties, and the importance of inquiry that does not aim to investigate 'conditions' as isolated phenomena.

Turning to patterns of strengths reported by the participants, all participants reported considerable interest in, and proficiency with reading at an early age that persisted throughout their lives. More than one participant reported reading levels measured in the 99th percentile on standardized assessments, while others, by virtue of the volume and complexity involved in graduate and post graduate level readings, demonstrate a level of reading proficiency that would be indicative of the above average reading ability. Most participants reported reading beyond age level very early, engaging in reading that was complex both in terms of vocabulary and context, and being able to do so quickly.

As well, participants reported being able to write well (referring to composition), with participants indicating that coursework that involved writing assignments (essays) generally resulted in not only achieving high grades, but in receiving positive feedback

[16] A database search conducted 27 May, 2014 produced 29, 500 published articles on visual spatial learners, though the scope of the results extends far beyond this inquiry, many abstracts contained references to utilizing visual spatial strategies in mathematics instruction.

about their insights, writing style and structure. Participants reported that doing well in both reading and writing was integral to their academic success and served not only to facilitate academic success, but was a source of self-esteem, self-efficacy and means of countering others perceptions of them as less capable of academic pursuits based on their mathematical difficulties.

Finally, the divergent perspectives of Geary and Butterworth on the role of working memory in the constitution of dyscalculia will remain at a standoff, as although participant data from psychometric assessment was not obtained through this process, nor was psychometric relayed by all on all participants, multiple participants did indeed have such data, and their reports (sometimes including percentile scores) suggest variance on the issue of working memory and processing speed with deficits being both confirmed and unsubstantiated.

As a result, the ability to achieve the same result of 'dyscalculia' is demonstrated by the vast potential contributories in one's social experiences (including and not limited to those related to gender, socio-economic status, and race),'co-morbid conditions', and pedagogical approaches to mathematics instruction that may compound learning difficulties for individuals that have visual spatial difficulties.

As with equifinality, through this inquiry, issues that support the concept of multifinality (one factor leading to multiple outcomes) also emerged. Though once again the conceptual complexity of multifinality warrants considerable attention, I will attempt to be brief, choosing to focus on the issue of 'resilience' as this is also a significant theme that emerged in the participant stories. According to Curtis and Cicchetti, "resilience is influenced by a complex matrix of the individual's level of biological and psychological organization, current experiences, the societal context, timing of the adverse event(s) and experiences, and the developmental history of the individual" (2003, p. ,779). They further emphasize the role of malleable brain development as influenced by all of these factors and reject a biological determinism that overemphasizes genetic determinants to brain and behaviour (2003). Though Cicchetti and Curtis's work focuses on psychopathology and not dyscalculia, it is important to consider the experiences of the

individuals (being shamed, bullied, abused, felling stupid, 'defective' and in some instances isolated) as having vast influence in both mathematical performance and later manifestation of co-occurring conditions. Similarly, the emergent successes that the participants experienced at the post-secondary had a transformative influence. The concept of learning disability can benefit from not only critical approaches, but emergent research in neuroscience that emphasizes the complex interplay of these factors. According to Billington, educational psychology has for too long focused on the separation of cognition and emotion and the privileging of psychometric data as both indicative of ability and predicative. When we step outside of the traditional boundaries of research, a more complex, less reductionist picture emerges (Billington, 2013).

7.4 Concluding Thoughts

My research objectives, theoretical frameworks and methodology were guided by my ontology, epistemology and my own experiences, but I approached the issue of dyscalculia as research that aimed to elucidate the experiences of others and give voice both to them, and to critical research methodologies that have been absent in the discussion on dyscalculia.

Though this work will be subject to criticism for the diversity of methods employed, I argue that failing to undertake research that embraces inter-disciplinarity and diversity of theory and methods has limiting and oppressive effects. In contrast, through this research, my understanding of dyscalculia has deepened and widened, as have the perspectives of many of the participants who contributed their time and their stories to this research.

When revisiting Billington's initial questions,

> How do we speak of children?
>
> How do we speak with children?
>
> How do we write of children?
>
> How do we listen to children?
>
> And finally,

> How do we listen to ourselves (when working with children)?
>
> (Billington, 2006, p. 8)

I find myself answering the questions with, "*not well enough"*. I believe that through this work (though the participants were adults) I explored these questions, and aimed to *listen* to the participants whose stories had been silent, to engage them in the construction of their voice in this work, representing them *holistically* and *ethically*, using methods that have been absent in the discipline. I have been conscientious of my own role in the research process and the potential to both harm, and support them, with my questions, and my writing, engaging in ethical mindfulness[17] throughout this process. I believe as I did in the infancy of this work, that their voices count, and though this work was intended to provide depth of perspective on how individuals with dyscalculia and those around them interpret and respond to it, the result has been much deeper as the depths of Foucault's theorization of power-knowledge (which has emerged as a focal point for future studies) has given me, and I believe the participants, back some power. The ominous creature is not so ominous any more. And those who wield mathematization of research as a bogeyman of intimidation, and mathematical hegemony, will now be met, not with silence and fear, but with a confident voice that has come to understand the depths of Einstein's statement that "*not everything that can be counted counts, and not everything that counts can be counted"*.

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[17] The term ethical mindfulness is borrowed from, Warin, J, Ethical Mindfulness and Reflexivity: Managing a Research Relationship With Children and Young People in a 14-Year Qualitative Longitudinal Research Study, 2001 DOI: 10.1177/1077800411423196

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Curriculum Vitae

Diana Elizabeth Kuhl, OCT

Degree	Specialization	University
M.Ed. (2012- In progress)	Educational Psychology	University of Western Ontario
B.Ed. (1998)	Social Science and Spanish (I/S)	University of Western Ontario
B.A. (1996)	Multicultural Studies	University of Windsor

Master's Thesis - *Voices Count: Employing A Critical Narrative Research Bricolage For Insights Into Dyscalculia*

Thesis Advisors - Dr. Wayne Martino and Dr. Elizabeth Nowicki

Graduate Courses Completed

9651 Assessment in Regular and Special Education (Focus on Psychometric Assessment)

9526 Psychology in Education: Issues, Theories and Practices

9626 Gender Theories in Education: Implications for Policy, Pedagogy and Practice

9685 IRR Course, Qualitative Research in Educational Psychology

9678 Diverse Traditions: Approaches to Educational Research

9657 Problems and Issues in Special Education

Teaching and Related Experience

2012-2013 Therapeutic Recreation Program Coordinator, Lambton College

Developed the following courses, including course outcomes, unit objectives and evaluation guidelines, for the post graduate program in Therapeutic Recreation at Lambton College

- TRE-2003 Leisure Education & Counselling in Therapeutic Recreation
- TRE-2013 Therapeutic Recreation Assessment
- TRE-2023 Adapted Recreation & Program Planning
- TRE-2033 Recreation Leadership
- TRE-2043 Research in Therapeutic Recreation
- TRE-2053 TR Practice & Portfolio Development

- TRE-3000 Therapeutic Recreation Internship

Taught the following post secondary credit courses at Lambton College (2010-2013)

- TRE-1003 Support Networks and Community Resources
- PSY-1023 Interpersonal Communication
- DDC-1043 Report Writing for the Developmental Services
- MAN-1113 Human Relations
- PED- 1073 Personal Wellness
- ENG-1113 Communications I
- ENG-2113 Communications II
- ENG-2033 Communications II for Health Sciences

1995-1996 Teaching Assistant (Multicultural Studies), University of Windsor

Mental Health and Social Services Related Employment Experience

2008-2010 Elementary Mental Health Education Program Coordinator, Self-Esteem is Elementary, Canadian Mental Health Association

2001-2008 Vocational Rehabilitation/TR Specialist, Canadian Mental Health Association

1999-2001 Employment Support Caseworker, Lambton County Social Services

1998-1999 Parental Support Worker, Ministry of Community and Social Services

Additional Relevant Academic Coursework and Professional Development

2010 Adjunct Faculty Training Course

2009 ASIST (Applied Suicide Intervention Training Skills)

2005-2007 University Courses in Therapeutic Recreation for R/TRO Registration, Brock University and Memorial University

2005 Additional Qualification, Special Education Part 1, Nipissing University

2003 Psychosocial Rehabilitation and Psychopharmacology Course, CMHA

1996 Spanish Language and Culture Program, University of Salamanca, (Spain)

1994 General Arts and Science Diploma, Lambton College